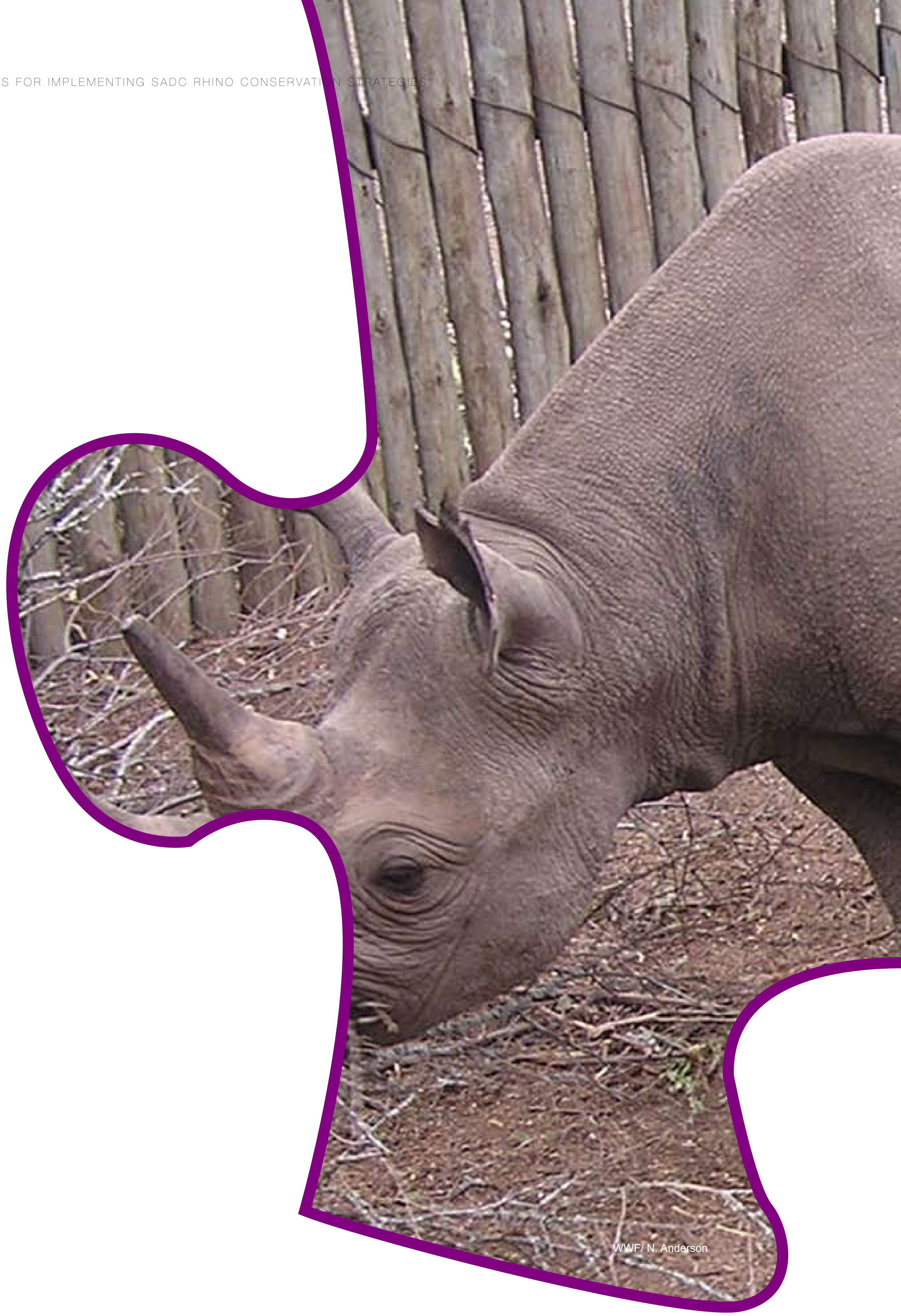
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RE-INTRODUCING RHINOS: BIOLOGICAL AND MANAGEMENT CONSIDERATIONS

SUMMARY OF GUIDELINES FOR: BIOLOGICAL AND MANAGEMENT CONSIDERATIONS IN RE-INTRODUCING RHINOS

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Ideally, each rhino re-introduction project will involve at least 20 rhinos, that are unrelated and all able to breed, being introduced into an area that has sufficient carrying capacity to allow rapid population growth to at least 100 animals.

The re-introduced rhinos should be of a subspecies that historically occurred at the re-introduction site.

In typical habitats within the SADC region (i.e. those lying between the more arid and the more humid rhino habitats within the region), the area required to introduce 20 black rhinos and to allow some room for growth is likely to be of the order of 300-400 km^2, while at least double this area will be required to enable population growth to over 100 rhinos. Thus wildlife authorities need to consider projects of this spatial scale when planning black rhino re-introductions.

The translocation of rhinos from one part of the region to another has to be done in accordance with the veterinary regulations of the relevant countries, but disease risks are usually low.

Behavioural factors have to be considered. In particular, fighting risks arise if rhinos are re-introduced to an area through a series of annual translocations; there is less fighting if the animals are all introduced in the same year.

The selection of re-introduction sites, although primarily based on issues of security and biological management, should take into account the opportunities for rhinos to contribute to strategic tourism development and to act as "flagships" for the conservation of other species.

5.1 What do we mean by "viability" of re-introduced rhino populations?

Since the priority rhino management issue for a number of the SADC member states is to re-introduce rhinos, and since these countries lack much of the technical expertise that is available within the larger range states, a specific section of this manual must be devoted to setting out guidelines for the re-establishment of free-ranging rhino populations within SADC range states. These guidelines apply at the stage of initial planning and do not incorporate the finer details of translocation and release procedures. The general species re-introduction guidelines of the IUCN Re-Introduction Specialist Group (see Annex 1A) are also applicable. Consideration must be paid not only to factors that pertain to the re-introduction of rhinos but also to those that pertain to the *in situ* consolidation of survivors of populations that have not yet been totally extirpated but which cannot constitute viable breeding groups without management interventions.

The long-term viability (sustainability) of such efforts at rhino re-introduction or consolidation will of course depend not only upon biological/ecological factors, which are outlined in this section, but also on economic and socio-political factors (including security) which tend to be more variable from one SADC state to another.

When considering "viability", there are subjective interpretations of this term. Even if some definition of viability can be agreed upon, it will often be the case that a phased programme of re-introduction or consolidation of a population is intended, so initially this will not constitute a "viable" breeding programme but should have a reasonable expectation of becoming so within a reasonable period. However, what is a "reasonable" prognosis of success? And what is a "reasonable" time horizon by which to have met some criteria of viability? Although there are no definitive answers for these questions, some general understanding can be gained by reviewing demographic and genetic management principles that apply to rhino conservation.

5.2 Genetic factors pertaining to rhino re-introductions

There can be little disagreement that a long-term aim of rhino breeding programmes must be to maintain the potential of these species to adapt to natural selection pressures (i.e. to evolve further). Conservation biologists cannot yet be precise about the population size and composition that would be required to limit the rate of genetic loss through inbreeding, genetic drift, etc. to a specified level. However, the "conventional wisdom" on rhino genetic management is as follows.

- Each population should be established with 20 or more effective founders. By "effective founders" it is meant that these animals will as far, as is known, be unrelated and will be capable of breeding (so if a population is started with five bulls and five cows each of which has a calf, then the maximum founder size is not 15 but only 10 because the cows and calves are directly related).
- Ideally, each new population will be established in an area with a carrying capacity of not less than 100 rhinos. This is often not possible; if it cannot be achieved then the less desirable alternative is to maintain at least one such population within a national or regional metapopulation. By "metapopulation" it is meant that two or more geographically separated populations will exist and rhinos will be translocated between these populations so that managed gene flow is achieved.
- There should be periodic exchange of effective breeders between populations of the same subspecies; i.e. at least one male or one female, capable of breeding, should be brought into each population every 10-15 years in order to compensate for inbreeding, genetic drift, etc.
- Rapid rates of population growth must be maintained, particularly in the smaller populations.

The founder animals should of course be of a "subspecies" that occurred within the area prior to extinction or is the same as any surviving rhinos in that area. There may be a risk in deriving founders from a small source population that itself has had a limited founder base and has stagnated through poor breeding; this "sub-sampling" of the gene pool could bottleneck the genetic diversity of the new population from the outset. This is not likely to be a significant risk as yet in southern Africa because various populations that are most likely to be the sources of founders for new breeding programmes have been shown to still retain a high degree of genetic variability (Harley et al., 2005). In principle, it is desirable to draw the founders from more than one source population, of the same subspecies.

5.3 Demographic factors pertaining to rhino re-introductions

The demographic objective of maintaining the maximum possible rate of population growth overlaps with the genetic factors outlined above; rapidly expanding populations will pass on more genetic diversity from one generation to the next than will populations with stagnant growth rates. An annual population growth rate of 5% is regarded as a minimum target for rhino populations (Section 4.11.8), although well-managed introduction programmes can double this rate. Because recently established populations (or remnant populations) are small, caution is required when assessing their growth rates because even a single birth can constitute a large percentage increase in population size and is not necessarily proof of adequate breeding success. A small population may well have a very impressive birth rate in one year but no calves born over the next couple of years, since calving by a few females can become synchronized either by chance or because of the way in which the population was established.

As noted in Section 4.11.8, a common mistake is to calculate growth rates as being equivalent to a simple interest rate rather than a compound interest rate, thereby giving an exaggerated impression of the growth rate when compared to the 5% per annum benchmark. Even if this mathematical pitfall is avoided, the difficulties in deriving a meaningful growth rate for small, recently established populations require that other indicators of breeding performance must also be considered. The average inter-calving interval of the adult females can be checked for conformity with the benchmarks outlined in Section 4.11.8. However, neither of these indicators will necessarily be applicable in the early stages of population establishment; for instance, the breeding potential of the females within a re-introduction area may be initially suppressed if they are held in pens without opportunities to mate over prolonged periods during the release process, or if they have problems settling-in after their release.

These monitoring complications point to the fact that since rhinos are relatively slowly-breeding animals, their management during a re-introduction programme must be proactive (potential breeding constraints must be avoided, through careful planning, before they arise), rather than reactive (simply responding to problems once they become apparent). Unless breeding is limited by poaching or by insufficient founders, the major constraint will be the quality and extent of suitable habitat. Hence, a professional habitat assessment (see Section 4.4) is essential.

Once the carrying capacity of the re-introduction site has been estimated, this estimate can be used to determine whether the area is sufficiently large to meet the demographic targets of the programme. If the area is sufficient for the 100+ rhinos that would optimally meet the genetic management guidelines, and if 20+ founders of a reasonable sex ratio are available, then demographic issues are unlikely to require further consideration during the planning phase. If the area is too small for 100+ rhinos, then as outlined above it is necessary to ensure that the new population can be managed as a satellite breeding group within a metapopulation, with definite opportunities for exchange of animals. These opportunities must be clear from the outset not only in terms of the legal or diplomatic issues that will influence the exchange of rhinos, but also in terms of the funding, expertise and equipment that will be required to achieve these exchanges.

Rhino management authorities may sometimes compromise on the basic genetic and demographic principles in recognition of other factors. For instance, in South Africa groups of five or six black rhinos are sometimes auctioned to private buyers. This is justified on the basis that although it does not constitute recommended genetic management of the auctioned rhinos, it does bring in significant funding which is then allocated to the protection and management of key rhino populations that remain the reservoirs of genetic diversity. Such situations are beyond the scope of these guidelines; for re-introductions to SADC countries such as Botswana, Zambia and Mozambique it should be feasible to follow "best practice" rather than compromising. Although the full complement of founder animals may not be introduced all at one time because of funding or other constraints, there should be a clear plan to introduce the additional founders (up to the target of 20+) in due course and the habitats/area should be sufficient to absorb these additions.

When re-introductions are undertaken by the private sector (commercial agencies or conservation NGOs) or as a joint venture between a state agency and the private sector (e.g. a custodianship scheme), there may be particular pressures to introduce rhinos in less than ideal numbers. In such cases the relevant wildlife management authorities need to consider whether the constraints to larger founder groups are truly insurmountable or whether some leverage can be applied to create a better situation. For instance, if the constraint is the size of the property to which the rhinos are being introduced, the wildlife management authorities should look for any opportunities to provide pressures or incentives (possibly assisted by donor agencies) to have this land incorporated into a larger wildlife complex such as a conservancy, without internal fencing. Zimbabwe's experience in creating large conservancies in its south-eastern Lowveld region is relevant (du Toit, 1992).

A guideline of the IUCN Re-Introduction Specialist Group (Annex 2) is that any re-introduction project should not diminish the viability of the source population (whether wild or captive). However, this will not be applicable in situations where fragmented "outlier" populations are being consolidated into a more viable one.

The sex ratio of the founder group should be as close to parity as possible. Having more females would increase the rate of breeding but a reduction in the number of males may reduce the genetic base of the re-introduced population, and may cause a problem of excess/surplus males in the donor population.

5.4 Ecological factors pertaining to rhino re-introductions

In order to meet the fundamental requirements of an adequate area of suitable habitat for a wild rhino population, professional input will be required to conduct an assessment of carrying capacity well before any translocation plans are finalized. Two levels of carrying capacity must be considered (see Section 4.4). Ecological carrying capacity (ECC) is the upper limit, at which population growth will be checked by a shortage of food or other density-dependent constraints. Maximum productivity carrying capacity (MPCC, also known as economic carrying capacity or the level of maximum sustained yield) is a lower density (assumed to be about 75% of ECC) at which population growth is optimised.

The carrying capacity of habitats for both species of rhinos varies greatly through the SADC region. For instance, black rhino ECCs vary from 1 rhino per 100 km^2 for parts of arid Kunene, Namibia, up to 1 rhino per 2 km^2 for valley bushveld habitats of Addo NP, South Africa.

As an initial and very rough planning guide for black rhino introductions, a stocking rate of one adult rhino per 10 km^2 is broadly applicable as MPCC over much of the former range of this species in south-central Africa, where Colophospermum, Acacia and Combretum are typical tree genera. However, this stocking rate would be too high in dystrophic (low soil nutrient) areas, such as extensive miombo woodlands on Basement Complex geology, and in arid areas such as most of Namibia.

Using this benchmark density of one adult rhino per 10 km^2, it will be apparent that to introduce the recommended minimum of 20 founders an area of at least 200 km^2 will be required, while to maintain the optimum population size of 100+ an area of 1,000 km^2 or more will be necessary.

It may be that much higher densities of black rhinos were historically recorded in the re-introduction area or in similar habitats elsewhere. However, it would not be prudent to use this type of historical or comparative information as the only basis for determining the area that is initially required for the release of the founder animals. Allowance must be made for the fact that the foraging efficiency of rhinos may be reduced until they become familiar with the area, and their initially unstable social structure will create greater problems of "social carrying capacity" (see below) than will be the case with a naturally expanding, indigenous population. Experience has shown that vegetation changes can cause rhino ECCs to change dramatically (up or down) over time, therefore past densities may no longer adequately reflect current ECCs.

It must be emphasised that a stocking rate of 1 adult black rhino per 10 km² (as MPCC) is certainly not always applicable within SADC range states. The use of this figure in these guidelines is merely to indicate the approximate order of magnitude of the area that will be required within the range of likely SADC re-introduction sites (e.g. in Mozambique and Zambia) for a straightforward re-introduction programme.

When deciding whether a proposed rhino re-introduction area is large enough, allowance must be made for population expansion in order to avoid having to translocate rhinos out, or to extend perimeter fencing, etc., soon after the first calves are born. SADC range states that are re-introducing rhinos are unlikely, in the initial stages, to have ready access to the expertise, equipment and funding that would be required to maintain an intensive regime of translocations. Neither is it likely that additional release areas will be immediately available with the requisite levels of security, infrastructure, etc., into which to move rhinos from the initial release area if it becomes overstocked.

The SADC RMG has recommended that a new area should be stocked at no more than half MPCC (to allow time for growth before the population needs to be harvested from, as well as providing a safety margin should ECC have been seriously over-estimated. At the benchmark MPCC density of 1 black rhino per 10 km² , at least 400 km² would be therefore be required to introduce the recommended minimum of 20 founders and allow space for some growth. At that benchmark MPCC, an area of 1,000 km² or more will be necessary to achieve the target population size of 100+ black rhinos. The officials within SADC wildlife management agencies who are considering rhino re-introduction programmes are strongly urged to plan at this spatial scale, rather than at any smaller scale that would preclude at least 20 founders, ideally expanding to 100+. The alternative and far more problematic scenario, of moving founders in dribs and drabs into smaller areas, is discussed later.

With regard to white rhinos, carrying capacities of different habitats within southern Africa are even more variable than those for black rhinos, hence it is not appropriate to refer to a benchmark density for this species for general planning purposes. White rhino densities range down from a maximum of 2 white rhinos per km² in Hluhluwe-iMfolozi, South Africa; most populations in the SADC region have much lower densities of around 1 white rhino per 5 to 10 km².

Apart from suitable habitat, the other obvious ecological requirement that has to be assessed prior to the selection of a re-introduction area is the reliability and distribution of surface water supplies. Abundant and uniformly distributed drinking sites seem an obvious attribute, but on the other hand advantage can sometimes be gained from a smaller number of water points, because of the way that they can provide a natural check against the excessive dispersion of rhinos from an unfenced release area.

5.5 Disease factors pertaining to rhino re-introductions

Inherent disease risks within the re-introduction area itself are most unlikely to arise to the extent that they would constitute a significant constraint to rhino re-introductions. However, an area that shows repeated outbreaks of anthrax is undesirable. The prevalence of trypanosomiasis in tsetse-infested areas would be a complicating factor for rhino re-introductions but should not necessarily preclude the translocation of rhinos; a careful re-introduction schedule is feasible, provided that close veterinary surveillance is ensured (Mihok et al., 1992; Dunham, 2005). The possibility of any environmental toxins or poisonous plants being present in the re-introduction area requires consideration, but is unlikely to be a "killer factor" that will preclude an area from receiving rhinos.

Where "outlier" rhinos are being consolidated within a reserve, disease risks will be of minimal importance in the planning. But if rhinos are being imported from other areas then there is a definite possibility that they may transmit diseases within the re-introduction area. The likelihood of such problems is low but nonetheless warrants a professional disease risk assessment, with particular consideration of tick-borne diseases and tuberculosis.

Tick-borne theileria or babesia parasites may flare up and kill black rhinos, especially if the rhinos are nutritionally stressed (e.g. during droughts) or are suffering from injuries or other diseases. Hence, it may be important to prophylactically treat rhinos that are being moved from areas where these blood parasites are known to have caused veterinary problems. Rhinos are the natural hosts of a number of ixodid tick species, some of which are the vectors of diseases (e.g. heartwater) affecting domestic livestock and some wildlife species (Duncan, 1989). It is therefore a prudent measure (and one that is stipulated by the veterinary authorities in most countries) to de-tick rhinos by applying topical acaracides before they arrive in the re-introduction area.

A more insidious disease risk arises with rhinos that have been raised in zoos, or held in captivity for long periods, and are brought back to wildlife areas for release (Osofsky et al., 2001). Black rhinos in captivity are particularly susceptible to a range of infectious agents, including fungal pneumonias. One explanation that is strongly suggested for this is that diet-related iron overloading develops progressively in zoo rhinos and suppresses the animals' immune systems (Osofsky et al., 2001). Veterinary authorities in southern Africa are very cautious about the transmission of bovine tuberculosis from infected areas in South Africa but tend to regard rhinos as a low-risk species in this regard; rhinos from zoos should be viewed more critically as potential carriers of this and other infectious diseases.

5.6 Behavioural factors pertaining to rhino re-introductions

Rhinos have more complex social systems than is generally realized. Translocations will inevitably disturb these systems and will tend to increase the risk of intraspecies fighting. Some problems are unavoidable, such as the jostling for optimum home ranges and social dominance among bulls when they are first released. Nonetheless, when a high frequency of injuries or deaths ensues from fighting amongst translocated rhinos, this problem should not merely be accepted as "normal" for rhinos – the possibility of underlying management problems must be considered.

It is desirable to bring all 20 or more founders in to a new area in a single year, rather than phasing the introductions over several years, because otherwise bulls that have come in first will establish home ranges and social dominance, and will fight with the bulls that are brought in afterwards. If it is not possible to achieve a single phase of introductions, then the rhinos may have to be released in different parts of the reserve (if it is large enough). This will spread the effort that is required for their protection over a larger area. Alternatively, the rhinos could be released into a series of adjacent, fenced compartments and the fences can be removed once the rhinos have established their home ranges. However, this requirement for fencing is expensive and any kind of extra management such as this can give rise to unexpected complications, so is best avoided if at all possible.

The social effects of translocations within donor populations also need to be considered.

5.7 Summary of strategic planning issues pertaining to rhino re-introductions

To help achieve strategic goals as outlined in Section 2.1, and to maximize the chances of success for each re-introduction project, the following strategic planning issues should be considered when planning and locating this type of project.

- Distance to other rhino populations (relevant to the logistical constraints of metapopulation management).
- The distribution of other important biodiversity features or hotspots (so that a concentration of effort on rhino conservation can coincide with the conservation of other key elements of the nation's biodiversity).
- The national priorities for tourism development and general improvement of parks (so that providing the habitats and security situation are conducive, rhinos are put first into areas where they can boost the tourism attractions, and can generate tourism revenues that will help to pay for their conservation).

- Plans for Transfrontier Conservation Areas that could, for instance, boost the restocking of a minor range state through cross-border assistance in rhino allocations, technical and logistical support from a major range state.
- Allocations of wildlife areas for development by the private sector (where the awarding of long-term concessions could stimulate Public-Private Partnerships and commercial investments that facilitate the restocking, monitoring, management and protection of rhinos).
- Whether there are any area-specific, long-term commitments from donor organisations for support programmes.
- Plans for community-based conservation projects that could, in due course, be boosted by the addition of rhinos.