

*Full Length Research Paper*

# **The effect of human-mediated mortalities of African leopard (*Panthera pardus pardus*) in Ethiopia**

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**Even though the challenges to the conservation of African leopard (*Panthera pardus pardus*) in Ethiopia are wide ranging, little is known about the trend of their potential threats. Similarly, the impacts of direct human-induced mortalities of leopards are poorly understood. Available literature sources that include published and unpublished reports and manuscripts on African leopard were reviewed in order to investigate the effect of human-mediated mortality like trophy hunting, poaching and retaliatory killing of leopards in Ethiopia. From our review, we concluded that poaching is the prominent problem as compared to the other human mediated mortalities of leopards. It is therefore recommended to put in place concrete protection measures to reverse the existing crimes against leopards and undertake further field assessment on their possible habitats and threats.**

**Key words:** Impact, threats, human-mediated mortality, trophy hunting, poaching, retaliatory killing, illegal killing.

## **INTRODUCTION**

Like the case of other African countries, large carnivores in Ethiopia are facing a serious threat to their survival as most of the natural habitats in Ethiopia are under high human pressure. Habitat loss, fragmentation, and degradation of natural habitat, retaliatory killing, and poaching are some of the major threats to the survival of carnivores and their prey populations (Jacobson et al., 2016; Ramesh et al., 2017; Yirga et al., 2017; Kebede and Gebretensae, 2018; IUCN SSC Cat Specialist Group, 2018).

The African leopard (*Panthera pardus pardus*) is no exception to this pattern. African leopards experience across their range severe declines (40-60%) in populations and they are classified by the International Union for Conservation of Nature (IUCN) Red List

Assessment as vulnerable (IUCN SSC Cat Specialist Group, 2018; Stein et al., 2020). The primary threats to leopards are anthropogenic. Habitat fragmentation, reduced prey base and conflict with livestock and poaching have reduced leopard populations throughout most of their range (Ray et al., 2005; Yirga and Bauer, 2011; Hunter et al., 2013; Westerberg et al., 2017).

The challenges to the conservation of African leopard in Ethiopia are wide ranging and human-mediated killings are among the main anthropogenic threats to the species in question. The risk factors for vulnerability of leopards to various forms of human-caused mortality include adaptation of leopard to inhabit human-dominated landscapes, level of protection of its habitats, and incidence of human-leopard conflict versus response to

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the problem (Yirga and Bauer, 2011; Stein et al., 2016; Kebede and Gebretensae, 2018; Stein et al., 2020). Moreover, high demand for leopard products, coupled with inadequate preventative measures is believed to result in an increase of illegal killing and illicit trade in recent years (Karanja, 2012; Ramesh et al., 2017; Tessema, 2017; Tessema et al., 2021). Unlike the case of southern Africa countries, little is known about the status and trend of potential threats to leopards in Ethiopia, especially concerning direct human-induced mortalities (Kebede and Gebretensae, 2018). Therefore, this review aims to examine the trends of trophy hunting, poaching and retaliatory killing of leopards in Ethiopia based on the available data from various published and unpublished studies related to the subject matter.

### Distribution of African leopard in Ethiopia

Despite the ever-increasing anthropogenic pressures, the leopard populations in Ethiopia inhabit a wide range of different ecosystems, with extreme variation in conditions and habitat types. It is found in most ecosystems of Ethiopia which range from cool afro-alpine to evergreen montane forests, to dry desert scrublands. Leopard can also occur close to major towns, including Addis Ababa, the capital city (Stein et al., 2016; Kebede and Gebretensae, 2018). It is generally true that there is lack of data on present distribution of leopards in Ethiopia since range-wide assessments have not been undertaken. However, there are considerable reports of series of recent assessments (Wendim et al., 2010, 2015; Wendim, 2018; Kebede et al., 2011; Asefa et al., 2014; Yadeta et al., 2014; Zerfu et al., 2014; Kebede et al., 2015a; Deksis et al., 2015b; Tsegaye et al., 2017; Yadeta and Getachew, 2016; Deksis et al., 2017; Pohlstrand, 2019) which indicate numerous sightings of leopards. There are also some details about depredation cases by leopards from various parts of Ethiopia (Yirga et al., 2011; Girmay and Teshome, 2015; Acha and Temesgen, 2015; Westerberg et al., 2017; Mohammed et al., 2017; Tsegaye, 2017; Biset et al., 2019; Tadesse and Zewde, 2019).

Therefore, the sightings and depredation cases indicated earlier reveal that leopards are widely distributed though their abundance varies from one habitat to another (Figure 1). Apparently, there is a need to update the possibly extant portions shown in the distribution map adopted by Kitchener et al. (2017) and IUCN SSC Cat Specialist Group (2018). Given the existence of ample prey population, combined with relative intactness of their habitats, it appears that some areas are specifically the main stronghold sites of the extant populations of leopard in Ethiopia. These areas include the south eastern Bale, Arsi and Harerge Massifs and the Omo Valley, Gambella and Mao-Komo forest areas in the south, south western and western part of Ethiopia (Wendim et al., 2015; Wendim, 2018; Kebede

and Gebretensae, 2018).

## METHODOLOGY

### Study area

Ethiopia is located in the Horn of Africa, bordering Eritrea in the North, Djibouti and Somalia in the East, Kenya in the South, and Sudan and South Sudan in the West. The country stretches from 3°N of the equator to 15°N latitude and from 33°E to 48°E longitude, and has an area of 1,127,127 km<sup>2</sup>. Ethiopia has great geographic diversity with high and rugged mountains, flat topped plateaus, deep gorges, incised river valleys and rolling plains. The climate pattern of Ethiopia is mainly determined by the alternations of inter tropical convergence zone and the influence of the Indian Monsoon throughout the year. The differences in altitude, topography and climate have created various ecosystem types of Ethiopia, which range from cool afro-alpine to evergreen montane forests, to dry desert scrublands (Biodiversity Indicators Development National Task Force, 2010; Hussein, 2021). Ethiopia is consequently endowed with a diverse suite of biological resources and the isolation of its mountain and desert areas has given rise to numerous endemic species of flora and fauna found nowhere else on Earth (IBC, 2005; Biodiversity Indicators Development National Task Force, 2010). Various efforts have been made to conserve the rich wildlife resources of Ethiopia and the Ethiopian Wildlife Conservation Authority (EWCA) is the federal institution mandated to ensure the development, conservation, and utilization of wildlife (Federal Negarit Gazeta, 2008; EWCA, 2015).

### Literature sources

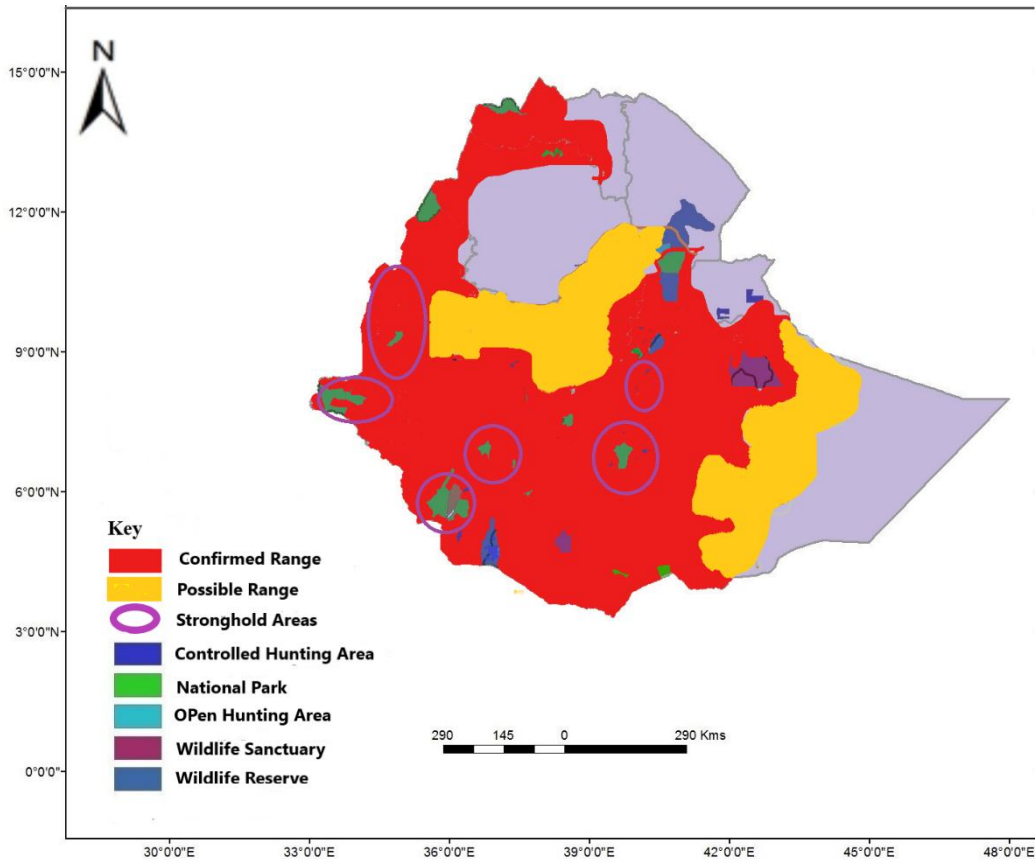
Various scholarly sources, published and unpublished reports as well as strategic documents related to the target species are the main sources for the review. This review has taken into account the national report of Leopard (*Panthera pardus*) quota of Ethiopia (EWCA, 2020), EWCA's hunting database (2011-2019) and the strategic plans of wildlife sector (EWCA, 2015). Google Scholar (<http://scholar.google.com>), Science Gate (<https://www.sciencegate.app>) and Science Direct (<https://www.sciencedirect.com>) were the academic search engines used to get the review material that is not found in local libraries and archives.

Specifically, the data on human-mediated mortality of leopards is based on reports of nine years (2011-2019). However, for the entire study, a total of 33 leopard related articles and books published in the past 24 years (since 1999) have been reviewed. Moreover, 21 unpublished reports of wildlife assessments (Gebretensae et al., 2008; Ewnetu et al., 2008; Wendim et al., 2010, 2015; Kebede et al., 2011, 2015a, 2015b; Yadeta et al., 2014; Zerfu et al., 2014; Deksis et al., 2015, 2017; Tsegaye et al., 2017; Yadeta and Getachew, 2016) which were submitted since 2008 to the concerned units of EWCA and regional offices were used as key sources for the review. These materials were supplemented by 5 policy-based documents (Federal Negarit Gazeta, 2008; EWCA, 2015; IBC, 2005; IUCN SSC Cat Specialist Group, 2018; IUCN, 2019).

## RESULTS AND DISCUSSION

### Licensed/Trophy hunting

Like the case of majority of sub-Saharan African



**Figure 1.** Distribution and stronghold sites for leopards in Ethiopia.  
Source: Adopted from Kebede and Gebretensae (2018).

countries, Ethiopia officially authorizes sport hunting. In Ethiopia, sport hunting activity is carried out in Controlled Hunting Areas (CHAs) and open hunting areas. Sororo-Torgam, Besmena-Odobulu, Abasheba-Demero, Munesa-Kuke, Arbagugu, Dindin, Shedem Berbere and Welishet-Sala are the main CHAs where hunting of leopard has been practiced. It is practiced in accordance with the wildlife conservation and utilization regulation no. 163/2008, adopted based on proclamation no. 541/2007 and with the following directives: revised directive No.31/2009 (Ethiopian Calendar) for wildlife hunting utilization and directive No.26/2007 (Ethiopian Calendar), for huntable wild animal's census and quota setting. With the exception of birds, hunters with valid permit are allowed to hunt an old male animal only and trophy size is typically used to determine the age of the animal (EWCA, 2020).

Annual offtake quota is set every three years through field surveys and population estimates for all huntable species based on quota setting directive mentioned earlier and the preceding laws. Accordingly, quotas have been set for leopard, which is listed on the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix I in

which trade is restricted to skins and body parts of limited number of individuals (Stein et al., 2016, 2020). Leopard is one of the 54 huntable species, and a total of 121 leopards of quota were set (Table 1) for the past nine years (2011-2019, excluding the Covid-19 season) in six CHAs that are considered as strongholds for leopard populations in Ethiopia (Kebede and Gebretensae, 2018). Only 33 leopards were hunted (EWCA, 2019, 2020) out of the allocated quota and this shows that low proportions (27%) of the proposed huntable leopards were harvested (Table 1).

Sport hunting, also known as trophy hunting is one of the oldest wildlife-based recreational activities. Some researchers have indicated that sport hunting can benefit the development and economy of local communities, thereby promoting the protection of wildlife resources as well as both ecological and economic sustainability (Di Minin et al., 2016; Saayman, et al., 2018). However, important debates remain regarding the social impacts of sport hunting and other forms of wildlife tourism on local communities near protected areas (Yasuda, 2012; Mbaiwa, 2018). Other studies also argue and raise questions on the sustainability of trophy hunting in most sub-Saharan African countries (Lindsey et al., 2016).

**Table 1.** Nine years quota allocation for leopard in CHAs.

Year	Total quota set	Number of hunted leopards	% hunted leopards
2011	14	3	21
2012	14	3	21
2013	14	6	43
2014	14	4	29
2015	10	5	50
2016	10	5	50
2017	12	5	42
2018	15	2	13
2019	18	0	0
Nine years total	121	33	27

Source: EWCA Database.

Additional studies are required to understand more regarding the main reasons behind the limitations of the hunting industry in Ethiopia. The low rate of harvest can be attributed to the limited interest of the hunters to spend more time searching for large carnivores since most of tourist hunters visiting Ethiopia are attracted mostly by some of the endemic species such as the Mountain Nyala (*Tragelaphus buxtoni*) and Menelik's Bushbuck (*Tragelaphus scriptus meneliki*). For this reason, wild animals like leopard, which are also found in other African countries are not commonly harvested by tourist hunters in Ethiopia (EWCA, 2020). Furthermore, the fact the aforementioned regulation (Regulation no. 163/2008) prohibits baiting indicate that there are no ways to attract the huntable leopards and save time for hunting. This restriction differs from the cases of other African countries which have higher hunting success. For example, in the case of Tanzania, baiting of lion and leopard is allowed as long as the bait animal is on license (Majamba, 2001).

## Poaching

The data collected by Tessema et al. (2021), from concerned regional and federal offices indicate that 114 products of leopards, which include claws, teeth and skins were seized in nine years (2011-2019). Data gathered for this review show that a total of 117 skins of leopards were seized in the same nine years. Seizure of a total of 107 skins of leopards (92% of the total skins seized, see Figure 2) in Metema (Ethio-Sudan border), Bahirdar (confiscated from various parts of the region), Humera (May Tselot) and Bambasi (EWCA, 2019; DW Amharic News, 2020) can reveal that the western, north western and northern parts of the country are the most poaching prone areas. Remarkably, these areas are situated far away from the south eastern stronghold sites for leopards.

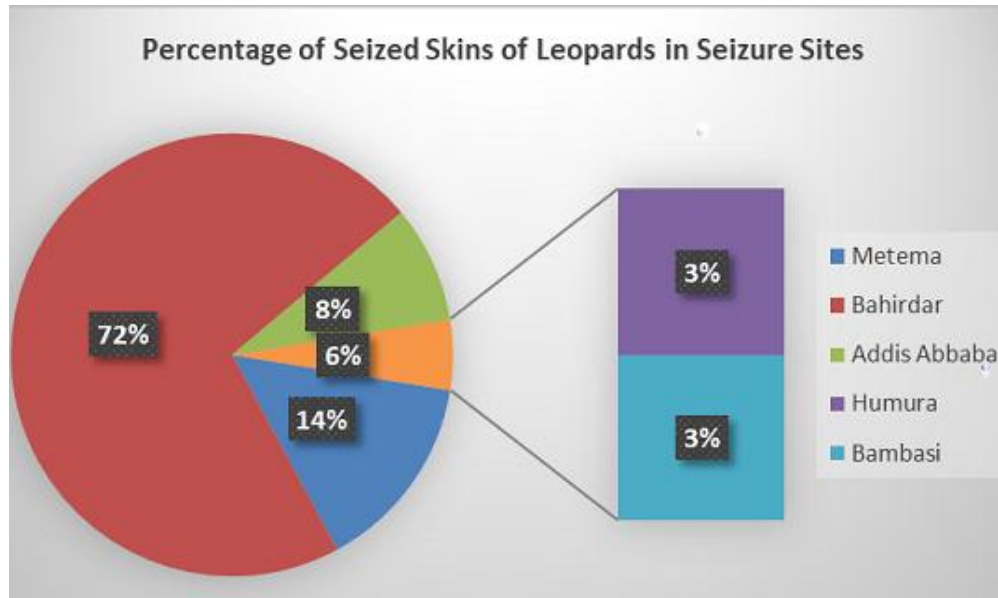
Poaching remains a serious conservation issue and

has now grown into organized criminal activity having international ramifications as it is a major existential threat to numerous wild organisms worldwide and is an important contributor to biodiversity loss (Cooper et al., 2009; Karanja, 2012; Ramesh et al., 2017). Nowadays, poaching is being undertaken through highly organized, networked and technologically well-equipped systems and resulting in significant loss of wildlife resources (Lawson and Vines, 2014; Gebretensae and Gebremicael, 2018).

Since the recent past, Ethiopia appears to be facing an escalating poaching and trafficking threat tied to organized crime and cross-border trafficking networks. High demand for wildlife products, coupled with inadequate preventative measures and weak institutions has resulted in an explosion of illicit trade in wildlife in recent years (Tessema, 2017; Gebretensae and Gebremicael, 2018; Tessema et al., 2021).

In Ethiopia, leopards are intentionally poached for illegal trade of their skins. The fact that significant number of seizures were made at different checkpoints of the country indicates the extent of the problem. High demand for wildlife products, coupled with inadequate preventative measures is believed to result in an explosion of illicit trade in recent years (Kebede and Gebretensae, 2018; Tessema, 2017; EWCA, 2020; Tessema et al., 2021). In some cases, leopards are also killed to use their skins for traditional ceremonies especially in the southern part of the country. A very recent study by Torrents-Ticó et al. (2022) has come up with alarming report indicating that 204 skins of cheetah (*Acinonyx jubatus*), leopard (*Panthera pardus*), African civet (*Civettictis civetta*), common genet (*Genetta genetta*) and serval (*Leptailurus serval*) were counted across two years ceremonies of the Daasanach community that take place every year or every second year in Kenya and Ethiopia.

The result of this study shows that the rate of seizure is higher in the western, north western and northern parts of the country as compared to the south eastern



**Figure 2.** Proportion of seized skins of leopards in different sites for nine years (based on the data obtained from EWCA and concerned regional offices).

stronghold sites for leopards. Inclination of the rate of seizure towards these areas is one of the interesting questions to be examined further through systematic analysis.

Through theoretical analysis, different logics can be framed regarding such trends. Either way, there could be an increase in demand for the products of leopard in Sudan or/and its outlets and a favorable environment for traffickers in the regions. This has also been explored in prior reports of INTERPOL-UNEP (2016), Hailu (2019) and Tessema et al. (2021) which disclose that illegal wildlife trade and trafficking ever-increasing trend is driven by consumers' increasing demand, gaps in protection and the world's increasingly interconnected systems of finance, communication and transport. On the other hand, it may indicate that strong law enforcement has been established along the north western and northern routes since in most cases, rate of seizure is positively correlated with strength of capacity of law enforcement (Lawson and Vines, 2014; Gebretensae and Gebremicael, 2018; Tessema et al., 2021).

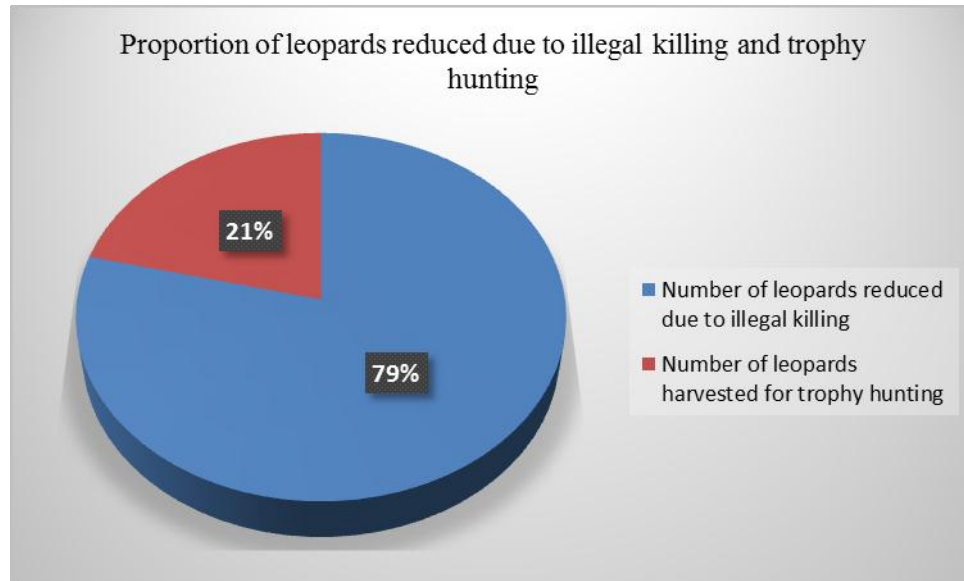
### Retaliatory killing

Even though exceptions exist due to leopard's highly adaptable hunting and feeding behavior (Bertram, 1999; Stein et al., 2016), the conversion of natural habitats typically leads to the depletion of its natural prey base (Ray et al., 2005; Hunter et al., 2013). Depletion of wild prey population and the existing expansion of livestock where wild grazers progressively being replaced by domestic ones obviously increases the possibility of attack

of livestock by leopards (Kebede and Gebretensae, 2018). Consequently, the livestock herders may be intolerant to leopard conflict and kill the leopards for real or perceived threats to their lives and livelihoods (Gebretensae et al., 2008; Yirga and Bauer, 2011; Mohammed et al., 2017; Westerberg et al., 2017; Tadesse and Zewde, 2019; EWCA, 2019).

Reports from various parts of the country for 9 years (2011-2019) indicate that 8 leopards were lost in Borena Saint (2), Chebera Churchura (2), Aluto-Adami Tulu (2) Yechilay (1) and Huruta (1) due to retaliatory killing (Biset et al., 2019; Acha and Temesgen, 2015; Westberg et al., 2017; EWCA, 2019). It is however wise to assume that most retaliatory killings are concealed and hardly ever reported. This is also true in the case of other African countries in which many leopards killed due to livestock depredation stay unrecorded, and the extent of mortality due to conflict remains unknown (Stein et al., 2016).

In spite of this trend, considering the existing limited data, human-leopard conflict is minimal around the CHAs, which are stronghold sites for leopard populations. This can be attributed to presence of a relatively adequate prey base in the CHAs as opposed to other populations of leopards in which the larger proportion of their range extends beyond protected areas with scarcity of prey (Stein et al., 2020). It can also be as a result of tolerance of the local community which are aware of the economic benefits gained through trophy hunting of wild animals since this industry has become a main source of income for some members of local community living around CHAs (Di Minin et al., 2016; EWCA, 2020).



**Figure 3.** Proportion of leopards reduced due to illegal killings and trophy hunting for nine years (based on the result of this review).

### Comparing the impact of the three human-mediated mortalities of leopards

Among the three human-mediated mortality of leopards, trophy hunting is licensed (legal) while poaching and retaliatory killing are illegal. This study that based on the reported data for nine years (2011-2019) has indicated that the threat and negative impact of the illegal killings (poaching and retaliatory killing) on the existing populations of the species in question is much larger as compared to licensed hunting. In other words, trophy hunting which is regulated and recurrently reported accounts for a smaller proportion of leopard deaths (Figure 3). The illegal killings of leopards appear to be driven mainly for the reasons discussed earlier.

The result of this review is consistent with Karanja (2012), Stein et al. (2016), Ramesh et al. (2017), Tessema (2017), Gebretensae and Gebremicael (2018) and Stein et al. (2020) which have plainly pointed out that poaching and retaliatory killing due to human wildlife conflict and illegal trade have resulted in considerable population losses of leopards. It however differs from EWCA (2020) which is not able to consider poaching as the prominent problem in this context and also argues that leopard is not threatened nor endangered in Ethiopia nor is likely to be in the future.

### Conclusion

In conclusion, it is generally assumed that most illegal killings are rarely reported. However, taking into account the reported data, poaching is considered the highest

threat of the three human mediated mortalities of leopards. If the existing situation keeps on this pace, poaching along with other anthropogenic threats is expected to put the leopard populations in Ethiopia at substantially greater risk despite its wider range. Therefore, there is a need to put in place concrete protection measures to reverse the existing crimes against leopards. Moreover, it is equally important to note that there is limited information on the overall status of leopard populations and their threats across their range and thus it is imperative to undertake further assessments on the possible habitats and threats in the south western and western parts of the country and establish national Red list category for the threatened species based on the final reports of the ongoing assessments.

### CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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