Ecology of the white lion: conservation management of the white lion (Panthera leo melanochaita Hamilton Smith 1842) in the Greater Kruger Park Region, South Africa

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Photo 5.1 White lion male in an acclimation boma (enclosure) before being reintroduced into free-roaming area at Tula Tsau Wildlife Area. *© Global White Lion Protection Trust*

5 White Lion Conservation

Reintroduction, Anthropogenic Impact and Conservation Management in the Greater Kruger Park Region.

Summary: The reintroduction and conservation management of white lions in the Greater Kruger Park Region by the Global White Lion Protection Trust is described for the first time. Although white lions are a natural occurrence in the Greater Kruger Park Region, and the frequency of occurrence increased historically, there was an absence from 1994 to 2006. The reason was proposed to be either a lack of camouflage preventing white lions from hunting successfully in the wild, or the impact of anthropogenic activities. Between 2006 and 2022 white lion cubs (17) were born to seven lion prides in the Greater Kruger Park Region, confirming that the recessive gene is still present in the wild lion population. However, at the time of writing (2023) only three adult white lions had survived in the wild, and the Global White Lion Protection Trust proposed that this was due to anthropogenic activities. In 2006 the Global White Lion Protection Trust reintroduced a pride of white and tawny lions to free-roaming condition and initiated a study to compare the ecology of white lions to wild tawny lions, and to consider the anthropogenic activities that could have had an impact on white lions, historically and at the time of this study. White lions showed natural behaviour similar to wild tawny lions in terms of their social behaviour, home range dynamics, movement patterns, habitat selection, and hunting success (Chapter 2, 3, and 4). The key anthropogenic activities that are likely to have affected wild white lions historically and at the time of this study were in accordance with those identified in the draft conservation policies being developed by the South Africa Government at the time of writing (2023): illegal removal from the wild into captive breeding (hunting) farms, trophy hunting of captive and wild lions, targeted poaching of lions for their body parts, and human-lion conflict. In conclusion, the conservation management of white lions in the Greater Kruger Park Region by the Global White Lion Protection Trust is an important contribution to the metapopulation approach to lions in South Africa, and in particular through the establishment that the cultural significance of the white lion to local Tsonga and Sepedi communities is a possible way to reduce poaching, trade in lion parts, and human-lion conflict.

Keywords: white lion; human threats; reintroduction; lion conservation policy; South Africa

5.1 Introduction

As outlined in the earlier chapters of this study, white lions are a natural occurrence in the Greater Kruger Park Region of South Africa, and do not occur naturally anywhere else. From 1994 to 2006, white lions were absent from the wild due to anthropogenic impact. An organisation called the Global White Lion Protection Trust (GWLPT)[3] therefore initiated a reintroduction programme to return white lions to free-roaming conditions in the region of their natural occurrence. The white lion is a natural colour variant, or leucistic form, of the southern subspecies of the African lion (*Panthera leo melanochaita*) that has only ever been recorded in the wild in the Timbavati, Klaserie and Umbabat Private Nature Reserves (Greater Timbavati Region) and the Central Kruger National Park (KNP) – the Greater Kruger Park Region – in South Africa (Robinson & De Vos 1982; McBride 1977; McBride 1981; Cruickshank & Robinson 1997; Tucker 2003; Cesare 2011; Turner et al. 2015; Dicks 2022). Although white lions occur within the wild lion population in the Greater Kruger Park Region, due to the rarity of white lions (only 13 wild-managed lions and three wild adult white lions) (Turner et al. 2022b; Dicks 2022), the anthropogenic activities that affect the wild tawny lion population may have a more significant impact on wild and wild-managed white lions in that region. These anthropogenic activities will be considered in this chapter. Human-lion conflict being one of the anthropogenic threats that has been identified for wild lions (eg. Bauer et al. 2015; Bauer et al. 2020), I will also discuss the long-standing cultural significance of white lions amongst the local Tsonga and Sepedi populations in the Greater Kruger Park Region that has led white lions to be referred to as a 'living cultural heritage' that may help to mitigate human-lion conflict and lion poaching for body parts (Tucker 2003; Meyerhoff Hieronimus 2017: 82-120;Turner & Wels 2023).

The conservation of white lions in South Africa is an indistinguishable part of the broader conservation efforts for tawny lions (*Panthera leo melanchaita*) since, according to taxonomic studies, white lions themselves are not a subspecies of *Panthera leo*, but instead belong to the southern subspecies *Panthera leo melanochaita* (Bertola et al. 2015; Kitchener et al. 2017). Conservation management seeks to minimise the direct and indirect negative impacts on species, by regulating human activities, with the goal of sustaining the existence of specific species or of biodiversity in general (Sale 2002). The conservation management of lions and other wildlife species in South Africa is guided and regulated by the conservation policies promulgated by the Department

[3] The Global White Lion Protection Trust is a non-profit conservation trust that was founded in 2002 after ten years of research into both the conservation and cultural significance of white lions (Tucker 2003; 2013; Turner et al. 2015), in order to re-establish white lions in the wild in their natural habitat and ensure their long-term protection as an important contribution to the biodiversity of the Greater Kruger Park Region and Kruger to Canyons Biosphere Reserve (www.whitelions.org).

of Forestry, Fisheries, and Environment (DFFE) in that country. The key conservation policies in South Africa were under review at the time of writing: the 'Draft Policy Position on the Conservation and Ecologically Sustainable Use of Elephant, Lion, Leopard and Rhinoceros' (Government Gazette 45160), 'The National Environmental Management Biodiversity Act (10/2004): Biodiversity Management Plan for the African Lion (*Panthera leo*)' (Government Gazette 39468), the 'Draft African Lion Biodiversity Management Plan Review Report' (DFFE & NLWG 2022), and the more overarching South African 'Revised Draft White Paper on Conservation & Sustainable use of Biodiversity in South Africa (Government Gazette 46687). Since white lions were absent from the wild in 2006, and there were no adult white lions in the wild at that time, the Global White Lion Protection Trust (GWLPT) reintroduced a pride of white and tawny lions to free-roaming conditions within a small fenced wildlife area (Tula Tsau Wildlife Area), in the Greater Kruger Park Region.

In Chapter 2, 3 and 4 the ecology of white lions was found to be similar to that of wild tawny lions in terms of their genetics, social behaviour, hunting success, home range dynamics and movement patterns (for more on the genetics of white lions and *Panthera leo melanochaita* see Robinson & De Vos 1982; Cruickshank & Robinson 1997; Bertola et al. 2015; Kitchener et al. 2017; and Cho et al. 2013). This is supported by historical and recent observations of white lions as part of socially cohesive prides in the wild (Cesare 2011; Gomersall 2015; Howarth 2022; Dicks 2022).

This conclusion supports the postulation by the Global White Lion Protection Trust that the absence of white lions from the wild from 1994 to 2006 is not due to white lions lacking camouflage and not being able to hunt, but may be due to anthropogenic activities. This chapter is therefore focused on the reintroduction and conservation management of white lions in the Greater Kruger Park Region by the Global White Lion Protection Trust in context of the anthropogenic activities that affect lions (white and tawny) in the Greater Kruger Park Region, and the metapopulation management approach to lions in South Africa. The chapter is structured as follows:

1. Firstly, the significance of white lions is discussed in terms of their genetics, hunting success, home range behaviour, social structure and general lion behaviour, as shown through current scientific research, including a discussion about their conservation and cultural importance.

2. Secondly, a review is provided of the reintroduction and conservation management efforts by the Global White Lion Protection Trust with regard to white lions (as part of wild tawny prides).

3. Next, the anthropogenic threats to wild and captive white lions in South Africa are summarised and put into context by considering the anthropogenic threats to wild tawny lions in the Greater Kruger Park Region, defined by the draft conservation policies in South Africa ('Draft Policy Position on the Conservation and Ecologically Sustainable Use of Elephant, Lion, Leopard and Rhinoceros') and recent scientific studies.

4. Finally, the conservation role of the white lion reintroduction by the Global White Lion Protection Trust is discussed, in the context of the anthropogenic threats to (white and tawny) lions, and the existing conservation management principles for the metapopulation approach to lion conservation in South Africa.

5.2 Theoretical Background

5.2.1 White Lion Significance as Members of the Southern Subspecies of the African Lion (*Panthera leo melanochaita*) in the Greater Kruger Park Region

Lions were eradicated from most of their range in South Africa by the 1900s, with historic populations remaining in only Kruger National and Kgalagadi Transfrontier Parks. Today just over 3500 wild lions are well protected in these and other large national parks and game reserves, with all populations either stable or increasing (Bauer et al. 2015; Miller et al. 2015; Miller et al. 2016). This managed lion metapopulation network comprises free-roaming populations and those maintained in smaller fenced reserves and protected areas across South Africa's provinces (Miller et al. 2016). Over the last three decades lions have also been reintroduced into over 49 smaller reserves with a total population of what are termed the 'managed-wild' lions of about 800 individuals (Miller et al. 2015; Government Gazette 39468). In addition to the wild and managed-wild lion populations there are also significant numbers of captive-bred lions in South Africa – the latest estimate is more than 8500 captive lions (Coals et al. 2019; Hutchinson & Roberts 2020; Green et al. 2021). At least 300 to 500 of these captive lions were estimated to be white lions, mainly bred for trophy hunting or the lion bone trade (Tucker 2013). Due to the unethical and unregulated nature of the majority of the captive breeding farms, the number of lions in captivity can only be estimated (Green et al. 2020; Government Gazette 45160).

I have already established earlier in this chapter that white lions are naturally-occurring members of the southern subspecies of the African lion *Panthera leo melanochaita*, in terms of their genetics (Bertola et al. 2015; Kitchener et al. 2017). The findings from my earlier scientific research in this doctoral study suggest that white lions show similar natural behaviour to wild tawny lions in terms of their hunting success, home range behaviour, social structure and general lion behaviour (Chapter

2, 3 and 4; Turner et al. 2015; 2022a; 2022b). To elaborate further on this point, in their study, Turner et al. (2015) found that there was no significant difference between the mean kill rate or mean consumption rate of white and tawny lions, concluding that white lions are capable of hunting self-sufficiently under managed free-roaming conditions in their natural habitat. Turner et al. (2022b) determined that the annual and seasonal home range size, male and female home ranges, potentially minimum daily distance travelled, and habitat selection of white lions were found to be similar to that of wild tawny lions, concluding that white lions established territories and displayed natural home ranging behaviour. Also, the social behaviour of white lions was observed to be similar to that of tawny lions by Turner et al. (2022a), and in fact the level of social cohesion between pride members was stronger for white lions than for the captive or wild tawny lion prides with which they were compared. As such, white lions show natural behaviour similar to that of wild tawny lions and are therefore relevant members of the Southern African lion subspecies (*Panthera leo melanochaita*) and, consequently, reporting on their reintroduction and conservation management should be a worthwhile contribution.

5.2.2 White Lion Reintroduction and Conservation Management in the Greater Kruger Park Region

The conservation and protection of all natural heritage is critical since the rate of global change in nature during the past 50 years is unprecedented in human history (IPBES 2019). The Global White Lion Protection Trust (GWLPT) was established in 2002 with the aim to reintroduce white lions to the wild in their natural habitat, as members of wild tawny lion prides, in the way that white lions occurred naturally (McBride 1978; McBride 1981; Cesare 2011). The frequency of occurrence of white lions in the region was increasing in the 1980s, with 12 recorded sightings in nine different prides in the Timbavati Private Nature Reserve and Central Kruger National Park (Robinson & De Vos 1982; Cruickshank & Robinson 1997). As a natural occurrence in the Greater Kruger Park Region of South Africa that has never occurred in the wild anywhere else, it has been suggested that the reason white lions were absent in the wild from 1994 to 2006 was due to anthropogenic impact. The proposed anthropogenic activities were removal (unauthorised or illegal translocation) of white lions from the wild in the Timbavati Private Nature Reserve to small fenced captive breeding farms, and trophy hunting of the pride males of lion prides in which the white cubs were born, leading to infanticide of the white (and tawny) cubs from those prides (Cadman 2006; Tucker 2003; Cesare 2011; Turner et al. 2015; Pinnock 2018). In 2006, the Global White Lion Protection Trust therefore initiated the first reintroduction of white lions to free-roaming conditions within a small fenced wildlife area in the Greater Kruger Park Region. Between 2006 and 2022 white lion cubs (17) were born in the Greater Kruger Park Region, confirming that the recessive gene is still present in the wild lion population (Dicks 2022). Since in 2006 there were no adult

white lions in the wild, no study had been done to investigate the ecology of white lions compared with free-roaming tawny lions. Although free-roaming white lions have been introduced to two fenced wildlife reserves in the Western Cape (Sanbona Wildlife Reserve: Gomersall 2015) and Eastern Cape (Pumba Private Game Reserve: Howarth 2022) of South Africa these reserves are not within the region of natural occurrence of white lions, and to my knowledge no published scientific studies have been done on the introduced white lions. The findings of this doctoral study could therefore be of benefit to the conservation management of the white lions in these reserves. My study is the first to compare the ecology of white lions in relation to wild tawny lions, to see if white lions show natural behaviour similar to wild tawny lions, suggesting that white lions can survive in the wild (see Chapter 2, 3, and 4). Prior to this study, the perception was that the white colouration led to a lack of camouflage in white lions such that they could not hunt successfully or survive in the wild. The earlier findings of this doctoral study (Chapter 2, 3, and 4; Turner et al. 2015; 2022a; 2022b), do suggest that white lions behave naturally in a similar way to wild tawny lions, and could therefore survive in the wild. This is supported by previous observations of wild white lions forming socially cohesive prides with wild tawny lions in the Greater Kruger Park Region and at Sanbona Wildlife Reserve and Pumba Private Nature Reserve (Cruickshank & Robinson 1997; Cesare 2011; Gomersall 2015; Dicks 2022; Howarth 2022). Notably, at the time of writing (2023), of the 17 white lion cubs that had been born in the wild in the Greater Kruger Park Region between 2006 and 2022, only 3 adult white lions had survived. Because the earlier findings of this doctoral study, historical observations, and anecdotal observations at Sanbona and Pumba Private Game Reserves, suggest that white lions are capable of surviving in the wild as part of wild tawny prides, it is proposed that the reason for the low survival rate of white lion cubs in the Greater Kruger Park Region was due to anthropogenic activities – i.e. the on-going trophy hunting of pride males of lion prides with white cubs leading to cub mortality due to consequential infanticide, and the high impact of ecotourism vehicles, viewing prides when white lion cubs are still very young, causing high levels of stress on the mother of the cubs and leading her to move the cubs prematurely or leave them unattended for long periods of time (Pinnock 2018; Tucker 2013; Turner et al. 2015; Gomersall 2015; Dicks 2022; Howarth 2022). These anthropogenic activities could have had a significant effect on white lion survival, in addition to the fact that the natural mortality rate of lion cubs (white and tawny) that do not survive to reach adulthood can be as high as 50% (Schaller 1972).

The Global White Lion Protection Trust initiated the following steps in its conservation efforts towards achieving its goal of reintroducing white lions to their natural home range, and protecting them from the anthropogenic impact thought to have led to their absence (cf. Turner et al. 2015):

1. Translocation of white lions of high genetic integrity (i.e. individuals that are genetically diverse and with a lineage that is traceable back to a wild origin within two or three generations) from captive hunting operations to a reintroduction enclosure (boma) in their natural habitat;
2. Rewilding of translocated white lions;
3. Integration of translocated white lions with wild tawny (non-white) lions;
4. Reintroduction of prides of rewilded captive-origin white and wild tawny lions to a wild-managed conservation area (fenced wildlife areas where lions hunt self-sufficiently but the prey population is replenished when necessary: definition from Government Gazette 39468);
5. Facilitating the birth of white and tawny cubs carrying the recessive white gene, in a wild-managed conservation area;
6. Introduction of individuals with different genetics when necessary to ensure genetic diversity and prevent inbreeding (Kitchener et al. 2017) - in accordance with the metapopulation management approach to lions in South Africa (as described by Miller et al. 2015);
7. Expansion of conservation areas belonging to the Global White Lion Protection Trust to include more suitable habitat and territory for the reintroduced lion prides and their offspring, as well as opening up important wildlife corridors within larger conservation areas;
8. Strategies to mitigate the anthropogenic threats to white lions: trophy hunting, trade in lion bones, poaching, disease (especially Bovine Tuberculosis bTB), and human-lion conflict.

The Global White Lion Protection Trust reintroduction of white lions within their natural habitat in 2006 was done by applying and advancing existing successful lion reintroduction techniques such as outlined by Van Dyk (1997) and Kilian (2003) (Turner et al. 2015). The rewilded offspring of reintroduced white lions of captive-origin were integrated with wild tawny lions from the region and released through a phased reintroduction technique and a 'soft' release approach. A pride of high genetic diversity (ie. a pride that is not inbred and has genetics that can be traced back to the wild) was established, which hunted self-sufficiently in their natural habitat, at a predation rate comparable to that of the wild tawny lions in the same habitat (Chapter 4; Turner et al. 2015). The lion prides reintroduced by the Global White Lion Protection Trust were translocated to a fenced wildlife reserve that is managed in a similar way to that of the 49 other fenced reserves that are part of the metapopulation management approach to lions in South Africa (Miller et al. 2016). As a unique and natural occurrence to the UNESCO-declared Kruger to Canyons Biosphere Reserve (Tucker 2003; Dicks 2022), the Global White Lion Protection Trust poses that the white lions are a contribution to the biodiversity of the Kruger to Canyons Biosphere Reserve. As apex predators responsible

for regulating prey populations ('trophic cascading': Hairston et al. 1960[4]), white lions (as part of wild tawny prides) play a role within the ecosystem of the Greater Kruger Park Region. In addition to the role that white lions potentially play within the ecosystem, the Global White Lion Protection Trust also points out that white lions are important due to their cultural meaning to local communities (Tucker 2003). According to the Global White Lion Protection Trust the cultural meaning of white lions to the Tsonga and Sepedi communities living on the boundary of the Tula Tsau Wildlife Area, is encouraging these communities to have a positive attitude towards protecting white lions and their habitat, helping to reduce human-lion conflict, and the targeted poaching of lions for their bones in that region (Tucker 2003). The Global White Lion Protection Trust has implemented the following strategies to reduce the impact of these anthropogenic activities: (i) Prohibition of trophy hunting in Global White Lion Protection Trust wildlife areas; (ii) Establishment of anti-poaching teams, and electrified fences with alarms on all Global White Lion Protection Trust wildlife areas; (ii) Replenishment of the prey population on Global White Lion Protection Trust wildlife areas with disease-free prey herds whenever it is necessary; (iii) Development of environmental education programmes in local Tsonga and Sepedi schools (the StarLion Programme: https://whitelions.org/starlion-education-initiative/), to help reduce human-lion conflict and poaching of lions for their bones. (iv) Creation of public awareness, through public campaigns, lobbying and partnering with other like-minded organisations, in order to change conservation policies in South Africa to better protect wild populations of white and tawny lions in their natural habitat by stopping captive lion hunting (so called 'canned hunting'[5]), and the trade in lion bones. The Global White Lion Protection Trust has therefore focused on the co-existence between Lions, Land and People: a conservation model that creates mutual benefits for people and their natural environment, thereby protecting white lions as a natural and cultural heritage.

For seven years, the Global White Lion Protection Trust led collaborative research projects together with five other countries, comparing the genetics of white lions with snow leopards, tigers, and the white 'Kermode' bear of British Columbia, which finally led to the discovery of the genetic marker (allele) TYR260G>A, a specific recessive gene responsible for white colouration in white lions, in October 2013 (Cho et al. 2013). As part

[4] 'In a trophic cascade, ecological processes and consequences initiated by a change at the top of the food chain work their way down to lower trophic levels and eventually rebalance the ecological relationships of numerous species.' Trophic cascade in Yellowstone National Park - AccessScience from McGraw-Hill Education, accessed 29 January 2021.

[5] '(A) Canned hunt would be any hunt where the target animal is unfairly prevented from escaping the hunter through either physical (fencing) or mental (habituated to humans) constraints' (Pearce 2018: 137). See also Campaign Against Canned Hunting (CACH) - Campaign Against Canned Hunting Home Page (cannedlion.org), accessed 29 January 2021, and a documentary made to protest against canned hunting practices in South Africa, Blood Lions – A Call to Stop Canned Lion Hunting, accessed 29 January 2021.

of a strategy to help protect *Panthera leo melanochaita* in the Greater Kruger Park Region, the Global White Lion Protection Trust aims to utilise the white lion genetic marker (allele) to ensure the genetic diversity of the reintroduced lion prides and ultimately to determine the frequency of occurrence of the rare white lion gene in the wild population.

Subsequent to the lion reintroduction programme of the Global White Lion Protection Trust, white cubs started being born in the Timbavati, Klaserie, and Umbabat Private Nature Reserves in 2006 to 2009, 2011, 2014, 2015, 2018, and 2019, in neighbouring Nwanetsi Area of Kruger National Park in 2014, 2015 and 2022, and in the Ngala Lodge traversing area (Timbavati Private Nature Reserve) in 2018 and 2019. This reoccurrence of white lions in the wild, has confirmed that the recessive gene is still present in the wild population of the Kruger to Canyons Biosphere Reserve and that white lions are a natural occurrence and part of the biodiversity of this ecosystem (Tucker 2003; Cesare 2011; Turner et al. 2015; Ngala Lodge[6]; Dicks 2022). The Global White Lion Protection Trust advocates that the restoration of white lions to their natural distribution range has conservation importance as well as cultural heritage benefits for the Greater Kruger Park Region, and the Kruger to Canyons Biosphere Reserve. White lions, as members of the subspecies *Panthera leo melanochaita*, are an apex predator and could be considered a 'keystone species' (Mills et al. 1993; Simberloff (1998). In the Greater Kruger Park Region the lion population has been negatively impacted by human interventions such as historical culling (cropping) programmes (Smuts 1982) and commercial trophy hunting activities (in the neighbouring buffer reserves) (Tucker 2003; Cesare 2011; Pinnock 2018), along with illegal poaching, trade in lion parts (Miller et al. 2014) (Government Gazette 45160), and the spread of diseases such as bTB (bovine tuberculosis) (Government Gazette 39468). The Global White Lion Protection Trust therefore ensured that the white lion reintroduction to their natural habitat was part of a restoration strategy for the biodiversity of the region, and a possible way to help mitigate human-lion conflict and targeted lion poaching for their body parts.

The approach of the Global White Lion Protection Trust to protect a charismatic apex predator that has significant cultural meaning within the greater ecosystem is based on other international precedents, such as that used to protect the Kermode Bear (*Ursus americanus kermodei*) in British Columbia (Western Canada), whereby this rare white variant of the Black Bear (*Ursus americanus*) has been declared Critically Endangered due to its conservation and cultural value. As with the Kermode Bear, which is being used as a keystone animal for protecting a 4000,000 ha wilderness area (Russell 2017; Marshall & Ritland 2002), it is hoped and envisioned by the Global

[6] https://www.andbeyond.com/magazine/the-rare-white-lions-of-ngala/, accessed 13 January 2023.

White Lion Protection Trust that protecting the white lions as a keystone animal for the Kruger to Canyons Biosphere Reserve, could ultimately help to ensure that the entire lion population and all naturally occurring species within their area of occurrence will be protected.[7]

5.2.3 Anthropogenic Threats to White Lions in the Greater Kruger Park Region

As naturally-occurring members of the southern subspecies of the African lion *Panthera leo melanochaita*, and more specifically the lion population in the Greater Kruger Park Region, the wild and managed-wild white lions face similar threats to the wild tawny lions in that region. Although the lion population in South Africa is regarded as being stable, and anthropogenic activities are therefore regarded as not having a significant impact, since there are only 13 wild-managed white lions and three wild lions in the Greater Kruger Park Region, white lions are more vulnerable to anthropogenic impact (Riggio et al. 2013; Turner et al. 2015; Turner et al. 2022a; 2022b). The downlisting of the conservation status of lions in South Africa by the Department of Fisheries, Forestry, and the Environment (DFFE)[8] from Regionally Vulnerable to Regionally Least Concern on the global IUCN Red List (Hutchinson & Roberts 2020), as well as the demand for lion bones for traditional and cultural use, could in the long term put the chances of survival of white lions in the Greater Kruger Park Region under threat. The downlisting could increase the demand for wild lion trophies and especially lion bones, increasing poaching and illegal hunting and threatening the future of wild lion populations in South Africa[9]. Equally, if not more concerning from a conservation perspective, is the reclassification of 32 South African wild species (which includes lions) as farm animals by the South African Government (Somers et al. 2020). The reclassification as farm animals means that these wild species are open to a higher level of consumptive utilisation and therefore possible commercial exploitation.

The specific human threats to wild and captive lions (white and tawny) in South Africa are summarised (2.3.1 and 2.3.2) based on the draft lion conservation policies under review by the South African Government: 'Draft policy position on the conservation and ecologically sustainable use of Elephants, Leopard, Lion and Rhinoceros', 'The National Environmental Management Biodiversity Act (10/2004): Biodiversity Management Plan for the African Lion (Panthera leo)', and the 'Draft African Lion Biodiversity Management Plan Review Report' (Government Gazette 45160; Government Gazette 39468; DFFE & NLWG 2022):

[7] Kruger to Canyons | Biosphere Region (kruger2canyons.org), accessed 12 January 2023

[8] Now the Department of Forestry, Fisheries and the Environment (DFFE).

[9] http://whitelions.org/2015/05/22/sa-proposed-biodiversity-management-plan-to-put-lions-at- greater-risk/, accessed 28 January 2023.

5.2.3.1 Anthropogenic Threats to Wild and Wild-Managed White Lions

Trophy-hunting: Trade-related practices such as trophy-hunting have been recognised as risk factors for lions (Bauer et al. 2018). White lions are specifically sought for by trophy hunters and this may lead to selective hunting and dilution of the white gene pool (Cadman 2006; Tucker 2003; 2013; Turner et al. 2015; Dickinson 2021). The trophy hunting of lions in the privately-owned Associated Private Nature Reserves (APNR) that are open to the Kruger National Park, has often removed pride male lions, that may or may not be carrying the white lion recessive gene, and led to consequential infanticide and long-term disruption of natural lion pride and population structure (Whitman et al. 2007; Turner et al. 2015; Pinnock 2018; Dickinson 2021).

Lion bone trade: The legalisation of the international trade in lion body parts and derivatives from captive lions in South Africa to South East Asia by CITES in 2016, has subsequently led to a concern that this could prompt an increase in poaching and most likely illegal trade (Williams et al. 2017; EWT 2017). According to the same authors, a concern exists that this illegal trade could become a serious threat to wild-ranging lion populations in South Africa. Legal international trade in bones that were reported as being from captive-bred lions, could serve as a cover-up for illegally wild-sourced lion parts (Nowell & Pevushina 2014; Coals et al. 2022). The international trade in lion body parts and derivatives from captive lions in South Africa to South East Asia was therefore stopped by the South African government in 2021 (Government Gazette 45160). In response to a relative paucity of evidence-based research into trade in wild lion body parts, the International Union for Conservation of Nature (IUCN) in its Resolution 059 at the World Conservation Congress (WCC) in Marseille in 2020 -'Combatting the illegal trade in lion body parts and derivatives' - calls for further consideration of drivers of poaching, illegal trade in lion parts and understanding of value-driven incentives for lion conservation (IUCN World Conservation Congress 2020). Detailed studies and investigations into the lion bone trade have therefore been done by several authors, including Williams et al. (2017a; 2017b), Coals et al. (2021), Williams et al. (2021), Coals et al. (2022), and Mbongwa et al. (2022). The following important points were taken from the abovementioned studies. Until recently, the focus has been on legal trade in lion bones to Southeast Asia (Williams et al. 2017a; 2017b; 2021), whereas in Southern Africa lion bones and body parts are also sourced and traded domestically for cultural purposes, including zootherapeutic or traditional medicines, clothing, ornamentation, bushmeat, and curios, involving intra-continental supply chains (Lindsey et al. 2012; Williams et al. 2017a; 2021). Although domestic trade and use of lion body parts is common in Southern Africa, traditional and local uses are often overlooked in terms of their potential impact on wild lion exploitation, poaching and even population decline in regions of low density (Coals et al. 2020; Williams et al. 2021; Arias et al. 2022), probably due to cultural-political sensitivities associated with the policing of traditional practices (Bauer et al. 2018; Naude et al. 2020). There are many cultural beliefs regarding lions,

including attributes of power, strength, and fear, and the lion therefore often denotes status and respect amongst kings, chiefs, and traditional healers (Thornton 2009; Williams et al. 2015; Williams et al. 2021). Despite the number of ethnographic studies that have been done on wildlife use in traditional and cultural practices (Mokgobi 2014), very little is known about the impact that traditional and cultural use and trade in lion body parts in South Africa for traditional medicine may have on wild lion populations (Coals et al. 2022). According to Tucker (2003), the white lions have a long history of being regarded as culturally and spiritually significant by several population groups in South Africa and other parts of Africa. In accordance with ancient African tradition in which clans had specific totem animals that were revered and protected, the white lion was regarded as sacred and protected as a totem animal by specific Tsonga, Sepedi, Swazi, and Khoi San (Bushmen) local communities, dating back centuries. The knowledge passed down through this oral tradition indicates that the white lions appeared over 400 years ago during the reign of Queen Numbi, in the area known today as Timbavati Private Nature Reserve. The Global White Lion Protection Trust has therefore suggested that the cultural meaning of white lions to the Sepedi and Tsonga communities bordering on the Tula Tsau Wildlife Area is helping to mitigate against lion poaching and trade in lion body parts in that wildlife area.

However, the recent legalisation of the trade in lion bones from captive lions in South Africa in 2016 has led to concerns that it could prompt an increase in poaching and most likely illegal trade (Williams et al. 2017; EWT 2017). According to the same authors, this illegal trade could become a serious threat to wild-ranging lion populations in South Africa. Legal international trade in bones from captive-bred lions could serve as a cover-up for illegally wild-sourced lion parts (Nowell & Pevushina 2014; Coals et al. 2022). The international trade in lion body parts and derivatives from captive lions in South Africa to South East Asia was therefore stopped by the South African government in 2021 (Government Gazette 45160). The impact of traditional trade on wild lion populations remains largely under-considered and unquantified, although some authors suggest that the impact may be larger than that of international (legal and illegal) trade (Williams et al. 2017; EWT 2017). Nevertheless, the results of a study by Coals et al. (2022) indicate that South African muthi (i.e. traditional, or cultural medicine) trade in lion parts within southern Africa has a trade footprint with international dimensions. This includes a trade in body parts from white lions which are sought after due to their cultural meaning and rarity, since they are only found in the Greater Kruger Park Region in South Africa (Tucker 2003). It has been suggested that due to their rarity (three wild and 13 wild-managed) white lions are particularly at risk of poaching for their body parts (Tucker 2013; Dickinson 2021). In response to a relative lack of evidence-based research into the illegal trade in wild lion body parts, the International Union for Conservation of Nature (IUCN), in its Resolution 059 adopted at the World Conservation Congress

(WCC) in Marseille in 2020 - 'Combatting the illegal trade in lion body parts and derivatives' - calls for further consideration of drivers of poaching, illegal trade in lion parts and an understanding of value-driven incentives for lion conservation (IUCN World Conservation Congress 2020). There is also concern that wild lion body parts from eastern and southern Africa could be drawn into the large illegal wildlife trade to Asia centred around elephant ivory and rhino horn (IUCN 2016). Coals et al. (2022) suggest that, in order to protect wild lion populations from illegal exploitation, there is a need for effective and socially just law enforcement and trade regulation engagement with stakeholders in culturally traditional lion trade systems.

Poaching for the bushmeat trade[10]: (White) lions often end up in snares intended for other species such as buffalo, zebra and wildebeest, targeted for the trade in bushmeat (Becker et al. 2022). Despite the daily snare patrols by anti-poaching teams on the Global White Lion Protection Trust wildlife areas, sometimes animals still end up in snares.

Bovine tuberculosis (bTB): In the Kruger National and Hluhluwe-iMfolozi Parks, Bovine tuberculosis (bTB) has spread throughout these parks by the movements of the buffalo, as maintenance hosts for bTB and a primary prey of lions, and over 80% of lions in some areas of the Kruger National Park are infected by bTB (Radloff & Du Toit 2004; Owen-Smith & Mills 2008a; 2008b; Funston et al. 1998; Keet et al. 2009). Since African buffalo and blue wildebeest are primary prey of lions in the Greater Kruger Park Region, lions (tawny and white) are at risk to the spill-over effects of bTB. With the existing shifts in climate towards drier conditions, lions, and all animal species, are likely to be under greater environmental stress, reducing their immunity, and making them more susceptible to diseases such as bTB (Government Gazette 39468).[11]

Human-lion conflict: Poor management of the boundary fences of wildlife reserves and national parks often leads to a high occurrence of human-lion conflict for communities bordering on the Greater Kruger National Park, with lions (tawny and white) being killed as damage-causing animals (Government Gazette 45160). Since certain tawny lions in the Kruger National Park have the recessive gene that causes the white colouration, potential gene carriers are at risk of being killed through human-lion conflict.

[10] 'The term 'bushmeat' is originally an African term for wildlife species that are hunted for human consumption, and usually refers specifically to the meat of African wildlife (Bennett et al. 2007).

[11] SANParks is presently planning to conduct a comprehensive study to investigate the incidence of bTB in the lion population in the Kruger National Park, and the correlation with the stress levels of lions, in relation to environmental conditions. The outcome of this study will be important for managing this threat to wild lion populations, which was introduced to African buffalo when European cattle were imported into South Africa in the 1950s or early 1960s (Bengis et al. 1996; Michel et al. 2006; Keet et al. 2009).

Policy concerns: (i) No national policy exists to enforce a minimum level of regulation for lion management in the 49 fenced wildlife reserves; instead, at the time of writing it is based on voluntary membership and adherence to management principles defined by the Lion Management Forum (LiMF) and adaptive management (Government Gazette 45160; Government Gazette 39468); (ii) Corruption and involvement of national park personnel in lion and rhino poaching has been identified within certain of South Africa's national parks and a number of the wildlife reserves (Bloom 2021); (iii) Trophy hunting of lions (white and tawny) is still an accepted practice within the private wildlife reserves that form part of the Greater Kruger Park ecosystem. In addition to the negative effects on the lion pride and population structure, trophy hunting in South Africa is opposed by many tourists and is a threat to the significant income source derived from ecotourism (Pinnock 2022); (iv) Poorly managed fence lines between the national parks and community areas leads to human-lion conflict and often the shooting of lions that escape into the community areas (Bloom 2021).

5.2.3.2 Anthropogenic Threats to the Captive White Lion Population in South Africa

The rarity of white lions and their spiritual and cultural significance to certain Sepedi and Tsonga communities in South Africa, and Asian communities in South East Asia, has made them highly sought after and therefore bred extensively in captivity in South Africa (Tucker 2003; Tucker 2013). The following are anthropogenic activities that affect captive white and tawny lions in South Africa:

Trade in lion parts: Since the international trade in captive lion bones and derivatives was legalised in South Africa in 2016, captive-bred lions (white and tawny) have been seen simply as a commodity, compromising the conditions under which captive lions are kept, with no regard for their fundamental living conditions or the prevention of inbreeding (Green et al. 2020; Dickinson 2021; Coals et al. 2022). Although the international lion bone trade from captive lions in South Africa was stopped in May 2021 due to the concerns raised by a high-level panel of experts (Government Gazette 45160; Green et al. 2021), the impact on illegal trade is not yet well understood (Williams et al. 2021; Coals et al. 2022). The controversial practice of lion 'farming' and associated industries of captive-bred or 'canned' trophy hunting linked to intercontinental lion bone trade throughout Southeast Asia brought issues of lion trade to the fore in both conservation and public discourse (Coals et al. 2019). Considerable debate focused on South African lion farming, particularly on how supplies of captive-bred lion products may influence trade dynamics and impact the few remaining wild lion populations (Williams et al. 2017a; Coals et al. 2019; Williams et al. 2021; Becker et al. 2022). Combatting the illegal trade in lion body parts and derivatives is critical to provide evidence-based research into drivers of wild lion overexploitation for trade, and the development of novel methods for the investigation and monitoring of trade in lion parts (IUCN World Conservation Congress 2020). A key

to monitoring the trade in lion parts will be to distinguish between captive-bred and wild lion bones, and as yet there is no effective technique for achieving this (Coals et al. 2021). The Global White Lion Protection Trust suggests that since lion bone parts from white lions are highly sought after, and there are so few wild (3) and wild-managed white lions (13), white lions are particularly at risk of poaching for their parts (Tucker 2013; Dickinson 2021).

Trophy hunting: although proposed in the 'Draft Policy on the Conservation and Sustainable Use of Elephants, Leopard, Lion and Rhinoceros' (Government Gazette 45160), it remains to be seen whether the hunting of captive-bred lions (white and tawny) will be banned by the South African conservation authority (DFFE); especially with the opposition from the captive lion breeding industry and lion bone traders, who are threatening with court action against the South African Government if the stricter policy measures are implemented.

Inbreeding and disease: In the more than 300 captive lion breeding operations (Government Gazette 45160), inbreeding of white and tawny lions is common, as well as poor hygiene within the lion enclosures, and the consequential spread of disease (Green et al. 2022).

Policy concerns: A number of policy concerns have been listed in 'The National Environmental Management Biodiversity Act (10/2004): Biodiversity Management Plan for the African Lion (*Panthera leo*)'(Government Gazette 39468) and the 'Draft African Lion Biodiversity Management Plan Review Report' (DFFE & NLWG 2022): (i) There is a lack of regulation of captive lion operations by conservation authorities due to insufficient resources, capacity, and funds to conduct regular inspections of permits, enclosure conditions, and lion numbers in the more than 300 captive breeding operations (Government Gazette 39468; DFFE & NLWG 2022); (ii) There is often a lack of compliance to policy requirements, and enforcement of regulations, at captive lion operations due to the respective South African provinces implementing different Ordinances, as well as the absence of a standard permit system (DFFE & NLWG 2022).

From the description above (2.3.1 and 2.3.2), it is apparent that the Global White Lion Protection Trust and draft conservation policies in South Africa (Government Gazette 39468; DFFE & NLWG 2022) have identified anthropogenic activities that could have an impact on lions (white and tawny) in the Greater Kruger Park Region. The rarity of free-roaming white lions in the Greater Kruger Park Region suggests that particular attention should be given to mitigating the anthropogenic activities that could put free-roaming white lions at risk.

5.2.4 Conservation Role of the GWLPT in the Reintroduction of White Lions to the Greater Kruger Park Region

According to the Global White Lion Protection Trust, the key objectives forreintroducing white lions to the Greater Kruger Park Region are: to return white lions to their natural habitat as part of wild tawny prides, as a natural occurrence of that region; to protect white lions from the anthropogenic activities that led to their absence (1994 to 2006) and low survival rate (2006 to 2022); and to better protect lions (white and tawny) in that region through the cultural significance of white lions to the local Sepedi and Tsonga communities that could reduce human-lion conflict, and poaching of lions for their parts. The long-term objective of the Global White Lion Protection Trust is that the reintroduced prides of white and tawny lions at the Global White Lion Protection Trust wildlife areas will contribute to the metapopulation management approach to wild lions in the Greater Kruger Park Region, and therefore South Africa.

5.3 Discussion and Conclusions

In Chapter 5 the reintroduction and conservation management of white lions in the Greater Kruger Park Region is outlined for the first time, and discussed in relation to the anthropogenic activities that could have had an impact on lions (white and tawny) historically, and at the present time in that region. The possible conservation role of the white lion reintroduction is then discussed in context of the metapopulation management approach to lions (white and tawny) in South Africa.

Since there were no adult white lions in the wild in 2006, the Global White Lion Protection Trust conducted the first reintroduction of white lions to free-roaming conditions in their natural habitat, which was reviewed for the first time in this chapter. The reintroduction methodology used by the Global White Lion Protection Trust was based on the reintroduction guidelines of the IUCN (IUCN / SSC 2013), and the conservation principles applied were aimed at protecting and managing the reintroduced lions in accordance with the principles of the metapopulation approach to lions in South Africa. The earlier findings of this doctoral study (Chapter 2, 3 and 4), showed that white lions are similar to wild tawny lions in terms of their genetics, hunting success, home range behaviour, social structure and general lion behaviour, and are therefore significant members of *Panthera leo melanochaita*. These findings agree with historical observations and reports that in the wild, white lions form socially cohesive prides with wild tawny lions, are able to hunt successfully, and to survive in the wild (Cesare 2011; Tucker 2015). I therefore agree with the postulation by the Global White Lion Protection Trust (GWLPT) that the most likely reason that white lions were absent from the wild from 1994 to 2006, was due to anthropogenic impact: illegal removal to breeding and hunting farms, the continued lion trophy hunting of pride

males which caused infanticide, and high impact ecotourism leading to undue stress on lionesses with young cubs during regular viewings by tourist or lodge vehicles (McBride 1977; McBride 1981; Whitman et al. 1997; 2004; Cadman 2006; Turner et al. 2015; Dicks 2022). Although 17 white lion cubs were born in the Greater Kruger Park Region between 2006 and 2022, only three survived. The natural high mortality rate of 50% of wild lion cubs within the first year was likely a contributing factor to the low survival rate (Funston et al. 2003), but a growing anthropogenic threat to lions (white and tawny) in South Africa, including the Greater Kruger Park Region, is the poaching of lions for their body parts for cultural and traditional use, as indicated by Coals et al. (2022) and the 'Revised Draft White Paper on Conservation and Sustainable Use of Elephants, Lion, Leopard and Rhinoceros in South Africa' (Government Gazette 46687). Until recently, the focus has been on legal trade in lion bones to Southeast Asia (Williams et al. 2017a; Williams et al. 2017b; Williams et al. 2021), whereas in Southern Africa lion bones and body parts are also sourced and traded domestically for cultural purposes, including zootherapeutic or traditional medicine, clothing, ornamentation, bushmeat, and curios, involving intra-continental supply chains (Lindsey et al. 2012; Williams et al. 2017a; Williams et al. 2021). Although domestic trade and use of lion body parts is common in Southern Africa, traditional and local uses are often overlooked in terms of their potential impact on wild lion exploitation, poaching and even population decline in low density regions (Coals et al. 2020; Williams et al. 2021; Arias et al. 2022). This includes a trade in body parts of white lions which are sought after due to their cultural meaning and rarity, since they can only be found in the Greater Kruger Park Region in South Africa (Tucker 2003). It has been suggested that due to their rarity (three wild and 13 wild-managed) white lions are particularly at risk of poaching for their body parts (Tucker 2013; Dickinson 2021).The Global White Lion Protection Trust proposes that the fact that the white lion is regarded as a living cultural heritage by local communities in the Greater Kruger Park Region, could in fact help to mitigate human-lion conflict and lion poaching for their body parts (Tucker 2003; Lagendijk & Gusset 2008; Evans 2018: pp. 155-8 and 243-7; Somerville 2020: pp. 196-8). The low incidence of lion poaching at the wildlife areas of the Global White Lion Protection Trust over the past 20 years, suggests that the Tsonga and Sepedi communities that border on the Global White Lion Protection Trust wildlife areas do have a positive attitude towards the conservation of white lions in the Tula Tsau Wildlife Area and the conservation of wildlife in general. The creating of jobs by the Global White Lion Protection Trust, its environmental outreach programme, and its school leadership programme may have contributed to this positive attitude. Recognition of the cultural and spiritual value of wildlife and the natural environment is also reflected in the mission statement of the conservation authority that manages South Africa's national parks (SANParks), which reads as follows: "To acquire and manage a system of national parks that represents the indigenous wildlife, vegetation, landscapes and associated cultural assets of South Africa, for the joy and benefit and spiritual well-being of the nation and the people of

the world." (McKeown 2015). Therefore, wildlife forms a key part of the heritage of South Africa, having cultural and political value, as well as potential economic value from tourist revenue[12]. On a broader scale the Global White Lion Protection Trust hopes that the cultural meaning of the white lion to local communities, will be supportive to protecting the Greater Kruger Park Region, just like the Kermode Bear (*Ursus americanus kermodei*) has been for protecting the 4000,000 ha Great Bear Rainforest in British Columbia (Western Canada).

Within the South African context, the aim of the Global White Lion Protection Trust is to contribute to the metapopulation management approach to wild lions in South Africa, in accordance with the management principles outlined in Miller et al. (2015) and by the Lion Management Forum (LiMF 2020:1), since the area where the white lion reintroduction took place (Tula Tsau Wildlife Area) is a fenced wildlife area bordering on other fenced wildlife areas (such as Kapama and Thornybush Private Nature Reserves) within the Greater Kruger Park Region. In light of the significant decline in the lion population on the African continent (Riggio et al. 2013; Miller et al. 2016), the high growth rate of lions achieved by the 49 fenced wildlife reserves in South Africa can certainly be considered a conservation achievement. However, rapidly growing lion populations in enclosed, albeit extensive, systems can very quickly result in significantly depleted prey numbers (Power 2003; Tambling et al. 2005; Hayward et al. 2007; Lehmann et al. 2008) and sometimes even localised extinctions of ungulates (Slotow & Hunter 2009) if left unmanaged. The adaptive management[13] principles defined by the metapopulation management approach to lions in South Africa (Miller et al. 2015; LiMF 2020:1) is therefore critical, and even more importantly that these principles are reflected in the final policy on lion conservation and management in South Africa. It is therefore important that the Global White Lion Protection Trust inspires similar organisations by continuing to apply the conservation management approach towards regulating and managing the prides of white and tawny lions on its wildlife areas going forward, in accordance with the ecological carrying capacity of the habitat, the natural pride social structure, and promoting genetic diversity.

[12] Marie-Christine Cormier-Salem and Thomas J. Bassett, "Nature as Local Heritage in Africa: Longstanding Concerns, New Challenges," Africa 77, no. 1 (2007): 1-17].

[13] Adaptive management: An iterative process of interventions to achieve management plan objectives in the face of uncertainty through development of an expectation of how the system may respond to a considered and planned intervention. Implementation thereof, monitoring the outcomes, adapting management interventions, and /or expectations, thereby allowing continual improvement through learning (definition from: Government Gazette 46687).

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