INGURUMA
THE LION ROARS AGAIN

Ecological Restoration Project

ZAMBEZE DELTA, MARROMEU COMPLEX, MOZAMBIQUE

Key Lion-Prey Research

1 October 2017

Dr Byron du Preez

1. Background

The Ivan Carter Wildlife Conservation Alliance *and* Zambeze Delta Safaris *have undertaken an ecological restoration project that is one of the most ambitious ever conceived of* – **with the goal of adding and protecting an extra 9,380 km² of extant lion *Panthera leo* range in Africa**. *Habitat loss, livestock encroachment and human persecution, and prey-base depletion have been defined as most significant threats to the survival of the lion (Bauer* et al. *2016), and therefore a project of this scale is critically important for the stabilisation of the species' future conservation security.*

Entire social units of free-ranging wild lions will be captured intact for translocation, which will minimise disturbance and stress to both the individuals and the population as a whole. Female prides and male coalitions will be sourced from the Bubye Valley Conservancy in south-western Zimbabwe (hereafter referred to as the 'source' area). The source site is located in the lowveld region of southern Zimbabwe, with similar weather conditions to the Zambezi Delta in Mozambique (hereafter referred to as the 'destination' area). The genetics of the lion source population have researched in depth and determined to be of excellent diversity (Groom, *pers. comm.*), as is characteristic of a large free-ranging wild lion population.

The lion translocation and reintroduction project is planned to take place during the second half of 2018, when the environmental conditions are optimal for the lions in terms of prey availability and accessibility, being the end of the dry season, when the ungulates are approaching calving. This also coincides with the best time for field research when the bush is least dense.

Post-release monitoring will chiefly involve satellite tracking via biotelemetry collars, so that tagged individuals may be located every hour of the day (4 elephant *Loxodonta africana* cows and 1 eland *Taurotragus oryx* bull are already collared thus in the lion reintroduction area). All of the adult female and all of the adult male lions will be fitted with satellite tracking biotelemetry collars: this may involve between 5 and 6 lioness' per pride, and 5 or 6 male lions depending on the constitution of the coalitions – and therefore between 15 and 18 satellite collars will be continuously actively deployed (out of a total of between 25 and 30 individual lions reintroduced).

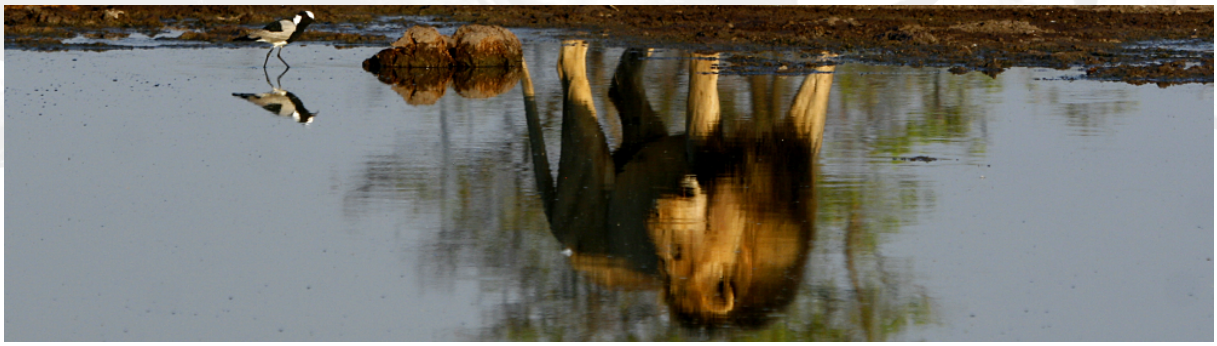
2. Motivation

Predators have landscape-level impacts on the ecosystem via trophic cascades – understanding these processes is key to holistic management and long-term conservation initiatives.

Due to the nature of the science, most large-scale ecological research is limited to observing processes already in motion, and trying to understand the driving mechanisms via comparison to other remote study sites with similar evironmental components. The problem with such meta-analyses is that no two sites are, in fact, directly comparable. Even small differences between sites in terms of geology, altitude, weather patterns, species composition, and human impact, for example, can combine in unpredictable ways and severely reduce the ability to make inference beyond generalisation.

However, here we are presented with a unique opportunity to study a large and diverse ecosystem ***before* and *after*** the introduction of Africa's apex predator. Landscape ecological research [e.g. the '*landscape of fear*' (Valeix *et al.* 2009) and '*energetic landscape*' (Gallagher *et al.* 2017)] is a field specialising in the understanding and prediction of the decisions that animals make in the spatiotemporal (*where* and *when*) use of the environment, for example with regard to the risk of predation – and in fact, the origins of human interest in animal behaviour and decision-making dates back in time at least 2300 years to Aristotle (Nussbaum 1978).

The fear, or risk, of predation can in fact have a greater impact than the direct effects of predation on a population (Creel & Christianson 2008). The famous reintroduction of wolves to Yellowstone National Park, United States of America, has had a landscape level effect on the ecosystem via trophic cascades as the result of predation, and risk of predation, on species such as elk that had had none for over 70 years, leading to the recovery of specific plant communities (Ripple & Beschta 2012). Wolf predation was even linked to hydrological conservation of river channels through reduced levels of erosion as riparian plant species recover (Beschta & Ripple 2012). There is, however, further evidence that complete environmental recovery to wolf pre-extirpation levels is not in fact likely (Marshall *et al.* 2013), such is the importance of a continuous in-tact ecosystem, with all component parts, and predators at the top of the food chain. Thus the Zambezi Delta lion reintroduction and ecological restoration project is of critical environmental importance, but not least of all in terms of the value of the research and data generated to guiding future conservation initiatives. Landscape experimental ecological research of the *before-after* type involving large predators is extremely rare, and thus valuable.



3. Proposal

Simultaneous biotelemetry satellite tracking of what will consist of the key prey-species *before and after the introduction of the* predators.

It is of critical importance that we begin to understand the baseline ecology of the Zambezi Delta system without the apex predator present (note that even the densities of hyaena *Crocuta crocuta* and leopard *Panthera pardus* are currently depressed) so that upon the introduction of lions we are able to better understand their influence. Biotelemetry involving satellite tracking devices is ubiquitous in large terrestrial mammal research due to the obvious advantages, which include continuous remote monitoring and relatively large sample sizes of simultaneous multi-species research. The spatiotemporal data recorded by such devices includes the minimum of point location data, but may include triaxial accelerometry, audio and video recording, and geo-fence technology which is particularly useful when involving predators in close proximity to humans and livestock. Additionally, specialised bespoke computer programs can analyse data in real-time to analyse predator kill-sites, inter- and intraspecific interaction, and distress and mortality signals, among others (du Preez 2015; du Preez *in prep.*).

Here we intend to tag with satellite collars a sample of the most abundant large ungulate species (and thus the most likely key lion prey-species upon reintroduction) and monitor their spatial ecology for a year before the lions are reintroduced, and subsequently simultaneously with the lions upon their release. A year of spatiotemporal data on ungulate behavioural habits and habitat use will provide adequate data to establish their current baseline ecology so that when the lions are reintroduced we are able to monitor the changes as they occur in relation to adjusting ecology to a new landscape of risk. The measured behavioural ecology of ungulates before and after the presence of lions, and lion behavioural ecology as they adapt to a new environment and establish a new population in a significant portion of their historical range, will include; territory and home range size and location, diel activity, habitat use, inter- and intra-specific interaction, decision making and situation specific behaviour.

Fifteen lion collars have already been sponsored, and we would like to at least match this with respect to ungulate collar deployment. Based on their body size and relative densities, the key lion prey-species have been identified as most likely including; buffalo *Syncerus caffer*, eland *Taurotragus oryx*, sable *Hippotragus niger*, waterbuck *Kobus ellipsiprymnus*, zebra *Equus quagga*, hartebeest *Alcelaphus buselaphus*, nyala *Tragelaphus angasii*, and reedbuck *Redunca arundinum*. However, whilst there is no limit to the number of animals that can be simultaneously tracked via biotelemetry, and in the perfect situation all animals would be tagged; in the real world resources need to be strategically allocated for maximum gain. Therefore, of the prey species identified, we would focus on tagging **buffalo**, **eland**, **sable**, **waterbuck** and **reedbuck**. These species represent a range of body sizes and ecological niches, occur at relatively high densities, and occupy the habitat types in the vicinity of the lion release sites that were carefully identified based on the vegetative structure providing adequate cover for hunting, and along the ecotone between the woodland and floodplain in which the greatest biodiversity and biomass of animals occur.

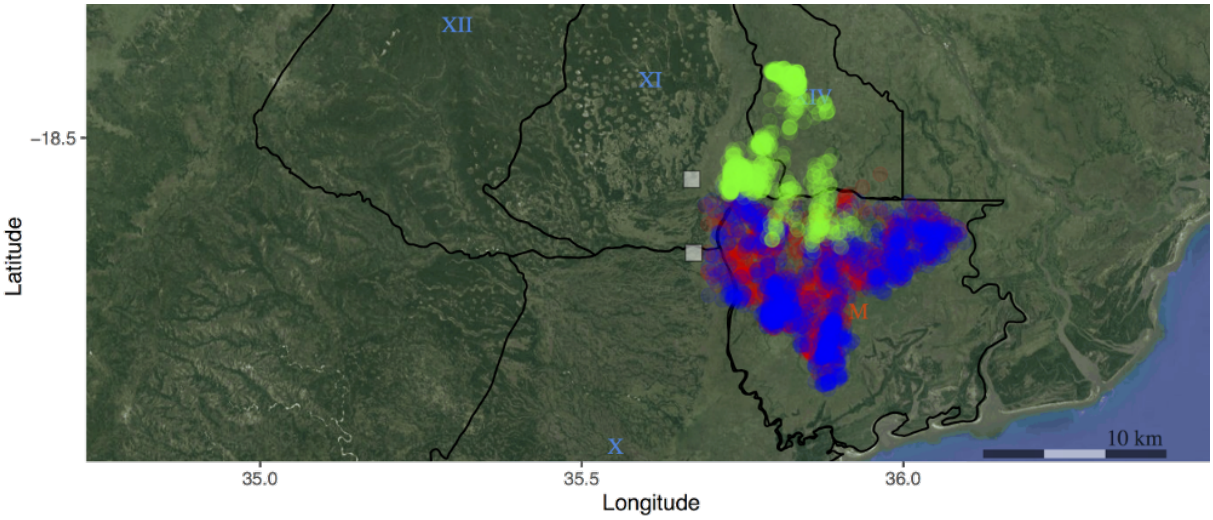


Figure 1: *Collar data from an eland* (green) *and two elephant cows* (red & blue) *currently tagged in the Delta. This is the most basic representation of relocational data, indication hot-spots of habtitat use for each species. More advanced analyses include predicting habitat transitions based on behavioural triggers, inter- and intra-specific interactions, ecological adjustment to an emergent landscape of fear, and response to human activity.*

We already have 5 collars deployed (1 eland and 4 elephant) and 15 lion collars already sponsored. We are planning to **tag at least 5 individuals** of each of the focal prey-species (***buffalo***, ***eland***, ***sable***, ***waterbuck*** and ***reedbuck***) to ensure that we collect sufficient data with which to statistically analyse. Therefore we would like to offer friends and philanthropists the chance to support our research project on the Zambezi Delta ecosystem restoration facilitated by the largest lion reintroduction in history.

Satellite biotelemetry collars cost approximately **US$ 3,500 each** (*$ 1,890 base unit + $ 270 annual satellite subscription fees + $ 260 veterinarian fees*). In return for the sponsorship of a collar, the donor will be able to **name the animal**, and will receive **monthly research reports**, and **photographic updates** whenever the opportunity presents. Donors will be able to **choose which species** they sponsor on a *first-come-first-serve* basis. Donor names will be acknowledged on the project website, and in all reports and scientific papers produced from the data (unless anonymity is preferred).

The Ivan Carter Wildlife Conservation Alliance is a **501(c)(3) registered** charity to which all **donations are tax-deductable**.

In addition to the lion-based ecological research collars, we would also appeal for sponsorhip of **additional elephant collars** in the face of the ***rising poaching threat***. The collars won't prevent poaching, but they will improve our understanding of the elephant movement patterns, and any eratic signals in the biotelemetry data will act as an instant first warning regarding potential poaching activity, not only on the specific collared animals themselves, but on their companions as well, when there is a signal of a sudden change in behaviour or movement. These collars will be focused on elephant bulls, and the same donor privileges will apply as to the lion-prey species donations.

With gratitude,

Ivan M. Carter
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4. References

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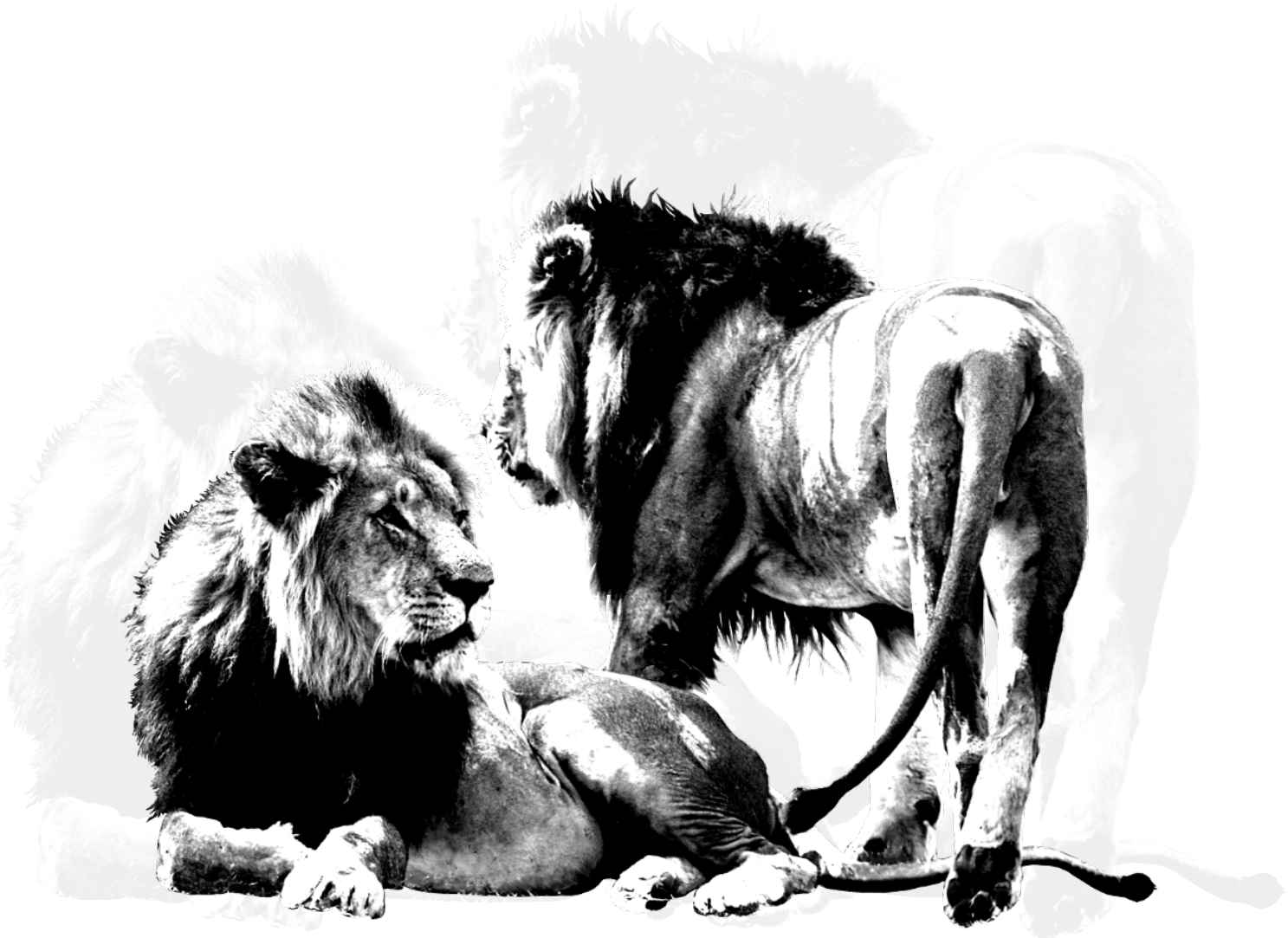

"Knowledge is like a lion; it cannot be gently embraced."

African Proverb