GUIDELINES

For Carnivore Translocations into Gonarezhou National Park, South-East Zimbabwe






African Wildlife Conservation Fund

This document was produced by the African Wildlife Conservation Fund. The organisation operates in the Zimbabwean Lowveld to conserve and protect Zimbabwe's predators through research, hands on conservation, education and outreach. This document was developed in line with the 2013 carnivore translocation guidelines developed by the International Union for the Conservation of Nature (IUCN) and relevant recent literature. It is important that these guidelines are implemented in the context of regional and international policies pertaining to biodiversity conservation and sustainable management of natural resources. The views discussed in this document do not necessarily reflect those of African Wildlife Conservation Fund or Gonarezhou National Park.

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Table of Contents

Executive Summary

"Conservation translocation is the deliberate movement of organisms from one site for release in another. It must be intended to yield a measurable conservation benefit at the level of a population, species or ecosystem, and not only provide benefit to translocated individuals."
International Union for the Conservation of Nature (2013)

Translocation can potentially be a very important tool in the management of large carnivores. Human population growth continues to expand into wildlife areas and fragment landscapes presenting barriers to natural dispersal patterns, so much so that natural colonisation of carnivores into wildlife areas is more than often no longer possible. The structuring influence of top-order predators on ecosystem functioning has been demonstrated in many terrestrial systems, therefore replacing or protecting top carnivore species can have positive effects on the ecosystem health of an area. However, carnivore translocations are expensive and can be risky. **There are a number of biological and non-biological factors which need to be considered before utilising translocation as a management tool.** There is no doubt that in some cases translocations have been highly successful, however, equally so there are many circumstances where translocations may not be suitable. The decision of whether to proceed with a translocation or not should be based on a feasible assessment of the risks versus the benefits of such an action and consider the possibility of alternate conservation actions.

As such, all translocation, reintroduction or supplementation exercises should be closely scrutinised, with a focus on the potential long-term direct and indirect impacts of the exercise on the target area primarily, and secondarily the source area or individual animal(s). Consideration should be given for the welfare of the animals in question; however, the risks to the target ecosystem should always be placed before those of a group of individuals.

This document outlines suggested protocols and considerations for the translocation of large carnivore species (>20 kg) into the Gonarezhou National Park in south-eastern Zimbabwe. It outlines step-by-step procedures to ensure that effective and meaningful translocations are carried out, and emphasises the importance of documenting and publishing post-release monitoring to inform future conservation planning.

Introduction

These guidelines were specifically designed to facilitate translocations of large carnivores into Gonarezhou National Park (GNP and/or the Park). However, with extrapolation and additional site-specific research these guidelines could also be used to facilitate the release of large carnivores into other wildlife areas. The term 'translocation' broadly encompasses the movement of animals within their known range (reintroductions and supplementations) and beyond their indigenous range (introductions), see Figure 1. This can be done for a number of reasons (political, recreational, commercial or conservation interest) and be from wild or captive-bred populations. **Translocation, in the sense used in this document, refers to the intentional movement of species from one area to another area.** Since the release site (GNP) already supports all the six large carnivore species, any translocations are for **supplementation** (Figure 1).

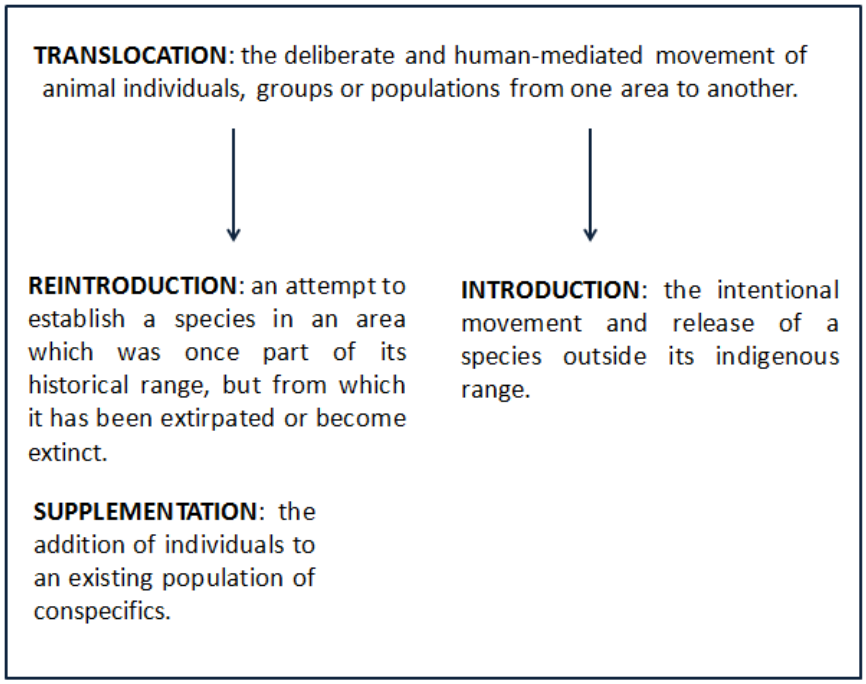

Figure 1: *Definition of terms*

Conservation translocations can be done for a number of reasons, including:

- To conserve threatened species.
- To reduce the population size of the source population and increase the population size of the target population in an effort to maintain or restore biodiversity.
- To restore ecological integrity.
- To improve ecosystem functioning and the long-term conservation status of the translocated species.
- To increase genetic diversity and establish a viable population.
- To maximise ecotourism benefit.

This document outlines procedures and protocols to assist decision makers in defining the objectives and justification for any carnivore translocation into GNP, assessing the potential risks

and establishing procedures for successful implementation. **The primary aim of any carnivore translocation into GNP should be to enhance the long-term survival of the species within the Park, and conserve biodiversity without having any detrimental impact on GNP ecosystem processes.**

An appendix to this document discusses in detail the pre-defined stages that should be duly considered and sufficiently planned for to ensure a successful translocation. However, **for practicality and ease of reference we have first and foremost provided summarised guidelines for both planned and emergency translocations** in the hope that translocations, in even the most hasty of situations, will be **done with the best interests of the animal(s) and the conservation goals of GNP in mind**. Bear in mind, best practice guidelines recommend each translocation exercise should be managed as a project in consultation with relevant stakeholders, government agencies, non-governmental organisations, ecologists, researchers and veterinarians.

Quick reference guidelines

Summary of step by step considerations for planned translocations of large carnivores into Gonarezhou National Park (non-emergency situations)

Appendix A of this document lays out in detail the considerations that should be given to any translocation (and reintroduction) exercise, and Appendix B describes species specific considerations. It is advised that both Appendices are read in full and understood before contemplating the translocation of carnivores into Gonarezhou National Park. However, for quick reference, below is a summary of the steps that should be followed in non-emergency situations and for planned or pre-meditated translocations:

Step 1: A motivation should be submitted to the Zimbabwe Parks and Wildlife Management Authority (PWMA) in order to obtain a permit.

The individual or organisation proposing the translocation should write a short motivation to the PWMA, including but not limited to:

- The reason why the translocation is deemed necessary.
- A history, **in as much detail as possible**, on the animal(s) proposed for translocation. Including; background, life history, source area details, age, sex, pregnant or not, group structure (if more than one animal) etc.
- Evidence that consideration has been given to **genetic** (Appendix Ac3) **and disease considerations** (Appendix Ac4), and any other potential risks (e.g. habituated livestock killer, potentially detrimental interspecific competition).
- A motivation of how the movement is aligned with the conservation principles and management guidelines of GNP, and how it will benefit the Park.

Step 2: The PWMA should consider whether the translocation is in the best interests of Gonarezhou National Park.

Translocation of large carnivores is often based on good intentions but invariably happens with little or no consideration of the potential risks involved to not only the animal itself, but also to the target area. The following should be considered when deciding whether a translocation is an acceptable option or not:

- The justification/motivation for the translocation needs to align with the conservation principles and management policies of the GNP (outlined below).
- **Translocations should not be carried out solely as a means of disposing of surplus stock, problem animals or because captive stock exists.**
- Importantly, translocations should only be carried out if there is a high level of confidence that the release of the carnivore will provide long-term conservation benefits. **If any uncertainty (disease, genetic, livestock killer etc.) remains the translocation should not proceed** (Appendix Ac8).

Step 3: Motivation is approved and permit received.

Once it has been decided that a carnivore translocation is the most appropriate conservation action, **clear and specific procedures for the translocation need to be established** (Appendix Ab), including veterinary regulations, capture and handling protocol, transport protocol, release stage and post-release monitoring. **Carnivore releases are considered fundamentally more complex than those of herbivores or omnivores**, and as such best practice guidelines recommend this step be informed by a comprehensive feasibility assessment (Appendix Ac).

Further, there needs to be careful consideration of the resources required and the funding needed. Monitoring protocols (Appendix Ad2), including post-release monitoring and data collected during the translocation, should be considered right from the start in order to monitor the progress of the translocation and ultimately its success or failure.

Step 4: Veterinary regulations must be adhered to.

Health regulations as prescribed by the Zimbabwean veterinary authorities must be adhered to. **Potential disease and pathogen transfer needs to be carefully considered and effectively managed to minimise the risk to populations in the destination area** (Appendix Ac4 and Appendix B). Likewise, it is important to consider whether the translocated individual(s) are likely to cope with new pathogens and stresses potentially encountered at the destination site. Risks can be reduced by veterinary intervention at the founder site (e.g. antibiotics), screening at the proposed release site (blood screening and samples), through vaccination if necessary, and by post-release monitoring.

Step 5: Capture, transportation and handling of the animal(s) to be translocated.

Conservation translocations should whenever possible adhere to globally accepted standards of welfare, and every effort should be made to reduce stress or suffering (Appendix Ac6). **The welfare of animals for release is of paramount concern through all translocation stages** and every effort must be made to adhere to the following:

- If the animal needs to be caught / trapped:
  - An **appropriate cage must be used**. The cage must be the correct size and structure, with no faulty trap doors which could injure the animal, or weakly constructed areas through which the animal could escape possibly injuring itself in the process. This could be dangerous and / or fatal for resident human populations.
  - The cage should be placed in a temperate environment as far as possible, under a tree or in shade thus ensuring the animal is **not fully exposed to direct sunlight**.
  - It would be beneficial to set the cage up in a remote location, or surrounded by trees or bushes, so that the animal is not exposed to excessive human activity or interference which would be very stressful.
  - The **cage should be checked every couple of hours** so that the animal is not kept in a confined, and potentially stressful situation, any longer than necessary.
- **Every effort should be made to relocate the animal to the chosen release site as quickly and efficiently as possible**.
- During transportation the **animal should be kept cool, and in a dark and secure environment with minimal external stimuli** (cover the cage with a dark sheet, keep

voice tones and activity low). A long acting tranquiliser can be administrated should it be deemed necessary, and depending on the release protocol.

Step 6: Carefully consider the optimal release site in the Park.

The release site within the Park should be very carefully considered (Appendix Ad1). Bear in mind the distance from where the animal(s) was captured (many species will walk a long distance to try to get back to their home area) and try to avoid creating conflict by releasing animals into the core of conspecifics home ranges, or into the home ranges of conflict species (e.g. cheetah / wild dog released in close proximity to lion core home ranges). This may require mapping of resident carnivores home ranges, or drawing on local knowledge (scouts/rangers) of predators movements. This is particularly important with regards to captive bred or rehabilitated animals which may not be 'predator wise', and should undergo re-wilding. Ensure there is sufficient water and prey in the area (which may prevent predators roaming and encountering unfavourable habitat). For water dependent animals, ensure they are released in close proximity to a water source. Finally, the location of the release site needs to be practically selected taking into consideration the spatial and biotic requirements of the species (Appendix B). **Wide-ranging carnivores released in close proximity to boundaries are likely to move out of protected areas post release, especially if they are habituated livestock killers**.

Best practice guidelines suggest that soft release (use of a boma) is optimal for carnivores, and that hard release should only be used in extremely pressing circumstances (**Appendix Ad1**)

Step 7: Document as much as possible about the animals, at the release site.

All data on the animal(s) to be moved must be recorded, including age, sex, history, source population, whether pregnant or not etc. Photos should also be taken of both sides, front and face of all individuals to be released, for later identification and monitoring. Genetic samples (hair, tissue and blood) should also be taken, as long as doing so will not jeopardise the animal's health. It is ideal if this data is collected at release as well as provided by the instigators of the move.

Step 8: Fit collars for post-release monitoring.

Every effort should be made to **fit the individuals or a couple of individuals in a group, with a GPS or Satellite Collar for post release monitoring** (Appendix Ad2). In most cases, providing the collars should be the responsibility of the organisation / individuals proposing the move. Worst case scenario, a VHF collar should be deployed initially. **It is recommended that the Chipinda and Mabalauta Substations keep a number of VHF collars suitable for large carnivores on station for such events.** If possible, collars with a drop-off mechanism should be used.

Step 9: Undertake post-release monitoring

The released individuals should be intensely monitored for a couple of days after release and thereafter on a regular basis for the first few months. Thereafter, they should be monitored on a monthly basis for up to one year, and ideally several years, to help understand whether the move was a success or not, and to learn valuable lessons for the future (Appendix Ad2). **Collars should be removed from animals when there is no longer a need to monitor them**. Further, behavioural monitoring should be carried out and data (knowledge of hunting, predator avoidance,

territoriality, daily movements etc.) recorded. This can be a valuable, early indicator of translocation progress.

Summary of step by step considerations for emergency translocations of large carnivores into Gonarezhou National Park (emergency situations)

This section recognises that in some cases a situation arises where time is inadequate for a detailed assessment of the risks and feasibility of the move. It is encouraged that in these situations, the Parks and Wildlife Management Authority think very carefully about whether such an emergency translocation is in the best interests of the Park itself and the recipient population, which must take priority over any benefits to the individuals in question. Questions to ask include:

Question 1: Is the move in the best interests of firstly, the GNP and resident carnivore populations, and secondly of the individuals to be moved?
To reiterate, translocations should not take place simply because surplus or captive stock exists, or if there is any uncertainty with regards to potential risks to resident carnivore populations or the Park (Appendix Ac8).

Question 2: What are the reasons for the need t move the animal?

- Is it a habituated livestock killer, in which case have the implications been considered? If yes, and it is decided to go ahead with the translocation, the release site will need to be very carefully considered.
- Is it from a captive or rehabilitated population which will require intensive support post release? **Please note that best practice guidelines recommend soft release in these situations**.

Question 3: What is the origin of the individuals to be translocated?

- Is there a risk of introducing genetic incompatibilities?
- Is there a risk of introducing disease to the recipient population?

If the decision is to proceed with the translocation, and a hard release is the only option, the following steps must be followed as a bare minimum.

Step 1: Consider the risk of disease.

Whatever the emergency, if there is a high risk of disease transmission into the recipient population, the animal(s) needs to be quarantined, treated and /or vaccinated before release – **otherwise it/they should not be moved**.

Step 2: Carefully consider the optimal release site in the Park.

The release site within the Park should be very carefully considered (Appendix Ad1). Bear in mind the distance from where the animal(s) was captured (many species will walk a long distance to try to get back to their home area) and try to avoid creating conflict by releasing animals into the core of conspecifics home ranges, or into the home ranges of conflict species (e.g. cheetah / wild dog released in close proximity to lion core home ranges).

Ensure there is sufficient water and prey in the area (which may prevent predators roaming and encountering unfavourable habitat). For water dependent animals, ensure they are released in close proximity to a water source. Finally, the location of the release site needs to be practically selected taking into consideration the spatial requirements of the species (Appendix B). **Wide-ranging carnivores released in close proximity to boundaries are likely to move out of protected areas post release, especially if they are habituated livestock killers.**

Step 3: Record as much as possible about the animals to be translocated.

All data on the animal(s) to be moved must be recorded, including age, sex, history, source population, whether pregnant or not etc. Photos should also be taken of both sides, front and face of all individuals to be released, for later identification and monitoring. Genetic samples (hair, tissue and blood) should also be taken.

Step 4: Fit collars for post-release monitoring.

Every effort should be made to fit the individuals, or a couple of individuals in a group, with a GPS or Satellite Collar for post release monitoring (Appendix Ad2). Worst case scenario, a VHF collar should be deployed initially. **It is recommended that the Chipinda and Mabalauta Substations keep a number of VHF collars suitable for large carnivores on station for such events.** If possible, collars with a drop-off mechanism should be used (especially on the more elusive species e.g. leopard).

Step 5: Undertake post-release monitoring

The released individuals should be intensely monitored for a couple of days after release and thereafter on a regular basis for the first few months. Thereafter, they should be monitored on a monthly basis for up to one year, and ideally several years, to help understand whether the move was a success or not, and to learn valuable lessons for the future (Appendix Ad2). **Collars should be removed from animals when there is no longer a need to monitor them.** Further, behavioural monitoring and data (knowledge of hunting, predator avoidance, territoriality, daily movements etc.) should be recorded. This can be a valuable, early indicator of translocation progress.

Gonarezhou National Park as a release site for large carnivores

"The Gonarezhou National Park will protect and conserve wilderness, biodiversity, ecological processes, wild and scenic landscapes within the Park boundary. The Park's exceptional resource values will be sustained for present and future generations, while supporting its role in the Great Limpopo Transfrontier Conservation Area and regional economic development. The culture and history of the Shangaan people will be recognised as one of the key components of the Park" Gonarezhou National Park mission statement.

Gonarezhou National Park in the south-east lowveld of Zimbabwe is a critical part of the Greater Limpopo Transfrontier Conservation Area (GLTFCA); a key conservation area for the conservation of Africa's large carnivores. Established in the early 1930's as a game reserve, the 5 043 km² GNP lies between latitudes -21° 00'-22° 15' S and longitudes 30° 15'-32° 30' E, and was gazetted as a national park in 1975. GNP borders Mozambique along its eastern edge and Kruger National Park in South Africa lies less than 50km to the south west. Apart from Malilangwe Private Reserve in the north-west corner, GNP is bordered entirely by community land, hunting concessions and rural settlements.

GNP is rich in wild ungulates, and African lion (*Panthera leo*), spotted hyaena (*Crocuta crocuta*), cheetah (*Acinonyx jubatus*), African wild dog (*Lycaon pictus*), brown hyaena (*Hyaena brunnea*) and leopard (*Panthera pardus*) constitute the large carnivore guild of the GNP. Please see *Table 1* for the population estimates of major wildlife species within GNP at the time of writing (2014).

Table 1: *Population estimates for major wildlife species within GNP (2014).*

Species	**Estimate**	**Density (km²)**
Elephant (*Loxodonta africana*)	10 151	2.05
African Buffalo (*Syncerus caffer*)	4 425	0.90
Impala (*Aepyceros malampus*)	12 347	2.50
Kudu (*Tragelaphus strepsiceros*)	2 564	0.52
Giraffe (*Giraffa camelopardalis*)	473	0.10
Eland (*Taurotragus oryx*)	384	0.08
Zebra (*Equus quagga*)	1 685	0.34
Wildebeest (*Connochaetes gnou*)	1 416	0.29
Lion	116	2.30
Leopard	398	8.00
African wild dog	100	4.20
Cheetah	75	1.50
Spotted hyaena	671	13.50
Brown hyaena*	---	---

* Unknown

When considering the feasibility of a carnivore translocation into GNP the following **potential conservation challenges must be duly considered** (especially where endangered or vulnerable species are considered), in light of the conservation principles and management guidelines of the Park as outlined below.

Potential conservation challenges for GNP as a release site for carnivores:

- GNP is a long, thin park with a **very high perimeter to area ratio**, introducing high potential for human-wildlife conflict particularly where wide-ranging carnivore species are considered.
- A large proportion of the neighbouring land is dominated by local communities which may not be tolerant of carnivores (Appendix Ac5). Retaliatory killings of predators, such as lion and spotted hyaena are used as a way to reduce livestock-carnivore conflict. Hunting methods include snaring, poisoning, hunting dogs, and the use of bows and arrows.
- Best practice guidelines suggest mechanisms for communication, engagement and problem-solving between the neighbouring public and GNP, and a discussion of the potential negative and positive consequences of the translocation (Appendix Ac5).
- Transboundary (Mozambique and South Africa) considerations are imperative, especially on the Mozambican boundary where illegal poachers have the potential to gravely affect the wildlife populations of the GNP. Best practice guidelines recommend any carnivore translocation into GNP should be developed within the national and regional conservation infrastructure and legal frameworks of South Africa and Mozambique, as well as Zimbabwe

Conservation outlook and guiding principles as per GNP Management Plan:

- To conserve biodiversity, natural resources and ecological processes through strategic adaptive management.
- To develop sustainable tourism and provide an outstanding wilderness experience and education for both local and international visitors.
- To deliver transparent, accountable and efficient administration and management of human, financial and physical resources to support the Park's purpose and mission.
- To support linkages with GNP stakeholders and partners at local, regional and international levels through collaborative management, and to safeguard the integrity of the Park resource values.

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APPENDIX A: BEST PRACTICE GUIDELINES BASED ON IUCN REINTRODUCTION GUIDELINES

Aa: Deciding when a translocation is an acceptable option

Primarily, the justification for any large carnivore translocation into Gonarezhou National Park needs to align with the conservation aims and principles of the Park (**Section Two**). **Translocation of large carnivores is often based on good intentions but invariably happens with little or no consideration of the potential risks involved to not only the animal itself but also to both the source and target area.** The following should be considered:

- A carnivore translocation can be justified if there is a high level of confidence that the release of the carnivore will provide long-term conservation benefits, not only for the ecosystem health of GNP, but for the social and economic interests of the landowners and communities bordering the Park.
- **Translocations should not be carried out solely as a means of disposing of surplus stock, or because captive stock exists.**
- Where a high degree of uncertainty remains or it is not possible to reliably assess that the translocation presents low risks (**Appendix Ac8**), it should not proceed and alternative conservation solutions should be sought.

Ab: The first stage or planning phase of a translocation

Once it has been decided that a carnivore translocation is the most appropriate conservation action, the goal(s) and objectives need to be defined and procedures established. The goal(s) defines the intended conservation result and/or benefit of the translocation, and the objectives detail how the goal(s) will be reached.

Objectives and subsequent procedures should be clear and specific and supported by time schedules, indicate the resources needed and assign responsibility for each element of the process. Importantly, a translocation should not proceed without assurance of funding for all defined activities over an adequate period of time. The translocation procedures must consider relevant biological and non-biological factors and be **informed by a feasibility assessment** (**Appendix Ac**).

Carnivore releases are considered fundamentally more complex than those of herbivores or omnivores. However, there is a distinct lack of monitoring and feedback which is vital to inform future conservation efforts. **Monitoring protocols, including post-release monitoring (Appendix Ad2), should be integral to the translocation design and established during the planning phase, not merely considered at a later stage.** First and foremost it needs to be decided what data needs to be collected, where and when, to provide the evidence needed to measure the progress of the translocation and ultimately its success or failure.

- Every stage of the translocation process should be documented so that decisions for revision, rescheduling or discontinuation can be made appropriately.
- The data collected at each stage needs to be collated and analysed and shared with the Parks and Wildlife Management Authority, and other relevant parties, to fuel an overall evaluation of the cost-effectiveness and success of the translocation.
- Not all translocations proceed according to plan and an exit strategy should be an integral consideration of any translocation. The decision to discontinue with a translocation can be justified if there are indications of a lack of success or the potential for undesirable and unacceptable consequences.

Ac: The second stage or feasibility study of a translocation

The feasibility assessment should cover the full spectrum of relevant biological and non-biological factors in order to ensure the practicality of the proposed translocation, and should include a comprehensive 'risks versus benefits' assessment. This information is critical for determining if a translocation could be successful and how it could be implemented in an effective and efficient manner.

Ac1: Baseline feasibility.

- Necessary knowledge of any translocation candidate should include its basic biology, history, inter-specific relationships, critical dependencies and biotic requirements.
- Where knowledge is limited, the best available information should be used. In particularly unique or difficult circumstances, information from closely-related species existing in comparable habitats could be used to predict alternative translocation scenarios and outcomes.
- Although not relevant to large carnivores, translocations of less distinct species should include an assessment of the taxonomic status of the individual to be translocated and of the potential recipient populations to determine compatibility.

Ac2: Habitat feasibility.

- Matching habitat suitability and availability to the requirements of the carnivore species (Appendix B) is central to the feasibility assessment and critical for the overall success of the translocation.
- A habitat viability assessment should be carried out to ensure there is sufficient food (enough prey species), habitat and/or territory available such that the translocated carnivore(s) will not disrupt existing conspecifics in GNP. (In the case of reintroductions, a habitat viability assessment is crucial and unquestionable).
- **Suitable habitat should satisfy biotic and abiotic needs of the carnivore species for all life stages** (e.g. adequate cover, adequate prey, denning sites and water sources), and have sufficient resources to sustain growth of the augmented population in the long term.
- Potential threats or disturbances to the species (e.g. fire, drought, disease), and to the existing population, should be known and understood. (In the case of a reintroduction, the cause(s) of previous extirpations must have been resolved or sufficiently reduced).

- The climatic conditions of south-east Zimbabwe and GNP should be deemed suitable for the foreseeable future.

Ac3: Founder population and source genetics.

- Whilst there are various types of source populations (*Figure A1*), **it is desirable that carnivores to be translocated into GNP come from wild caught populations**.
- The removal of individuals for translocation must not endanger the wild source population or have potentially negative effects on existing conspecifics within GNP or the ecosystem health of the Park.
- **The source population should show similar ecological characteristics (morphology, behaviour, habitat preference) to the proposed recipient population and ideally be closely related genetically whilst still providing adequate genetic diversity.**
- Genetic diversity amongst individuals reduces inbreeding depression and increases the likelihood of some individuals or their offspring thriving under novel conditions and surviving stochastic events.
- However, if founders from widely separate populations or areas are mixed, there may be genetic incompatibilities. Source populations physically closer to, or from habitats that are similar to, the destination area may be more genetically suited and less likely to jeopardise the genetic integrity of the recipient population. In the case of the lowveld, carnivores should ideally be translocated from Kruger National Park or another more closely related population.
- If captive bred, habituated or rehabilitated carnivores are to be used, individuals must be from a population which has been soundly managed both demographically and genetically, according to the principles of contemporary conservation biology. A captive bred, habituated or rehabilitated carnivore's probability of survival should approximate that of a wild counterpart.
    - Most captive bred carnivores struggle to survive in the wild unless they have been through a long (and often expensive) program of re-wilding, or, in the case of social carnivores, if they have been bonded with wild individuals before translocation to a new wild area.
    - Soft release is particularly recommended if the animals come from a captive background (or have spent significant time in captivity undergoing rehabilitation)

WILD CAUGHT: Carnivores that have never been held in a captive facility for any length of time.

REHABILITATED: Carnivores that were wild caught, but have been held in a captive facility for less than 12 months and/or with minimal interaction with humans.

HABITUATED: Carnivores that were wild caught but have been held in a captive facility for longer than 12 months and/or have been exposed to high levels of human intervention.

CAPTIVE BRED: Carnivores that have been bred in captivity, or that were wild caught at less than six months of age.

PREDATOR AVERSE: Carnivores that have an awareness of the threat of other large predators.

PREDATOR HABITUATED: Carnivores that have no awareness of the threat of other large carnivores.

Figure A1: Definitions of source populations.

Ac4: Disease and parasite considerations.

- There is always a risk of introducing disease or foreign parasites into the recipient population no matter what precautions are taken, but it is imperative to try and minimise this risk. As such, **the health and physical condition of animals selected for release should be carefully assessed**, and only those in good physical condition should be translocated.
- **Potential disease and pathogen transfer needs to be carefully considered and effectively managed to minimise the risk to populations in the destination area**. Likewise, it is important to consider whether the translocated individual(s) are likely to cope with new pathogens and stresses potentially encountered at the destination site.
- Health regulations prescribed by the Zimbabwean veterinary authorities must be adhered to.
- Risks can be reduced by veterinary intervention at the founder site, screening at the proposed release site, through vaccination if necessary, and by post-release monitoring.
- **Quarantine before release, as a means of disease and/or pathogen prevention needs to be assessed on a case-by-case basis**. However, the stress of unfamiliar or unnatural conditions of confinement may promote pathogenicity or bring out latent infections.
- If reasonable precautions are taken and every effort made to reduce stress to the animal(s) there is rarely cause to consider translocation unfeasible due to disease and parasites.

Ac5: Anthropogenic influences.

- As human populations increase and further fragment habitats, an important part of the conservation of wildlife, and free-roaming carnivores in particular, is likely to fall on individual landowners rather than on large protected areas alone.
- **Translocation planning should integrally consider the socio-economic circumstances** (e.g. relative wealth and education), values and attitudes (e.g. regard for conservation) **of human communities in or around the release area to ensure long-term conservation benefits and longevity of the augmented population.**

- This is particularly important if the cause of species' decline/isolation was due to human factors (e.g. snare poaching, loss or alteration of habitat, declining prey availability and human persecution). **The translocation should ideally be fully understood, accepted and supported by local communities and landowners.** More so in the case of carnivore translocations which may pose a threat to human life or economic resources such as livestock and game.
- Before any carnivore is translocated into GNP, mechanisms for communication, engagement and problem-solving between the neighbouring public and those responsible for the translocation should be established well in advance of any release. The potentially negative (e.g. loss of stock or game) and positive (e.g. economic opportunities through ecotourism) impacts of any carnivore release should be discussed.
- Where carnivores are transported across country borders, or are likely to move across such boundaries post release, **translocation design should be compatible with the regulatory requirements of all affected countries and jurisdictions**.
- The **possibilities of trans-border movements or range expansion need to be considered**. Any carnivore translocation into GNP needs to be developed within the national and regional conservation infrastructure and legal frameworks of South Africa and Mozambique, as well as Zimbabwe.
- No release should occur without adequate measures that address the concerns of relevant interested parties. Where the security of the population is at risk from human activities, measures should be taken to minimise these. If these measures are inadequate, the translocation should be abandoned or alternative release areas sought.

Ac6: Animal welfare.

- Conservation translocations should **whenever possible adhere to globally accepted standards of welfare**, and every effort should be made to reduce stress or suffering.
- Stress in translocated individuals may occur during handling, transport and holding including confining unfamiliar individuals in close proximity.
- Individuals in source populations may suffer stress if the removal of certain individuals disrupts established social relationships.
- The welfare of animals for release is of paramount concern through all translocation stages.

Ac7: Regulatory compliance.

First and foremost a 'Capture and Translocation Permit' from the Zimbabwe Parks and Wildlife Management Authority (PWMA) is required. Thereafter, a 'Vet Movement permit' is required from the Wildlife Unit's Veterinary Department. In order to obtain these permits the following steps should be followed:

- A proposal needs to be submitted to PWMA via the Research Department. The proposal should outline the reasons for translocating the animal(s) and why GNP has been selected as the release site. This proposal should preferably include a report from the acting ecologist of GNP at the time of writing.
- Once the proposal has been reviewed by the Research Department it will proceed to the Permits Office (make sure to keep a note of any reference numbers at this stage).

- Permit applications are reviewed every Thursday and the application can take up to three weeks to be approved (but this can vary hugely).
- Once the application has been approved and a 'Capture and Translocation Permit' granted, a 'Vet Movement Permit' is required from the Wildlife Unit's Veterinary Department

Below please find the contact details for the relevant authorities:

- Research Department (Olivia Mufuti): 0772572062
- Permits Office: 792786

Ac8: Risk assessment.

Risk assessments are vital to reduce the possibility of unexpected and unacceptable consequences and remedial financial expenses.

- Risks to the target ecosystem should always be placed above the risks or benefits to a group of individuals.
- Translocations should improve genetic diversity without the risk of genetic incompatibilities.
- Potential **disease and pathogen risks need to be considered** and minimised where applicable and possible.
- The **attitudes of the landowners and communities bordering GNP** need to be assessed before their potential contribution to conservation can be determined. It needs to be considered whether released animals are at risk of direct (e.g. poisoning, shooting, targeted poaching) or indirect (e.g. poaching of prey species) human persecution. Likewise, whether the released animal(s) poses a threat to human life or economic resources. Where there are risks to either local landowners or released animals, those risks need to be addressed and mitigated as best as possible.
- As such the selected **release site should reduce risks to the released animal** in allowing the predator to acclimate to its new surroundings quickly and effectively and to exploit available resources, and reducing the probability of the predator roaming beyond the boundaries of GNP and encountering unfavourable habitat.
- The risk assessment should include predictions of range expansion over time and potential trans-boundary risks.

Ad: The third stage or release, implementation and monitoring

The implementation of a translocation extends well beyond the release of the animal and should take into consideration all aspects discussed in Appendix Ab and Appendix Ac, importantly post-release monitoring. Post-release monitoring is often one of the first things eliminated in translocation procedures in an effort to reduce costs. Post-release monitoring of carnivores is crucial in Gonarezhou National Park.

Given the shape of the Park it is likely that carnivores, wide-ranging species in particular, are likely to explore the boundaries and neighbouring land use types. Once carnivores are released into GNP and become established within the environment, emphasis will shift to monitoring and adjustment

of management based on monitoring results. **Documenting the results of attempted translocations is crucial for the future conservation management of carnivores in GNP.**

Ad1: Release sites and strategy.

- Release sites should **meet the abiotic and biotic requirements of the species** and enable the animal to exploit the surrounding areas quickly with minimal stress.
- Release sites should address all seasonal habitat requirements of the species and be appropriate for all life stages. For example, when caring for offspring females are restricted to optimal habitat as they need to satisfy elevated energetic requirements with minimal time away from their young.
- Provide adequate connectivity or corridors to suitable habitat if the landscape is fragmented, but likewise be suitably protected from inhospitable habitat and edge effects which may be detrimental to the long-term conservation success of the release.
- The location of the release site needs to be practically selected taking into consideration the spatial requirements of the species (Appendix B), and the shape and size of the destination area. Wide-ranging carnivores released in close proximity to boundaries are likely to move out of protected areas post release, especially if they are habituated livestock killers.
- Ensuring that there are **adequate resources** (e.g. prey, water available) **at the release site may reduce carnivores wandering greater distances**, reducing mortality rates along reserve boundaries and potentially livestock depredation.
- It is important to **consider the life stage and season of the carnivore being released**. For example, if releasing a female cheetah with cubs one needs to consider whether the cubs are likely to move off from the mother soon and whether the release site habitat will be able to support them in their early independence. And, male carnivores are more likely to wander/roam extensive areas seeking females for reproduction.
- **Whether or not to utilise hard or soft release** (*Figure A2*) should be evaluated on a case-by-case basis. However, it has been suggested that soft release is optimal for carnivores. Soft release provides an opportunity for the carnivore to stabilise after the translocation procedure and for the effects of any administered drugs to wear off. Habituating animals to release sites enables them to hone behavioural skills such as locomotion, social skills and foraging. It may also help reduce dispersal and 'homing behaviour' (the tendency for a released animal to return to the capture site).
- It is advisable to release carnivores in sex ratios similar to that exhibited by wild populations to ensure reproductive encounters. Conversely, if one aspires to have a comparatively slow or incremental population growth rate carnivores can be released in disproportionate sex ratios, for example four male lions to two lionesses. Population increase could potentially be reduced through infanticide by competing males.
- Releasing individuals, either sequentially or simultaneously, at different release sites will enable independent exploitation of area and resources with potential conservation benefits.

SOFT RELEASE: Carnivores to be released are held in capture units or bomas for a period of up to eight weeks to ensure they do not attempt to return to their original home area. This type of release is recommended for all translocations, reintroductions and supplementations.

HARD RELEASE: Carnivores are released immediately into the destination area without the assistance of capture units or bomas. This type of release is not recommended except for under extremely pressing circumstances.

Figure A2: Definition of release terms

Ad2: Monitoring and continuing management.

- The intensity and duration of monitoring will be case-specific and will not only help to refine ongoing translocations, but inform future translocation procedures.
- It is recommended that **carnivores released into GNP be fitted with a GPS or satellite tracking collar** to allow for direct and effective monitoring. In the case of groups of animals, it is preferable that at least two individuals in the group are be fitted with one of the aforementioned. Indirect methods (e.g. spoor, informants) may be utilised to assist telemetry tracking. If possible, collars with a drop-off mechanism should be used.
- Key to any translocation should be monitoring of demographic performance including, survival, reproduction rates, and dispersal, and for groups of animals, population growth rate, age structure and sex ratio. Comparing demographic traits of reintroduced populations with wild populations will help managers identify how animals respond to their new environment and determine when a reintroduced or augmented population has become an established, viable population.
- Interventions (e.g. supplemental feeding; veterinary aid) should be adopted where necessary.
- **Behavioural monitoring can be a valuable, early indicator of translocation progress**. Behavioural traits of carnivores include, amongst others, knowledge of hunting, predator avoidance, territoriality, social organisation, daily and seasonal movements and habitat choice. Comparisons can be drawn against data from comparable natural populations or the same individual(s) before removal from their source population and area.
- Ecological impacts arising from a translocation need to be assessed, especially when a translocation is designed to create or restore an ecological function, and appropriate managerial changes made.
- Mortality monitoring is important to assess the extent to which translocated individuals experience disease or adverse welfare conditions, persecution, starvation etc, and to identify the underlying causes. Mortality is not necessarily an indicator of failure unless survival is not increased in future translocations.
- Including local landowners and communities in post-release monitoring may provide a practical means of assessing attitudes and any costs or benefits arising from the translocation, as well as engaging continuous interest and support.

APPENDIX B: SPECIES SPECIFIC CONSIDERATIONS

Individual carnivore species each have a unique set of abiotic and biotic requirements, and thus will vary in their responses to translocations. Please see below for species specific considerations for carnivore translocations into GNP.

Cheetah

The cheetah (*Acinonyx jubatus*) is a unique and specialised member of the cat family. It is listed as vulnerable (IUCN 2008), with a decreasing population trend largely due to habitat fragmentation. Cheetah are listed on CITES Appendix 1. They stand 85 cm at shoulder height and weigh 50 kg on average. The cheetah's body is uniquely adapted to reaching high speeds, giving it a distinctive shape and making it the fastest mammal on land.

Cheetahs are diurnal and hunt during the day. The special 'tear marks' on their faces help to reduce the glare of the sun. They can reach speeds of 103km per hour while running down and chasing prey. Cheetahs hunt medium-sized antelope (c. 35kg) as well as smaller mammals and ground-living birds. They exclusively eat fresh meat, and can take small livestock and cattle calves. It is often mistakenly assumed that cheetahs are plains/savannah animals only, but the species can and does exist in different types of habitats including wooded areas, mountainous terrain and dense vegetation. They are adapted to living in arid environments and are not obligate drinkers.

Cheetahs can be solitary or live in small groups. Groups usually consist of mothers and cubs (one-six), coalitions (males) and sub-adults just after independence. Sub-adult groups may consist of both males and females, but eventually split up when the individuals become sexually mature. Male coalitions are formed when male siblings remain together in a group. Occasionally, unrelated males form coalitions. Cheetah cubs are kept concealed during the first three months of their lives. During this time they are particularly vulnerable to lions and spotted hyaenas.

In areas where prey is migratory, female cheetah tend to follow the herds, while male coalitions establish small territories (average 30 km²) and attempt to mate with females passing through (Durant *et al*. 1988; Caro 1994). However, in areas where prey is non-migratory (as is the case in GNP), male and females have overlapping ranges that are similar in size. Ranges can be as big as 1,642km^2 (e.g. on Namibian farmlands, where prey is non-migratory; Marker 2002), although the animals tend to use core areas which are significantly smaller (200-300km^2).

Cheetah tend to occur at relatively low densities (10-30% of the density of lions, for example) and whilst population densities vary greatly, they average out at about 1.0 cheetah / 100km^2 (IUCN SSC 2009). In Gonarezhou National Park, a cheetah density of about 1.5 cheetah per 100km^2 (as per data from 2014) represents **a healthy cheetah population with no cause for concern**.

Translocation considerations for Cheetah

- Given the conservation status of cheetah, no translocation should proceed that constitutes any more then very minor and unavoidable risk to the released individuals.
- Cheetah populations may be limited in the presence of high lion and spotted hyaena numbers through inter-specific competition (e.g. direct killing, kleptoparasitism, reduced habitat utilisation). Consequently, if lions and spotted hyaenas are present in the release site only cheetah experienced in living with predators should be translocated.
- Cheetah are known to be susceptible to several feline diseases, and populations with weak heterogeneity are possibly more susceptible. Disease and parasite considerations (Appendix Ac4) should be thoroughly reviewed.
- It is advisable to release cheetah within a protected area. The release site should be larger than 10 000km² if fenced. Cheetah can be released in smaller fenced reserves provided they are part of a managed meta-population under a national management plan (e.g. South Africa).
- Many populations of cheetahs exist outside protected areas, and due to their wide-ranging nature are likely to roam beyond the borders of protected areas. Consequently, if release sites are adjoined by human communities, mitigation measures must be in place, and efforts made to ensure the intervention does not exacerbate human-wildlife conflict.
- Because of the fragile conservation status of the species, it is essential that the removal of cheetah for translocations or reintroductions should not negatively impact the source population
- Where cheetah are actively sought for reintroduction or translocation into a wild area within historical range, it is preferable that they come from a wild, not captive, background
- There is little role for captive breeding of cheetah in southern Africa.

African Wild Dog

African wild dogs (*Lycaon pictus*) are a unique and special canid. They are listed as endangered on the IUCN Red List (IUCN 2014) with a declining population trend. Latest global population estimates are of only 6,600 individuals left in the wild, equating to c. 660 breeding packs. The Greater Limpopo Transfrontier Conservation Area, of which GNP is a key part, is home to almost 10% of the remaining global population. Wild dogs are *not* listed on CITES (because they are generally not traded) and are listed on Appendix 2 of the Convention of Conservation of Migratory Species (CMS).

African wild dogs (hereafter wild dogs) are social carnivores. They are obligate cooperative breeders, and live in packs, in which usually only an alpha pair produce offspring, which are then raised with the help of the other pack members. Packs can number anywhere between 2 and 40 individuals (average pack size is about 10 adults and yearlings) and litter sizes average c. 8-10 pups, although single litters of over 15 pups have been recorded.

Wild dogs hunt cooperatively in packs and kill medium sized ungulates, predominantly impala. In neighbouring Savé Valley Conservancy, impala form 74% of the diet, with kudu comprising 12% (Mbizah *et al*. 2012). Steenbok are likely to be an important part of their diet in Gonarezhou. Wild dogs are almost exclusively hunters and rarely scavenge. When they come into contact with livestock, they can predate on goats or sheep and occasionally calves. However, they are easily scared off by people, so should not be a significant threat to livestock that is properly herded (and kraaled). Wild dogs are crepuscular, favouring the early mornings and evenings for hunting. They are not particularly active at night, except around the full moon.

Wild dogs are a wide-ranging low density species and need vast areas of intact habitat to support a viable population. A single pack can range over 3,000km^2, but average home ranges tend to be more in the region of 300-800km^2. As such, it is not unlikely that a pack will range outside of the boundaries of a protected area, particularly in parks like GNP which have a high perimeter to area ratio, and where the Park width rarely exceeds 60km.

Wild dogs have a 3 month denning season (usually between late April and September in southern Africa), when they are confined to a den to raise a litter of pups. During this time, home ranges can decrease to c. 80km^2, in which there needs to be sufficient prey. Den sites are typically burrows excavated by aardvarks (often expanded by warthogs), or caves and crevices in rocky areas.

Population densities for African wild dogs range considerably, but in no instances can they be considered a high density species (some of the highest densities ever recorded are only c. 4 dogs per 100km^2). However, because pack size is so variable (even within a single pack over the course of a single year), it is **more meaningful to talk about the number of packs – or breeding units – as the unit for wild dog populations**. At the time of writing (2014) GNP was known to support at least 8 known breeding packs, and estimated to hold at least 12 packs. This is a healthy population, given the size of the Park, and there is **currently not a need to supplement the population** from a numbers point of view.

Translocation considerations for African wild dogs

- Wild dogs should be translocated either as a bonded pack (in the case of assisted recolonisation) or as a group of related single-sex individuals (in the case of augmentation of an existing population)
- Given their social structure, it is particularly important for wild dogs to be soft released (Appendix C), so they can re-bond after the trauma of the translocation, and to prevent homing (e.g. the tendency to move back in the direction of their origin – this has been documented on many occasions). Normally 4-6 weeks in the boma should suffice to break the homing tendency for wild dogs.
- If captive bred or rehabilitated individuals are to be released, they should first be bonded with wild individuals in a controlled environment and then soft-released at the release site. Packs that are completely captive should not be released into the wild. Rather they should

be split into same sex groups, bonded with wild groups of the opposite sex and then released as two groups.

- Given the endangered status of African wild dogs, no translocation should proceed that constitutes any more than the unavoidable risk (that occurs in all translocations) to the released individuals.
- Further, African wild dog populations may be limited in the presence of high lion and spotted hyaena numbers through inter-specific competition, including by direct killing, kleptoparasitism and habitat competition. Consequently, if lions and spotted hyaenas are present in the release site only predator 'wise' wild dogs should be used for translocations (i.e. those from a background of living with lions and hyaenas), and efforts should be made not to release the wild dogs in the core home ranges of lions.
- African wild dogs are known to be susceptible to several canine diseases, and populations with weak heterogeneity are possibly more susceptible. Disease and parasite considerations (Appendix Ac4) should be thoroughly reviewed, and vaccinations given as necessary.
- There is evidence that rabies vaccinations can protect an animal against rabies (even if only for a few months), and there is no risk to the animal (due to use of recombinant (non-live) vaccines), so it is recommended that if animals from a rabies-naïve area are to be moved to an area with endemic rabies, that they should be vaccinated. Likewise, if moving animals from rabies endemic areas, quarantine should be considered.
- It is advisable to release African wild dogs only within very large protected areas (>5,000km^2), only considering smaller, unfenced protected areas if there is good connectivity with neighbouring wildlife areas. Wild dogs can be released in smaller *fenced* reserves, provided they are part of a managed meta-population under a national management plan (e.g. in South Africa).
- Due to their wide-ranging nature, African wild dogs are likely to roam beyond the borders of protected areas. Consequently, if release sites are adjoined by human communities, there should be good neighbour relations and conflict mitigation measures should be in place. Monitoring systems, and ideally good community outreach programs, should also be in place to help avoid conflict.
- Given their wide ranging nature and ability to travel great distances in dispersal events (>400km) it needs to be considered whether the translocation of free-ranging wild dogs between open (non-fenced) wildlife areas will be of any functional benefit. However, natural dispersal to areas >200kms away are relatively infrequent, and translocation may be considered as a way of 'seeding' areas in which wild dogs have become locally extirpated.

African Lion

The African lion (*Panthera leo*) is listed as Vulnerable on the IUCN Red list, with a recorded 30% decline in numbers over the past two decades (IUCN 2014). Latest global population estimates suggest only 32,000 lions remaining in 67 lion areas (only 17% of their historical range). The Greater Limpopo Transfrontier Conservation Area is considered to be one of only 10 strongholds

(areas supporting more than 500 lions) for lions in Africa (Riggio *et al.* 2013). The lion is included in CITES Appendix II.

Lions are the most social of the cats, with related females remaining together in prides, with their cubs, and related and unrelated males forming coalitions competing for tenure over prides. Average pride size (including males and females) is four to six adults. Lions are primarily nocturnal, spending most of the day sleeping, although they can be active at dawn and dusk, especially during cooler months.

Lions tend to live at higher densities than most other felids, but with a wide variation from 1.5 adults per 100 km² in southern African semi-desert to 55/100 km² in parts of the Serengeti (Sunquist and Sunquist 2002). In most areas in Zimbabwe lion densities range from 3-8 lions/100km^2. Pride ranges can vary widely even in the same region: e.g., from 266-4,532 km² in the Kgalagadi Transfrontier Park of South Africa (Funston 2001). In most Zimbabwean habitats lion home ranges probably vary from about 200-500km², which is typical.

Female lions conceive as early as 32 months and given their gestation of 14–15 weeks may have their first litter between 40 and 60 months of age (Smuts *et al*. 1978). In large free-ranging populations, litter sizes vary from one to six but generally converge onto an average of three cubs. Birth intervals depend on whether cubs are raised to maturity. Generally, new litters are born every 20 to 24 months, and about every 30 to 36 months in southern African woodlands (Smuts *et al*. 1978). When litters are lost, intervals range between four and six months.

Although lions drink regularly when water is available, they are capable of obtaining their moisture requirements from prey and even plants (such as the tsama melon in the Kalahari Desert), and thus can survive in very arid environments. Lions are apex and keystone predators. Medium- to large-sized ungulates (including antelopes, zebra and wildebeest) are the bulk of their prey (Hayward & Kerley 2005), but lions will take almost any animal, from rodents to a rhino. They also scavenge, frequently displacing other predators (including cheetah, wild dogs and spotted hyaenas) from their kills. Lions will also kill other predators with which they come into contact, and are a particular threat to African wild dogs during denning season.

The main threats to lions are anthropogenic; indiscriminate killing (primarily as a result of retaliatory or pre-emptive killing to protect life and livestock) and prey base depletion, as well as targeted poaching for skins and bones. Habitat loss and conversion has led to a number of populations becoming small and isolated (Bauer 2008). Trophy hunting is carried out in a number of sub-Saharan African countries, including Zimbabwe, and is considered an important management tool for providing financial resources for lion conservation for both governments and local communities. However, there is concern that current management regimes can lead to unsustainable offtakes (Packer *et al.* 2006).

The lion has a broad habitat tolerance, absent only from tropical rainforest and the interior of the Sahara desert (Nowell and Jackson 1996). Gonarezhou National Park constitutes good lion habitat, although restricted water availability may negatively influence prey abundance and thus lion densities. Estimates of carrying capacity for lion in the Park average at about 200 individuals (c. 4

lions / 100km^2). The current population estimate of 116 lions is thus still fairly low, although the positive population trend indicates a rapid natural recovery, and suggests **no need to artificially augment the population of lions at the time of writing**.

Translocation considerations for Lion

- Lions can be translocated as individuals, coalitions or prides. Ideally individuals should not be moved out of a pride.
- Release of captive bred lions into a wild situation should never be considered.
- A good age to translocate lions is between 18 and 22 months. This is because lions are fully weaned and male lions are usually expelled from the pride at this age. Lions at this age are also able to fend for themselves and are adaptable to new circumstances. (Kettles & Slotow 2008). However, 100% mortality was recorded for male lions dispersing below 30 months of age from Hwange National Park (Elliot 2013). All of these lions left areas with resident lions and where killed by people outside or other lions.
- Lions have a strong homing instinct and it is strongly recommended that they are first kept in a boma for about eight weeks (a soft release) before being released (see Appendix C).
- An individual that is hard released is very likely to return to where it came from and/or roam outside the Park and could trigger conflict. It is recommended that hard releases are not performed.
- Lions are a high conflict species. Serious conflict-causing individuals are often best destroyed (Stander 1991, Funston 2011).
- For GNP, with its high perimeter to area ratio, most lion territories will overlap the Park boundaries. Releasing potential conflict-causing animals into the Park is likely to exacerbate human-lion conflict and may simply transfer the problem from the original area to the Park. Therefore, if the translocation of a potential conflict-causing individual (habituated livestock killer etc.) is absolutely unavoidable, there must be a good monitoring and community outreach program in place to help mitigate conflict.
- Lions are the apex predator and a robust species, and breed well in the absence of high anthropogenic pressures, so augmenting numbers in a protected area where the species already exists is rarely necessary. Inappropriate lion translocations can significantly negatively impact populations of native prey species, as well as populations of smaller carnivores such as cheetah and African wild dogs
- Lions can suffer from, and be carriers of, several diseases that can be transmissible to both other felines and canines. Disease threats should therefore be reduced through testing and vaccination wherever possible (Miller *et al*. 2013). For example, lions must be vaccinated against rabies before being moved within South Africa (Bishop *et al*. 2003).
- Animals should be tested for known diseases and available vaccinations administered whenever possible (e.g. when immobilized for transporting). When translocating animals, this would include vaccination for rabies, canine distemper, feline herpes and feline calici viruses. Additionally, a BTb skin-test should be done if they are being moved from an area where BTb is known to occur. Lions should also be treated for tapeworms (to prevent measles) (Miller *et al*. 2013).

Brown Hyaena

Brown hyaenas are listed as near-threatened on the IUCN Red List; global population size is estimated to be below 10,000 mature individuals, and the species experiences a measure of deliberate and incidental persecution resulting in a population decline. The species was removed from CITES Appendix II in 1994; there is very little trade in the species.

The brown hyaena is found in a variety of habitats, including desert areas, semi-desert, open scrub and open woodland savanna with a maximum rainfall up to about 700 mm. It shows an ability to survive close to urban areas. It is independent of drinking water, but needs some type of cover in which to lie up during the day, preferably rocky, mountainous areas with bush cover.

Brown hyaenas are primarily scavengers of a wide range of vertebrate remains, which is supplemented by rodents, wild fruits, insects, birds' eggs and the occasional small animal which is killed. Brown hyaenas are generally poor hunters and live prey (e.g. spring hares, bat eared foxes, korhaans) makes up only a small portion of their diet. Brown hyaenas seldom attack domestic livestock, and are not a significant threat to human livelihoods.

Brown hyaenas live in small social groups, called 'clans.' Clans range in size from a solitary female and her cubs to groups containing several females and their offspring of different ages. The clan cooperatively defends a territory, but its members typically forage alone. Brown hyaenas maintain a stable clan hierarchy through ritualized aggressive displays and mock fights.

Female brown hyaenas typically produce their first litter when they are two years old. They mate primarily from May to August, the gestation period lasting 97 days. Clan males will assist the females in raising their cubs. Females give birth in dens, which are hidden in remote sand dunes far from the territories of spotted hyaenas and lions. Mothers generally produce one litter every 20 months. Usually, only the dominant female breeds, but if two litters are born in the same clan, the mothers will nurse each other's cubs, though favouring their own. Litters usually consist of 1-5 cubs. Cubs leave their dens after four months, but they are not fully weaned, and do not leave the vicinity of their den, until they reach 14 months of age.

In the Kalahari, clan territories varied in size from 170 to 480 km^2 (Mills 1990), but reached larger sizes along the Namib Desert coast (Wiesel 2006). Clan size is determined by the type of food in the territory and territory size by the manner in which the food resources are distributed.

The translocation considerations for brown hyaena can be found under the spotted hyaena.

Spotted Hyaena

Spotted hyaenas are listed as Least Concern on the IUCN Red list, as the species remains widespread in Africa, and the total world population well exceeds 10,000 mature individuals. Viable populations still exist in a number of countries and the global population may be between

27,000 and 47,000 individuals. However, there is a continuing decline in populations outside protected areas (and even within some protected areas) due to persecution and habitat loss.

Spotted hyaenas are present in all habitats including semi-desert, savannah and open woodland, dense dry woodland, and even montane habitats. The spotted hyaena is the most social of the carnivores in that it has the largest group sizes and most complex social behaviours. Its social organisation is unlike that of any other carnivore, bearing closer resemblance to that of some primates. However, the social system of the spotted hyaena is openly competitive rather than cooperative, with access to kills, mating opportunities and the time of dispersal for males depending on the ability to dominate other clan-members. Females provide only for their own cubs rather than assist each other, and males display no paternal care. Spotted hyaena society is matriarchal; females are larger than males, and dominate them.

In many parts of their range, they occur in close association with human habitations. Often considered scavengers, spotted hyaenas are in fact effective and flexible hunters. Unlike other large African carnivores, spotted hyaenas do not preferentially prey on any species, and only buffalo and giraffe are significantly avoided. Spotted hyaenas prefer prey with a body mass range of 56–182 kg (average 102 kg). When hunting medium to large sized prey, spotted hyaenas tend to select certain categories of animal; young animals are frequently targeted, as are old ones.

When targeting livestock, the spotted hyaena primarily preys upon cattle, sheep and goats. Reports of livestock damage are often not substantiated, and hyaenas observed scavenging on a carcass may be mistaken for having killed the animal.

The spotted hyaena is a non-seasonal breeder, though a birth peak does occur during the wet season. Females are polyoestrus, with an oestrus period lasting two weeks. Like many felid species, the spotted hyaena is promiscuous, and no enduring pair bonds are formed. Members of both sexes may copulate with several mates over the course of several years. The average litter consists of two cubs, with three occasionally being reported. Cubs will nurse from their mother for 12–16 months, though they can process solid food as early as three months. Mothers do not regurgitate food for their young. The clan's social life revolves around a communal den. While some clans may use particular den sites for years, others may use several different dens within a year or several den sites simultaneously. Spotted hyaena dens can have more than a dozen entrances, and are mostly located on flat ground.

Territory size is highly variable, ranging from less than 40 km² in the Ngorongoro Crater to over 1,000 km² in the Kalahari. Home ranges are defended through vocal displays, scent marking and boundary patrols. Clans mark their territories by either pasting or pawing in special latrines located on clan range boundaries.

Population densities based on systematic censuses vary substantially, from 0.006 to 1.7 individuals per km². **At the time of writing, Gonarezhou has a healthy population of spotted hyaenas which is not in need of supplementation.**

Translocation considerations for Spotted and Brown Hyaena

- Expert advice (Gus Mills, pers. com.) warns against translocations of brown and spotted hyaenas into an area where other members of the species are already present. There is a fair degree of inter- and intra-specific intolerance between the two species, subjecting the translocated individual(s) to a potentially stressful situation and rendering the translocation of very little conservation benefit, if any. In the case of a problem animal, euthanasia is likely to be the more humane approach.

Leopard

Leopards are listed as near-threatened on the IUCN Red list. They have a wide range and are locally common in some parts of Africa. However, they are declining in large parts of their range due to habitat loss and fragmentation, and hunting for trade and pest control. Remaining populations are often fragmented, because they are generally extirpated from areas densely populated with people or where habitat conversion is extreme. Leopards are listed on Appendix I of CITES.

The leopard is an adaptable, widespread species with the widest habitat tolerance of any Old World felid, ranging from rainforest to desert. In Africa, they are most successful in woodland, grassland savanna and forest but also occur widely in mountain habitats, coastal scrub, swampy areas, shrubland, semi-desert and desert. They range from sea level to as much as 4,600 m on Mt Kenya. The species' success in the wild is in part due to its opportunistic hunting behaviour, its adaptability to habitats, its ability to run at speeds approaching 58 kilometres per hour, its unequalled ability to climb trees even when carrying a heavy carcass, and its notorious ability for stealth.

Leopards are versatile, opportunistic hunters, and have a very broad diet. They feed on a greater diversity of prey than other members of the *Panthera* genus, and will eat anything from dung beetles to 900 kg (2,000 lb) male common elands, though prey usually weighs considerably less than 200 kg (most commonly 20-80kg). Their diet consists mostly of ungulates, followed by primates. However, they will also opportunistically eat rodents, reptiles, amphibians, insects and birds.

Leopards are elusive, solitary and largely nocturnal. Depending on the region, leopards may mate all year round. Gestation lasts for 90 to 105 days. Cubs are usually born in a litter of 2–4 cubs, but mortality of cubs is estimated at 41–50% during the first year. Females give birth in a cave, crevice among boulders, hollow tree, or thicket to make a den. Around three months of age, the young begin to follow the mother on hunts. At one year of age, leopard young can probably fend for themselves, but remain with the mother for 18–24 months. The average typical life span of a leopard is between 12 and 17 years

Home ranges of male leopards generally vary between 30 km^2 and 78 km^2 and of females between 15 to 16 km^2, although significantly larger ranges have been recorded (e.g. up to 300km^2 in

Namibia). Virtually all sources suggest that males do have larger home ranges. There seems to be little or no overlap in territory among males, although overlap exists between the sexes.

Densities vary with habitat, prey availability, and degree of threat, from less than one leopard per 100 km² to over 30 per 100 km², with highest densities obtained in protected East and southern African mesic woodland savannahs. At the time of writing, leopards were estimated to be at a density of 8 per 100km^2 in GNP, which is slightly lower than that recorded in Phinda and Mkhuze in South Africa (average 9.7/100km²; Balme *et al*. 2009). **At present there is no significant cause for concern, but the trend needs to be closely watched**.

Translocation considerations for Leopard

- Leopards are strongly territorial, and thus the release site will need to be determined by an area unoccupied by resident leopards within the protected area.
- Introducing a leopard into an area that already forms part of another leopard's territory is likely to either result in a fight (and mortality/injury of one leopard) or dispersal of one of the leopards in search of an unoccupied area (Weilenmann *et al*. 2010). This could result in the animal leaving the protected area and possible conflict with neighbouring landowners/communities.
- Given that there is a healthy population of resident leopards in the Park, translocations of the species is not recommended and should be avoided.
- Leopard co-exist with other competitive predators (lions and hyenas) across their natural range, and provided there is sufficient escape terrain (cliffs, koppies, trees) available, can live alongside other predators quite easily.
- Leopards are not particularly susceptible to disease, but feline HIV and canine distemper are two potential concerns. Contact with domestic species would greatly increase the risk.
- Leopards are difficult to contain, and have a strong homing instinct, and thus there is substantial potential for conflict. In a study in Botswana, all four translocated leopards either returned to the trap site or showed extensive ranging behaviour, and three of the four leopards resumed stock-raiding and were shot when ranging outside protected areas (Weilenmann *et al*. 2010). Translocations are rarely an effective management tool for stock-raiding leopards.
- Leopards are persecuted for their skins and bones and have been known to take livestock. Extreme caution should be exercised if translocating leopard to an area where they are likely to come into contact with humans and / or livestock. For Gonarezhou, with its high perimeter to area ratio, there is a high probability that the carnivores may roam beyond the Park boundaries. There must be a good community outreach program in place to help mitigate conflict; including improving livestock husbandry/protection measures (Athreya *et al*. 2010).

APPENDIX C: SOFT RELEASE PROTOCOL FOR LIONS (AND OTHER CARNIVORES)

From Miller *et al*. 2013

It is essential that all lion introductions involve a holding period within a boma before release onto the reserve. This allows the lions to recover from the stress and trauma of the capture and transport and from the drugs used in the relocation. It provides time for acclimatization to new surroundings and possibly new pride members. In the case of lions captured from unfenced areas, it allows them to learn to respect electric fences.

Fence: Bonnox or diamond mesh; inward folding half metre apron, pegged and rock-packed; inside electrification at least five live strands using large bobbins, with three in the lower metre; outside electrification.

Roads: Three metre road/clearing inside and outside of fence; for access and as a firebreak.

Location: Centrally located, preferably near a main road, but not visible to tourists, to allow ease of access and habituation to traffic noise. For larger reserves where more than one pride may be released, having a second boma in a different part of the reserve could reduce confrontation following a second release.

Habitat: Open grassland for good visibility with a few small thickets for shade, shelter and cover.

Size: 60 m × 80 m is large enough for a small pride; extension should be made to the length only if possible to ensure a maximum distance of 30 m from the fence to any animal – a reasonable distance for a darting from outside the boma if required.

Water: A 1 m × 1 m shallow (<30 cm deep) trough with raised edges (to prevent fouling by sand and vegetation), located close to the fence for easy visibility from outside the boma and away from the feeding/immobilizing areas. Filling can be controlled by a ball valve or, preferably, from outside the fence. It should be easily drained and cleaned (although cleaning should be avoided during the habituation period to prevent stress to the lions). It is ideal if the trough is empty when animals are drugged.

Parasites: Lions should be treated for internal and external parasites to reduce the stress on the animals and limit the build-up of parasites within the boma over time.

Introduction into boma: Immobilized lions should be placed in shade and allowed to wake up quietly. A carcass should be provided and the animals should not be disturbed for at least the first 24 hours. Long-acting tranquilizers (e.g. Clopixol Acuphase®) have been used on wild-caught lions to aid the habituation to fences as well as to introduce non-related lions to each other.

Feeding method: Extreme care should be taken to ensure lions do not form an association between food and people or vehicles. A screen (not covering more than two sides of the boma) should be used to block any visual cues related to feed- ing. One successful approach is to hoist carcasses up to a tower (from behind the screen) and allow them to slide down a cable into the boma (or even better, lower the carcass in to reduce the disturbance). Feeding repeatedly in the same place can allow for darting from behind the screen as well. More recent developments include a fenced and screened 'feeding camp' that is attached to the boma. A carcass can then be placed in the closed feeding camp and the gate to the main boma opened from outside the boma. The carcass can be chained to the feeding camp to assist in darting or left unchained to allow the lions to drag the carcass into the main boma for less stressful feeding. The feeding camp is both cheaper to build and easier to use than the original hoisting tower method. If darting from outside the boma without compromising habituation is not an option, a carcass containing a sedative, such as Dormicum® can be used. A dose of 150 to 300 mg per lion has been used successfully to sedate lions to make them more approachable and easier to dart. Extreme caution should be exercised when approaching sedated lions as they lose their fear of humans and are unpredictable.

Feeding frequency: Animals should not be overfed in the boma. Twice weekly feedings are recommended to allow the lions to experience hunger which should lead to them testing the fence and 'learning' about electrification.

Food: Whole, ungutted carcasses should be used to prevent any nutritional problems from developing. Smaller animals (such as impala or warthog) are preferred to prevent the need to clean the boma during the habituation.

Vehicle habituation: Habituation to vehicles while in the boma is essential for effective post-release monitoring, future immobilizing (e.g. for collar changes/removals) and tourism viewing. Including a road around the boma in the design facilitates this as vehicles can be driven around the boma with increasing frequency during the habituation process. An unoccupied vehicle can also be left outside the boma for extended periods. There should be no need to drive a vehicle within the boma at any time. There should be no exposure to humans on foot at any time to reduce stress and prevent loss of inherent fear of humans on foot.

Release from the boma: There is no set length of time for holding lions in a boma before release onto the reserve. Younger lions tend to habituate faster than older lions. Six to eight weeks is probably sufficient in most cases, but if the lions are not thought to be sufficiently bonded, habituated or fence-aware, a longer time may be required. Lions have been held in a boma for up to four months on Pilanesberg NP with no apparent adverse effects on hunting ability or fitness. Lions should be allowed to leave on their own and not chased out of the boma, it is not important that they all leave at once. A carcass can be dragged through the entrance of the boma and chained to a tree outside the boma to entice the lions out (it is important to chain it or the lions may drag it back into the boma). If other lions are known to be in the area, the release should be delayed until they have moved off.