



INGURUMA LION REINTRODUCTION PROJECT
ZAMBEZE DELTA, MARROMEU COMPLEX, MOZAMBIQUE

THE CABELA FAMILY FOUNDATION

PART I

THE HISTORY & FUTURE OF LIONS

OCTOBER 2017



DR Byron du Preez



"tea under the mango tree..."

This is where the real conservation is achieved.



PREFACE

TODAY, lions *Panthera leo* [LINNAEUS 1758] are a highly emotive species [1,2,3], probably because they are so interwoven into human history and have been globally important cultural symbols for thousands of years: depicted in some of the earliest Paleolithic cave art in the Chauvet Cave of southern France [4]; were deities in ancient Egypt [5]; and were the symbol of British Empire, still starring on their coat of arms today [6]. In Christianity, the lion features on several occasions in the Bible, both as a real animal (e.g. Daniel 6:16-24) and conceptually (e.g. Psalms 17:12); and where the duality of its aggressive and protective natures are extolled (Joel 3:16). Both God (Hosea 11:10) and the devil (1 Peter 5:8) are also variously compared to lions in terms of their power and destructive potential respectively. And yet never before since the beginning of our relationship with them has the future of lions been so precarious as it is today.

The IUCN Red List of Threatened Species have classified the lion as ‘*Vulnerable*’ since at least 1996, with some populations recently elevated to ‘*Endangered*’, estimating that overall there are less than 25,000 wild lions remaining in less than 25% of their former range [7]. Lions historically occurred throughout Africa, parts of Europe, the Middle East and Asia [8], but their surviving conservation strongholds currently occur only in patches of eastern and southern Africa [9,10].

Lions are uniquely social amongst extant big cats, with males forming coalitions of up to nine individuals that may be associated with female prides in excess of 20 animals [11], and so it is unsurprising that lions are also the dominant carnivore wherever they occur [12]. The lion is an ideal umbrella species for conservation; being large, charismatic and easily observable [13], and the species is so popular that commercial wildlife operations (both consumptive and photographic) risk losing out on a significant share of the market if they cannot offer them to prospective clients [14]. The lion is therefore often prioritised in conservation efforts, where their charisma is exploited to generate the funding urgently required to maintain wildlife area viability [14]. However, despite the global fascination and their ecological potential, the fact remains that there is little available space remaining for the reestablishment of viable lion populations in Africa [15].

The Ivan Carter Wildlife Conservation Alliance, with the incredible support of the Cabela Family Foundation, and in partnership with Zambeze Delta Safaris, have undertaken one of the most ambitious ecological restoration projects ever conceived of – with the goal of adding to and protecting potentially more than 9,000 km² of extant lion range in Africa. Habitat loss, livestock encroachment and human persecution, and prey-base depletion have been defined as the most significant threats to the survival of the lion [7], and therefore a project of this scale – where a massive area of habitat is protected, livestock do not occur, human persecution is under control, and the prey base has been restored to historical levels – is critically important for enhancement of the species’ future conservation security [7].





Figure 1: *Some of the earliest recorded drawings of lions in Paleolithic cave art, Chauvet Cave, Ardèche, France. Here lionesses are shown hunting.*

Courtesy of https://en.wikipedia.org/wiki/Cultural_depictions_of_lions



Figure 2: *Bushman rock art of a male lion in the Matobo Hills, Zimbabwe. Included in the same canvas as this lion was an image of a rhino – two critical conservation species that even ancient cultures recognised were special.*

Photograph: Byron du Preez





EXECUTIVE SUMMARY

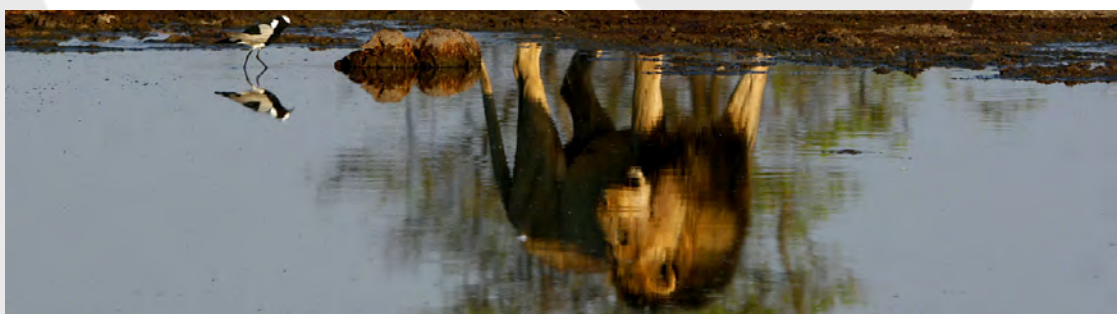
- Lions were once abundant in the Zambezi Delta, but there remains no viable population. According to the IUCN, the main threats to wild lions include:
 - i. Indiscriminate killing (*e.g. snaring and retaliatory or pre-emptive persecution*)
 - ii. Reduced prey base and density
 - iii. Habitat encroachment and destruction
 - iv. Reduced population sizes and ranges
 - v. Inefficacy of lion conservation management (*including hunting*)
- Poaching was the primary and ultimate cause of the local decline and eventual extirpation of lions in the Zambezi Delta.
- Carnivore populations have failed to recover as there lacked sufficient individuals to re-establish founder populations.
- Ungulate populations in the ~9,000 km² Zambezi Delta have presently recovered to estimated pre-war levels, human occupancy levels within the area are relatively low, and the professional anti-poaching effort is immense.

With regard to lions, a large area, adequate prey, low human density, and active protection are the key factors relating to the potential for a viable free-ranging wild population.

- There are currently more than adequate resources for a large resident population of lion, and there is on-going investment in the protection and enhancement of the ecosystem, and therefore the environment is primed for reintroduction of a lion seed population to recolonise the Zambezi Delta, and re-establish balance and intact food chains.

This work was entirely made possible by the generous support of the

CABELA FAMILY FOUNDATION





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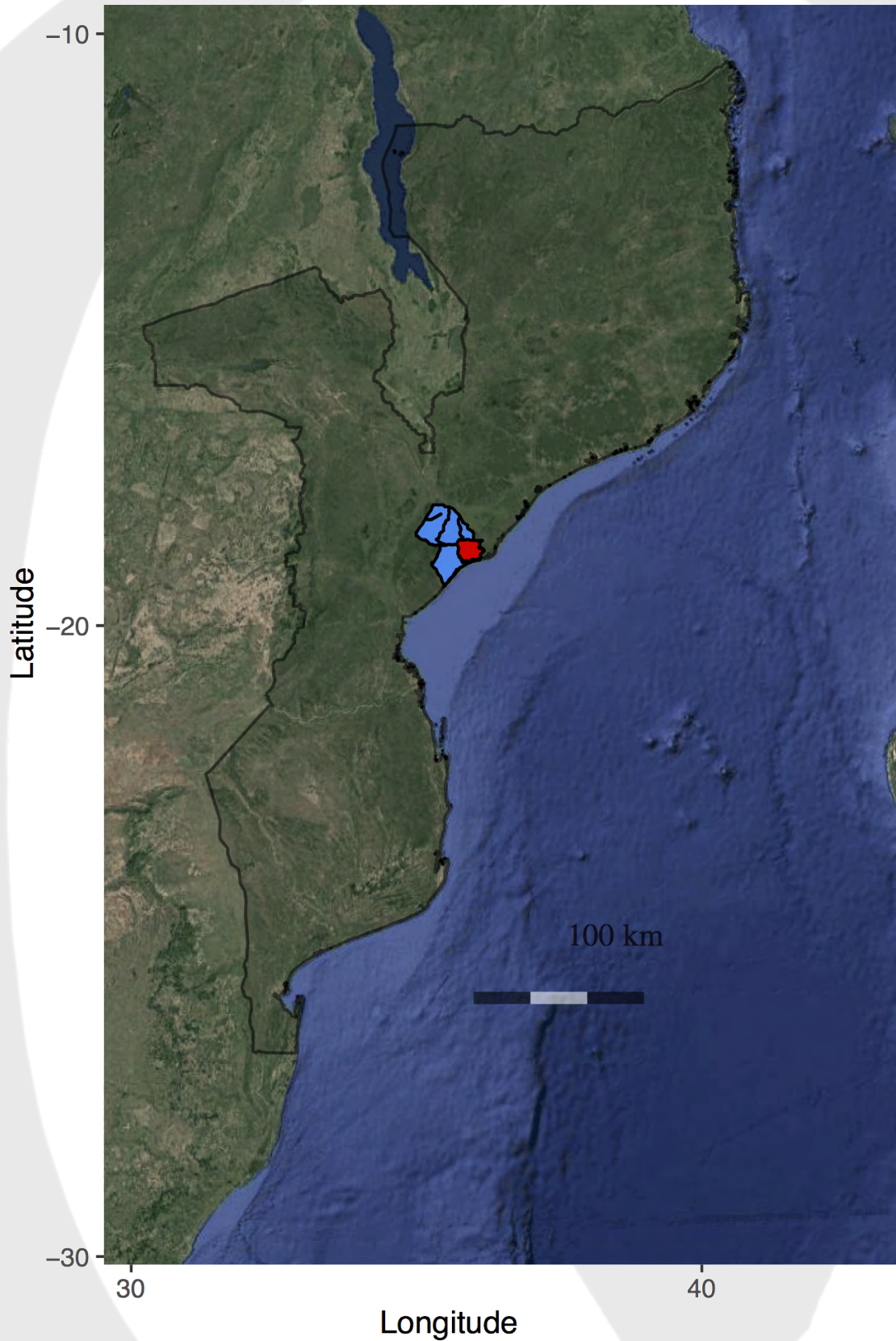


Figure 3: Map of Mozambique (grey), indicating the 9,380 km² total area of Coutadas 10, 11, 12 & 14 (blue), and Marromeu National Park (red) combined, and into which the lions will be reintroduced.



1. BACKGROUND

“In parts of Portuguese East Africa, Lions are probably more numerous than in any other part of South Africa” – Kirby 1896 [31 *op. cit.* 32]

1.1 The recent history of conservation, Mozambique

The Mozambican Civil War, which raged from 1977 to 1992, resulted in the death of an estimated one million people and the displacement of a further five million [16,17]. Five million people effectively became refugees in their own country, and the majority of these sought refuge from the war by dispersing into the country’s vast undeveloped areas, with neither income nor basic provisions, and thus resorted to ‘living off the land’ – placing unbearable pressure on the ecosystems and wildlife therein. Over vast swathes of unique habitat types, the Mozambican wildlife was decimated [18,19,20].

Whilst two decades of focused conservation efforts in Mozambique have seen some areas return almost to their former ecological glory [21], the human population has grown faster than both the country’s economy and infrastructure [22,23] – and with no formal education and few transferable skills [24], many Mozambicans still live off the land, practicing slash-and-burn cultivation [25], and trapping animals for food and profit [26].

The setting of passive traps (snares) for animals (bush-meat) is a very efficient method of killing, given remaining wildlife and no preventative anti-poaching effort. Until the wildlife has been completely destroyed, killing may exceed local requirements, and with road networks between towns and villages (i.e. economic hubs) ever improving, bush-meat is potentially big business; even – or maybe especially so – in poor African countries [27,28,29].

Whilst an efficient method of killing, bush-meat poaching is an extremely inefficient method of utilising the wildlife resource, realising only 0.31-0.52% of the actual value of the animals killed [30]. Most of the animals killed are never even recovered, and thus truly wasted.

The global challenge facing wildlife conservation is obviously in protecting ever-shrinking areas for the habitats and wildlife therein, whilst also integrating the ever-growing local communities as part of the process and solution – the end goal being the development of custodians of the wildlife as opposed





to incentivising agents for the black-market trade. The overall success or failure of conservation efforts can be measured against the level, or lack, of

local support; and therefore enhancing the local communities must be an integral part of any modern conservation mandate.

1.2 The state of lion conservation in Mozambique

There are numerous accounts and records of lions from throughout the Zambezi Valley to the Delta penned during the late 19th and early 20th centuries by the pioneering explorers and hunters in the area; and all such reports mention that lions were abundant and widespread throughout Mozambique [31,33,34].

Apparently, the historical record of lions in the National Archives of Mozambique date back to the 17th century, and although details of the precise lion distribution are lacking, most historical accounts suggest widespread occurrence throughout the country [35].

Currently, the lion range in Mozambique is still relatively extensive, with projected total coverage of between 66 and 78% of the country's land area, and an extrapolated total population size of approximately 2,700 individuals [35], however these are probably overly optimistic estimations. In fact, there are few currently accurate data on Mozambican lion range – and even less on pop-

ulation densities therein.

Lion surveys in Mozambique have historically been conducted in: Gorongosa National Park [36]; Gilé National Reserve [37]; Chimanimani National Reserve [38] and in a few other places across the country [39]. However, despite the ecological, cultural, and financial value of the species, only Gorongosa National Park and Niassa National Reserve currently have reliable estimates of lion density [35].

Lion population viability and potential is based on habitat suitability and prey density [7]; therefore, whilst reports indicate that lions are potentially still widespread, it is likely that their densities have suffered the same national downward trend as that of their prey over the last few decades [35]. Lions are also an infamously infanticidal species [11,40,41,42,43,44], and cub survival, population recruitment, and ultimately local persistence, is based on stable social units with low rates of male turnover.





1.3 Zambezi Delta Lion Reintroduction Project

Zambeze Delta Safaris was established in 1994 in the Coutada 11 block of the Marromeu Complex in eastern Mozambique. At that time the ecology of area was ruined by the devastating legacy of the war, which still remains in some areas of Mozambique today.

As a stark example of the desolation, buffalo *Syncerus caffer* numbers had dropped to just over 1,000 individuals from a once huge population of over 55,000 [45], and only 44 sable *Hippotragus niger* were found in the entire area [46]. A massive and on-going effort and financial investment in staff, local communities and the ecosystem has been key in turning the tide and reestablishing a productive environment. Today the buffalo are pushing 30,000 head, and the sable population has rebounded to over 4,000 individuals.

But as the wildlife populations grow, so too does the incentive for poaching. The Zambeze Delta Safaris Anti-Poaching Unit originally consisted of 5 local villagers (2 of whom were trained in Gorongosa National Park); but has today matured into a serious force, with over a dozen motorbikes and a Land Cruiser and helicopter – and the personnel have developed into a very strong team that is skilled at adapting to and reducing the ever evolving poaching threat. However, anti-poaching deals with the symptom, not the cause, and

is therefore only part of the solution – though no doubt a very important part. The other part of the success has been secured in forging and enhancing positive relationships with the local communities. Meat harvested from the safari hunting operations is distributed between the villagers and camp staff, and a mobile milling unit regularly services each settlement. Additionally, a school and clinic have been built on site and are freely accessible to the local community. But as with any successful partnership, both sides need to be respectful of their relationship, and to act responsibly with regard to one another – if a local villager is caught poaching, the village elders are gathered and the issue discussed openly; and normally the meat distribution and milling opportunity for that particular village are suspended over a set period. This strategy has even led to several poachers ‘resigning’ and handing in their gin-traps and snares rather than risk costing their villages these privileges.

The hunting-led conservation model in Mozambique is a wonderful example of a positive feed-back loop – the more the wildlife population recovers, the higher the hunting quota; the higher the revenues generated, the more funding is available for anti-poaching and community support (and the more support from the community, the more they directly benefit); the more pro-





tection, the more secure the long-term conservation status of the wildlife.

Wildlife populations in the Zambezi Delta have recovered to the point that is now appropriate to implement the next phase of the ecological restoration: *carnivores*. As a function of their position at the top of the food chain, predators regulate the entire trophic system [47,48] and are thus a critical cog in the ecological machine. Lions were historically present and common in the Zambezi Delta [33], and vagrants are occasionally

still encountered on the boundaries; but the abundant lion population of old has not recovered to historical levels.

However, before undertaking any landscape ecological engineering, due diligence dictates that we address three pertinent questions regarding the current and future viability of lion populations at any proposed relocation site:

- i. *Why did the lions disappear?*
- ii. *Why did the lions not return?*
- iii. *Is the current environment ecologically suitable for lions?*



Figure 4: *Lions are particularly vulnerable to cable snares: often scavenging carcasses in a snare line, where the whole pride may be caught in the remaining nooses.*

Photograph: Byron du Preez



2. PART I – DISAPPEARANCE OF THE LIONS

Lions were once abundant in the area [33], but today there are only rumours of the odd vagrant, with none permanently established in the area. This begs the obvious question of *what happened to the Zambezi Delta lions?*

2.1 What happened to the Zambezi Delta lions?

In 2006, the International Union for Conservation of Nature Species Survival Commission (IUCN-SSC) commissioned a regional workshop for eastern and southern Africa with the mandate of gathering the major authorities and local stakeholders to produce targeted situational conservation strategies for the lion [35]. This workshop determined that the greatest anthropogenic threat to lions was due to poaching – either as the unintended by-catch from illegal bush-meat snares, or the illegal intentional killing (pre-emptive or retaliatory) of individuals caught up in human-wildlife conflict (suspected or actual). The second largest cause responsible was legal Problem Animal Control operations in which known or suspected conflict cats, or those just in the wrong place at the wrong time, were exterminated. Trophy hunting ranked as a relatively low threat to lions nationwide, mostly because this occurs in only a few populations and is thought to be well controlled by the authorities. There were no data on the relative impact of disease on lion mortality levels, and to what extent anthropogenic in-

fluences affect this, but based on this fact is likely to be low.

Despite a lack of experimental data on the cause of the local lion population decline, there is ample empirical evidence that it was both directly and indirectly related to the same factors that caused the crash in the local ungulate populations: directly in terms of being killed in snares and gin-traps (either targeted or as by-catch); and indirectly as when the herbivores disappeared, so too did their prey-base.

Anecdotal evidence of lions falling victim to snares includes a man-eating male lion that was shot in a village of Coutada 11 shortly after the establishment of Zambeze Delta Safaris [46]. This particular individual was missing a paw and most of its teeth, both of which are indicators of an encounter with a gin-trap – the lion's teeth broken while gnawing the steel on its leg.

Several of the current staff, including most of the Anti-Poaching Unit, were by their own admission for-





mer poachers (though many considered themselves subsistence hunters) before the opportunities of employment in the safari industry were presented [26,46].

In September 2017, as part of a community consultation and education program, each of the communities within Coutadas 10, 11, 12 and 14 were engaged in open forum discussion regarding the imminent reintroduction of lions. This program was the first in a series of planned engagements, and apart from further strengthening relationships, the information shared from both sides of the table was enlightening for all parties involved. Each meeting at every village began with structured interviews for a representative sample of the community (a summary of which is provided in Appendix A). Everyone could identify lions from photos, but very few of the younger members of the community had actually seen a real lion (though several of the older members remember them in the area). Whilst there is evidence of lions being snared locally, a somewhat surprising but con-

sistent revelation during the discussions was that lions are deeply involved in local spirituality, and that ‘*spirit-lions*’ are locally revered as protectors of the community. This phenomenon was reported by Livingstone in 1857, and apparently remains persistent in the same area today. It is therefore doubtful that lions were the direct targets of poaching activity during the war years, and were most likely collateral when scavenging carrion from a clutch of snares. Snares set for bush-meat are often set in clusters around particular features, such as well-worn game paths or popular water points, and are therefore effectively self-baiting death-traps for carnivores. Lions are particularly susceptible to snares [49] (Figure 4) – probably more so than any other species due to their propensity for scavenging carrion in conjunction with their socially cohesive behaviour and movement in which whole prides can be eliminated in a single snare-line – and entire populations are vulnerable to unchecked poaching, which was the case for over 3 decades in the Zambezi Delta.



Figure 5: Removed snares: *countless*



Figure 6: Cable snare: *would you see it?*





The worst part about snares is that they are as simple as they are efficient – just a short piece of wire turned into a noose and set at head-height along a trodden game path is guaranteed to kill – or mortally injure – something. Wire, due to its tensile strength and low-profile, is the most dangerous type of snare; but nylon rope, fibrous tree bark and vines, and even mosquito nets donated by NGOs then melted and twisted into strings, are just as effective.

Thousands upon thousands of such snares have been removed since the Zambeze Delta Safaris Anti-Poaching Unit was formed (Figures 5, 6, 7, 8 &

9), and it is impossible to gauge the actual quantity that have been deployed in the area since the early 1970s. Gin-traps are a variation on a theme, and the same principles regarding deployment and destruction, particularly with regard to potential for large carnivore destruction, hold.

Lions have relatively enormous home ranges [15] – which increase in size with a decrease in population density [50,51] – and a constantly maintained bank of snares could therefore create a very large population sink that eventually even affects lions far beyond the normal boundaries of an unpersecuted population [51].



Figure 7: *Haul of poached wildlife*



Figure 8: *Carcass and offending gin-trap*

There is no doubt that poaching (directly in terms of targeted snaring and bycatch; and indirectly in terms of reduced prey density) was the primary and ultimate cause of the local decline and eventual extirpation of lions in the Zambezi Delta.





Figure 9: *The scourge of Africa – neverending gin-traps*

Photograph: Byron du Preez



3. PART II – LION POPULATION RECOVERY

Having identified that poaching was the major factor relating to the local extinction of the Zambezi Delta lion population, and having also shown that anti-poaching efforts are subsequently to thank for the almost complete recovery of ungulate populations to estimated pre-war levels, the next logical question to ask is *why did the lion population not also recover?*

3.1 Why did the lion population not recover?

The nature of this question, in a landscape ecological context, precludes the possibility of there existing any formal data to analyse. However, by considering the bigger picture, and referring to data on pertinent related topics, we are able to compile a reasonable corpus of evidence that help to reveal the answers to this question.

Firstly, poaching was not limited to the Zambezi Delta, but widespread throughout Mozambique's wildlife areas. Indeed, few places have a comparable anti-poaching track record to that of Zambeze Delta Safaris' Anti-Poaching Unit, and hence even though the local environment recovered ecologically with regard to the requirements of large carnivores, there was an overall dearth of lions in the larger ecological landscape available from which to naturally repopulate the Zambezi Delta. Competition with other predators can therefore also be ruled-out as lions are the dominant carnivore wherever they

occur, and the factors affecting lions would similarly apply (more or less) to other species.

Secondly, since the original dispersion of people into wildlife areas at the onset of civil war in the 1970s, many of the original settlements have expanded into much larger compounds as the Mozambican human population grew. Today these hives of human activity, and the routes between them (as well as a complete lack of surviving natural prey therein) have effectively become biological barriers ^[15,52] to lion movement and natural dispersal. Biological barriers are non-physical obstacles to movement that include territorial boundaries between individuals or social groups, as well as tracts of otherwise intact habitat but in which there is a deficit of the resources required to survive the journey; for example food and/or water. Lions that currently exist in relatively stable populations and within normal reach of the Zambezi Delta are sim-





ply unable to navigate the human landscape whilst supporting themselves nutritionally and without being removed as ‘problem animals’; *real or perceived*. The obvious potential lion source population for the Zambezi Delta would be that of Gorongosa National Park, which is protected, and stable – however, this population is currently at a relatively low density, and there therefore exists little or no reason for these lions to risk dispersing through lower quality and human-occupied habitats with the associated danger and lower chances of survival – although that is not to say that this does not occasionally still happen. In time, with on-going protection, the Gorongosa lion population could potentially be a valuable local source population, but this is currently of no real benefit to the Zambezi Delta.

Vagrant individuals and small family groups of lions are occasionally encountered on the boundary of the Zambezi Delta, and these are either a rem-

nant of the historical population, or migrants that have managed to bridge the divide. Lions are an exceptionally and complexly social felid [12], and their behavioural ecology is based on this; paternal protection is fundamental to cub survival and population recruitment [11], and the currently disrupted relic groups do not benefit from the advantages of a stable and cohesive social unit (despite relatively fine-scale spatial and temporal fission-fusion behaviour) that normally defines their species [42]. Being at the top of the food-chain without any natural predators except man and themselves, as well as their organised sociality and sororal parental cooperation, lion populations have exponential growth potential (Figures 10 & 11). That these lions (though not necessarily the same individuals) have been sighted on and off for several years without establishing a permanent and expanding population locally confirms that, for whatever reason, they remain below a viable ecological threshold.





According to a resource dispersion hypothesis [55], at least as it pertains to lions, female territoriality is based on securing and defending a minimum prey base resource that provides for current and potential offspring; whilst access to females is the key male resource, and male territorial behaviour is based on the acquisition and defense of mating-rights. It is possible that without competition for prey from other females, the vagrant lionesses have no patch to defend from others as there is ample food available throughout a huge area, and thus wander uncon-

strained; and without resident females, there is nothing for the males to defend and thus hold them in the area. As already discussed, lower lion population densities are associated with larger territories, and this wide-ranging behaviour increases the risks of encountering snare-lines and exposing them to lethal problem animal control campaigns. Consequently, reintroducing a sufficient number of lions to within the boundaries of the protected area would facilitate local population stabilisation, and which, on reaching critical mass, would become self-sustaining.

Despite almost complete ungulate population recovery, the carnivore populations have failed to recover as there lacked sufficient individuals to re-establish founder populations, but the wildlife resources have now exploded to a level that warrants predation, and which would benefit the entire ecosystem to re-establish top-down control of the trophic system.



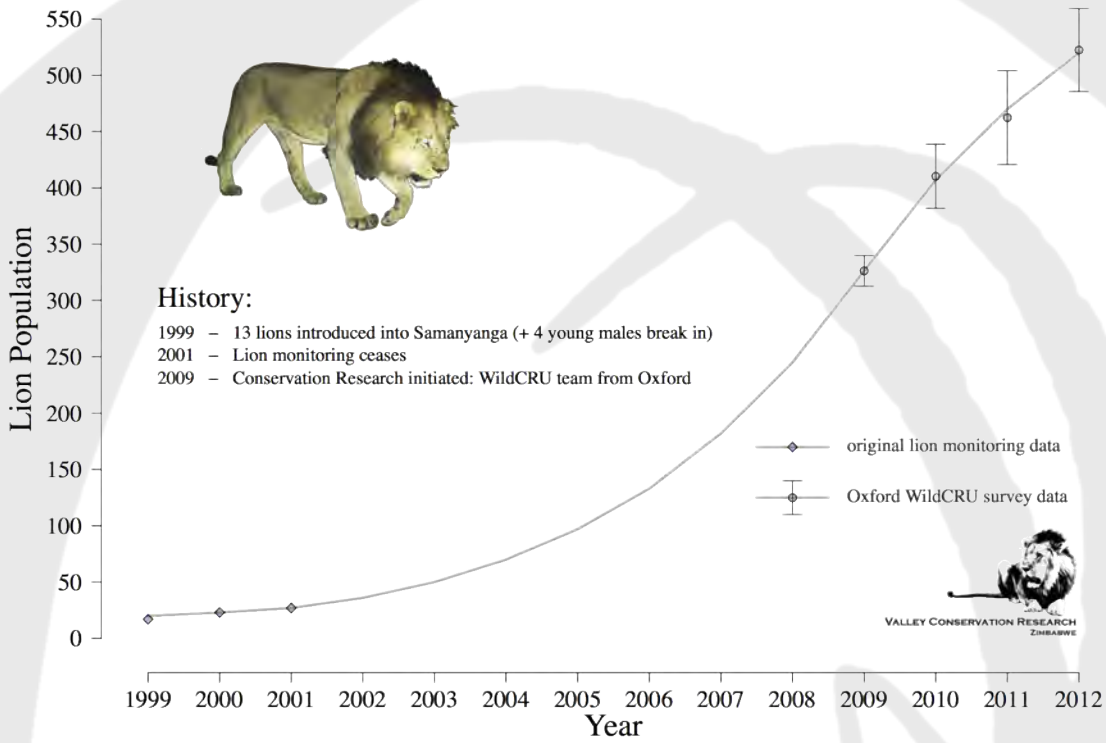


Figure 10: Actual density calculations [53,54] of a reintroduced lion population, which successfully experienced an exponential growth rate.

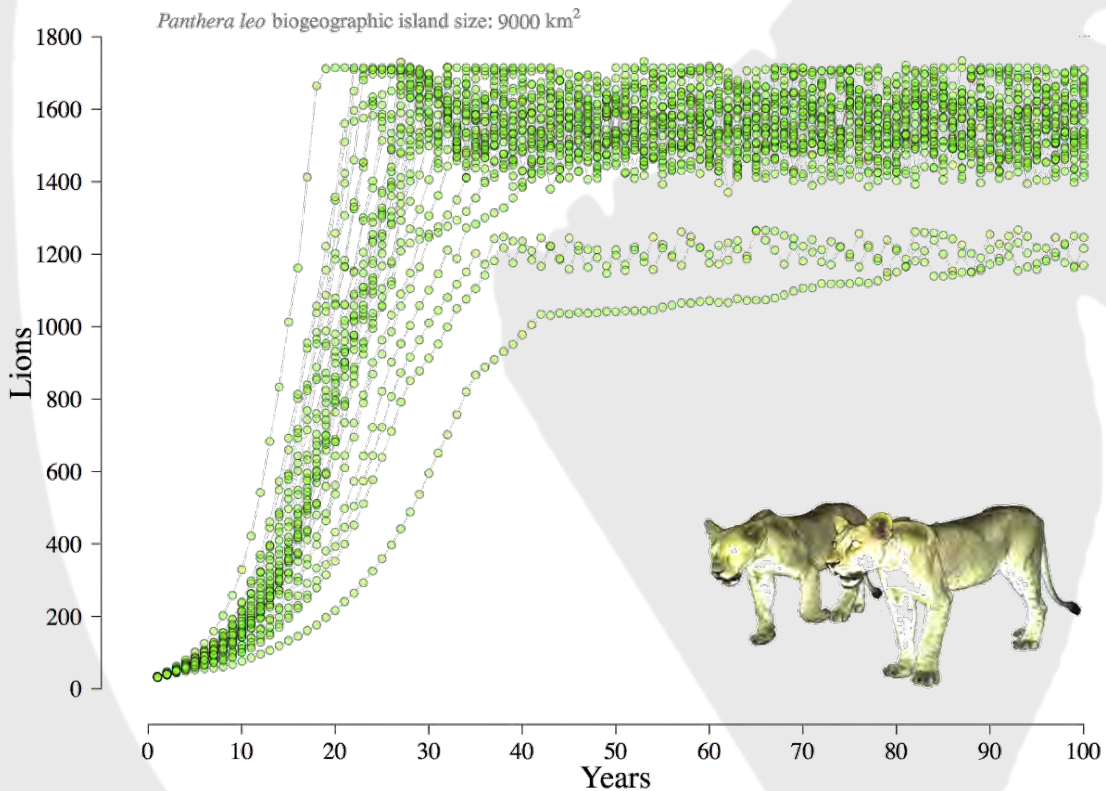


Figure 11: Predictive modelling of the Zambezi Delta lion population growth rates post release. The model parameters were based on actual vital statistics of the source population after a decade of research, including: home-range size, group (pride and coalition) size, birth rates, death rates, recruitment rates, & harvest.



4. PART III – ENVIRONMENTAL SUITABILITY

As already discussed, ungulate populations in the $\sim 9,000$ km² Zambezi Delta have presently recovered to estimated pre-war levels, human occupancy levels within the area are relatively low, and the anti-poaching effort is well-organised and growing from strength to strength. With regard to lions, a large area [56], adequate prey [57], low human density [58], and active protection [59] are the key factors relating to the potential for a viable free-ranging wild population, and therefore we are now finally in a position to tackle the question of *is the current environment suitable for lions?*

4.1 Is the ecosystem suitable for lions?

Lions prefer foraging in habitats that facilitate prey catchability over areas that simply have high prey density [60]. The Zambezi River floodplain contains an enormous biomass of large ungulates [61], and is bordered by an extensive ecotone [62]. Ecotones are characterised by proportionally higher biomass and biodiversity than in uniform habitats [63], and in which the additional cover optimises predation by both stalk and ambush techniques [64].

Comprehensive and detailed descriptions of the quantitative spatial vegetative structure of the Zambezi Delta [61,62] describe a range of habitat types that could potentially support massive ungulate abundances, as well as the physical attributes that favour lion behavioural ecology in terms of cover, camouflage and thermal regula-

tion. Lions were once abundant in the Zambezi Delta [33] and the habitat in this same area has changed relatively little in the intervening years [62], at least with regard to minimum lion ecological requirements [58].

It is also quite probable that the same biological barriers that have prevented lion immigration will be the same that prevent their emigration – and with the rehabilitated prey populations, there will be no reason why they would.

The potential addition of the lions has already resulted in a multiplication of effort: *i.* the anti-poaching unit has been upscaled to include more men, motorbikes, helicopter hours, and tracking technology to facilitate strategy and coordination; *ii.* a full-scale scientific

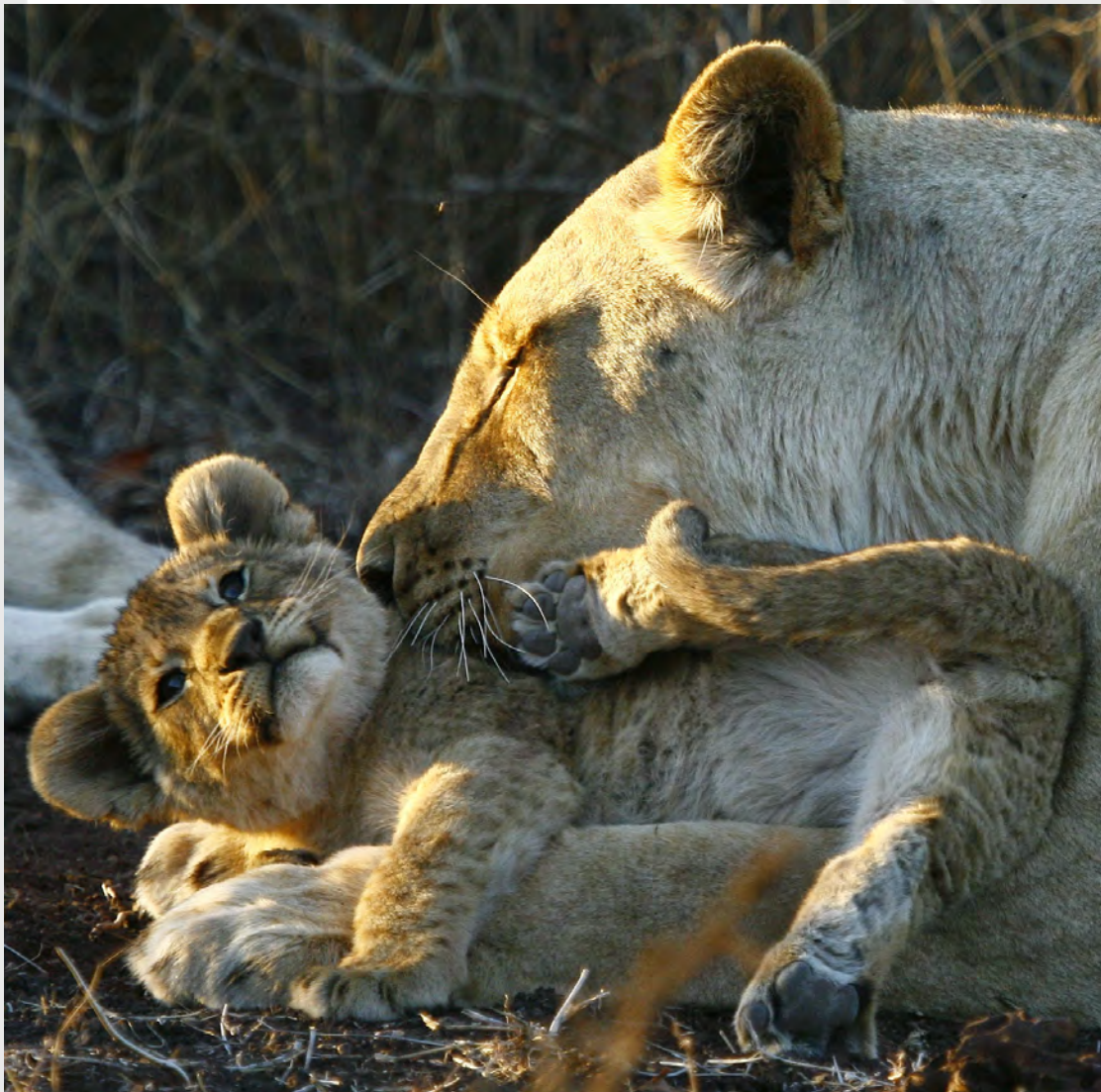




research team is already in play both on the ground and remotely; *iii.* we have enlisted the support of the local chief and the community under him; *iv.* relationships between neighbouring Coutadas in the Zambezi Delta have

been strengthened. Each of these factors further enhances the area habitation quality for lions in terms of both survival rate and recruitment into the population.

Based on the evidence that there are currently more than adequate resources for a large resident population of lion, as well as that fact there is on-going investment in the protection and enhancement of the ecosystem, we can safely conclude that the environment is therefore more than suitable for reintroduction of a seed population of lion to recolonise the Zambezi Delta, re-establish balance and intact food chains.





5. THE NEXT STEPS

Reintroducing lions into a landscape in which they have been absent so long is an exciting prospect, and would be a huge coup for real conservation in an era where the philosophies of such confound actual achievements.

It is accepted that the reintroduction of lions to any part of their historic range should only be undertaken when specific conditions have been satisfactorily met: [35]

- i. *The factors responsible for the original decline have been subsequently dealt with*
- ii. *There is social acceptance by the local communities*
- iii. *There are no ecological constraints*
- iv. *There is an overall benefit*

Via this research we have indeed found evidence in excess of support for each one of these conditions. However, whilst the translocation exercise itself is a colossal undertaking and achievement in its own right, the lion reintroduction project – or ecological restoration program – is so much more than simply transporting some lions. (The practical and technical details of the proposed physical translocation are comprehensively covered in a separate report [65].) A scientific team with extensive experience in both lion conservation ecology and in the location of the Zambezi Delta itself has been founded, and which will undertake full-time monitoring of the lions via both direct obser-

vations and continuous follows, and remote monitoring via satellite biotelemetry collars fitted to the lions [66]. Geofence technology will help preemptively alert us to lions moving beyond safe boundaries, and a reaction unit consisting of a licensed dangerous animal capture expert and a helicopter pilot constantly on stand-by will be available to dart and remove lions from potentially dangerous situations. Web-scraping programs will be developed that download and analyse collar data in real-time to reveal aspects of their behavioural ecology as it occurs, for example; interactions between individuals and social groups; fission-fusion events; territorial take-overs; as well as where and when kills are made so that we can record what they are feeding on, and possibly why – all of which are hugely valuable data for the scientific team in documenting the adaptation of the lions to a new environment (at least from their perspective). With the lions comes greater local investment in the area and the community: more anti-poaching scouts have been employed, and more motor-bikes provided for the unit; lion-guardians and community chaperons will be employed to protect the people and the lions from one-another; local scientists and students will be in-





involved and provided with world-class research opportunities and skill development; representatives of the project will participate in national and international conservation workshops. The lion source populations are all well researched – and the behavioural ecology of a successfully reintroduced lion population was intensively studied for more than a decade by the project ecologist [15,67,68,69,70,71,72,73,74,75,76,77].

Fifteen lions will be collared and monitored constantly from the moment that they are released, which in itself will provide a wealth of valuable data

on spatiotemporal lion behavioural ecology; however, we are also already in discussion with a tracking technology company to produce auxiliary collar attachments that record additional data on fine scale behaviour and movement, and with which we can micro-analyse the decision-making process of lions, and the triggers thereof. These will also be the first solar collars to be fitted to lion, and will pave the way for the future of biotelemetry and reductions in necessary handling events, which would be an ethical and practical win, as each capture inherently contains an element of danger for both parties involved.

6. BONUS RESEARCH OPPORTUNITIES

Scientifically, we are presented with an unprecedented opportunity to study a large ecosystem before and after the introduction of Africa's top predator. What would be the logical next step, in a perfect world, and which would elevate this project to the next-level, and increase its impact, would be to collar a range of prey species in the reintroduction before the lions are released [78].

This data would reveal the landscape effect of predators on the spatiotemporal behaviour, movement, and decisions of prey, as well as the overall impact of carnivores on the ecosystem [79,80,81] on a scale similar to that of the research on the wolf *Canis lupus* reintroduction into Yellowstone National Park [82,83,84]. We are currently sourcing funding to launch this aspect of the research.

7. ACKNOWLEDGEMENTS

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CABELA FAMILY FOUNDATION

Thank you,

**Ivan Carter &
DR Byron du Preez**





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APPENDIX A - STRUCTURED INTERVIEWS: THE COMMUNITY & LIONS

Brief over-view of the structured interview results with the local communities residing in the Zambezi Delta regarding wildlife and, in particular, lions:

- The average age of the interviewees was 44 years old (range: 19 – 80)
- 23 had formal positions in the community
- 28 had some level of education (range: grade 2 – grade 7)
- 100% of interviewees derived their main income from cultivation; 8 had additional sources of income, including small business and a couple were Zambeze Delta Safaris camp employees
- One third of interviewees claimed not to know what a lion was – yet when presented with a photo panel of carnivores (Appendix B), only one could not identify any lion (*a 50 year old woman with grade 2 level education, no formal employment, and no formal position in the community*)
- When presented the carnivore photo panel (Appendix B) 44/45 interviewees identified the male lion ('E'), but only 31 also identified the lioness with cubs ('B') (one person incorrectly identified the caracal ('A') as a lion)
- When asked their feelings about lions 43/45 interviewees described fear – but only 24 said they did not want lions to be reintroduced into the area
- Of those that *did not* want lions, the 2 main reasons cited were that:
 - i. lions are dangerous
 - ii. they did not think them to have an important role in the ecosystem
- Of those that *did* want lions, 9 based their opinion on tourism and development potential, 6 realised their ecological importance, and the rest were cultural/spiritual reasons
- Only one person said that wildlife had no value, and 100% of interviewees stated that they benefitted from meat donations by the safari operators in their areas
- Nearly all interviewees owned chickens, and a few had cats and dogs, but none had any larger livestock such as goats, pigs, donkeys or cattle that could potentially be a source of conflict with regard to lions
- 26 people stated that lions were an integral part of their culture
- 11 people said that lions were actively involved in superstition
- Worryingly, 22 interviewees claimed that lions had a role in traditional medicine





APPENDIX B - IDENTIFY THE LION



A



B



C



D



E



F





DR Byron du Preez read for a Doctorate of Zoology at the UNIVERSITY OF OXFORD on the *impacts of lions on leopard behavioural ecology*.

Zimbabwean born, Byron has lived in Africa his whole life, and has worked on big cats and conservation, with a special focus on lions, for more than a decade.

IVAN CARTER
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compiled by Dr Byron du Preez