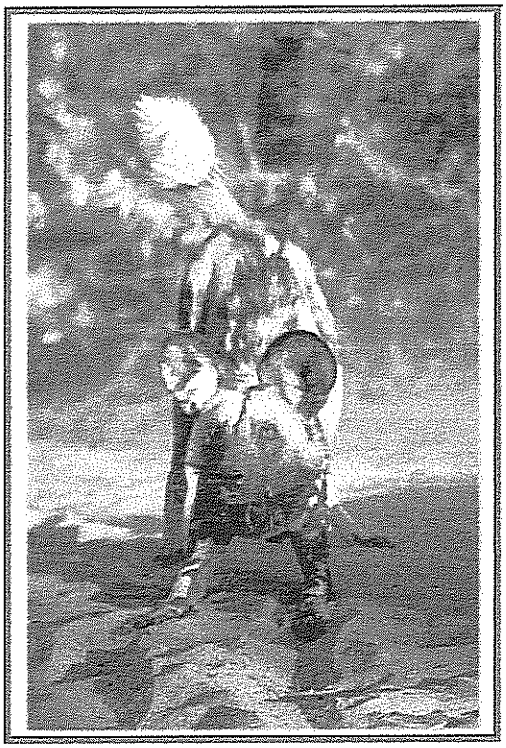
AFRICAN WILD DOG INTRODUCTION INTO GAME RESERVES.

A METAPOPULATION MANAGEMENT STRATEGY.



SYNOPSIS OF LITERATURE COMPILED BY

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ABSTRACT

Experience of African wild dog (AWD) introductions has been unsuccessful in most cases, of partial or unquantified success in a few cases and successful in even fewer. The reintroduction of AWD is possible if the right technique is used. If a entire wild caught pack is not available, which is the likely scenario given the difficulty in capture and the threat to the wild population of removing breeding units, a combination of captive and wild caught animals is the recommended method to reintroduce AWD especially if they are to be released into an environment where they will have to compete with other large predators. Adequate protection from persecution and disease is also essential for a successful reintroduction. Post release monitoring is important to determine the post release success or failure and information gathered can be used to improve on reintroduction technique (Hofmeyr, 1997).

1.0 INTRODUCTION

The AWD reflects many critical problems to carnivores in general. Their decline has been well documented over the past 30 years (Woodroffe, 1999a). Formerly distributed throughout 39 sub-Saharan countries, today between 3000-5000 animals remain in perhaps 14 countries, only 6-7 of which contain populations >100 individuals. The isolated northeast of Namibia is estimated to contain between 313 and 1166 individuals (Stander, 2003) but only 5% of their range is within protected areas. This suggests that the long-term survival of the species depends on the maintenance of viable and connected populations both within and outside protected areas.

AWDs decline reflects the expansion of human population and the associated fragmentation of habitat available to wildlife. Because AWDs live at low densities and have large home ranges, even 'fragments' covering thousands of km^2 will not support viable populations (Woodroffe *et al*, 1997). Packs often range beyond the borders of parks into land taken over for livestock farming. Thus even normally protected populations are subject to road kills, disease contracted from domestic dogs and depletion of wild prey. Like other large predators, they kill livestock under some circumstances, and have been shot, snared and poisoned in most livestock areas irrespective of legal protection

In 2002, the IUCN/SSC reintroduction specialist group held a Strategic Planning Workshop where reintroductions were shown to be growing in conservation significance because they:

- Are increasing in number;
- Attract public attention;
- Are regionally important and;
- Can use flagship species to facilitate habitat conservation.

Certainly canids are generally charismatic, ecologically significant, and often sufficiently wide-ranging to be adequate umbrella species for habitat preservation, but the restoration of many species can still be ecologically or politically problematic.

Successful reintroductions require that a number of species-specific, environmental, and bio-political criteria be met (Kleiman & Beck 1994). There should be a need to augment the wild population, sufficient founder stock should be available, and extant wild populations should not be jeopardized by the reintroduction (Kleiman & Beck 1994, Woodford & Rossiter 1994). The species' biology should be well understood, appropriate reintroduction techniques should be known, and sufficient resources should be available for the program. The original causes for the species' extirpation should be removed and sufficient unsaturated, protected habitat should be available. Reintroductions should conform to legal requirements, be supported by both government and non-government agencies, and have minimal negative impacts on local people (Kleiman & Beck 1994).

Compared to smaller, less wide-ranging species, many canids could be ill-suited for reintroduction because:

1) Their large home range requirements can only be satisfied in extensive protected areas which might not be available (Woodroffe and Ginsberg 1998);
2) Local people frequently oppose the reintroduction of species that prey on domestic livestock or threaten humans (Phillips 1995, Woodroffe and Ginsberg 1999) and;
3) The extensive planning and implementation required for reintroductions (Fritts *et al.* 1997) is prohibitively expensive.

The present surviving population of AWD is extremely fragmented and is highly unlikely that areas where dogs have become extinct will be re-colonised by natural migration. The only alternative is to re-establish dogs to their former ranges (Hofmeyr, 1997).

In order to improve this situation, a managed metapopulation comprising a number of local populations of introduced AWD in several medium sized reserves, in South Africa, has been proposed (Mills, Ellis, Woodroffe, Maddock, Stander, Pole, Rasmussen, Fletcher, Bruford, Wildt, Macdonald & Seal 1998). A metapopulation suggests a population of local populations, with colonization and extinction of local populations in a metapopulation likened to births and deaths of individuals in a local population. A similar approach executed with strong management support is a viable option in Namibia.

Reintroducing wild dogs into optimal habitats where they no longer occur, or into existing, small populations to increase population size, is therefore considered an important tool for saving wild dogs in Africa (Mills *et al.* 1998).

Here we examine the successes or failures of canid reintroductions and aim to identify lessons from these programs which might aid future reintroduction attempts.

2.0 METAPOPULATION MANAGEMENT FROM THEORY TO PRACTICE

(From: Moehrenschlager & Somers, In press.)

A metapopulation is a set of spatially isolated groups of individuals that share individuals among them (Wells & Richmond 1995). Numerous canid species are threatened by habitat loss or habitat degradation. One of the main consequences of this is increased fragmentation (Saunders *et al.* 1991) which increases the likelihood of extinctions (Gilpin & Hanski 1991). When habitat is limited, extant and reintroduced canid populations must be managed as a metapopulation to ensure their long-term persistence.

When individuals are moved from one location to another and released to re-establish populations or metapopulations, the scope of such activities may differ depending on program goals, release techniques, and geographic aspects. We adopt the definition of a **reintroduction** as an attempt to establish a species in an area which was once part of its historical range, but from which it has been extirpated or become extinct (IUCN 1998). We include wild or captive animals, or a combination of these in our definition. A **translocation** is a deliberate and mediated movement of wild individuals or populations from one part of their range to another with existing conspecifics. **Supplementation** is the addition of individuals to an existing population of conspecifics. **Soft releases** are those releases where the animals are housed in an enclosure at the place of release for sometime before release. **Hard releases** are those where the animals are released directly from vehicles or crates without any acclimatization phase at the place on reintroduction.

Species respond differently to fragmentation and therefore an autecological approach has been suggested to the maintenance of metapopulations (Laurance 1991). Differential responses can be due to the landscape pattern, levels of habitat loss (Harrison & Fahrig 1995), life-history and ecological traits such as diet or vulnerability to predators and competitors (Laurance 1991). The persistence of patchy distributions is related to a number of factors, including rates of local extinction within habitat patches, as well as the frequency of immigration and recolonisation (Lindenmayer & Lacy 1995). It has been shown that seemingly low levels of dispersal can be sufficient to create a stable metapopulation structure (e.g. Simberloff & Cox 1987) which may also allow the viability of canid populations despite relatively small exchange rates between isolated subpopulations.

Four metapopulation parameters have been identified (Hanski 1999) that would characterize canid metapopulation dynamics:

(i) Habitat patches can support locally breeding populations;
(ii) All patches are at risk of extinction;
(iii) Recolonisation must be able to occur and;
(iv) The dynamics between patches are asynchronous.

The successful management of sub-populations depends on the minimum viable metapopulation size (Hanski *et al.* 1996). This is the minimum number of interacting local populations necessary for the long-term persistence of a metapopulation in a balance between local extinctions and recolonisations (Hanski *et al.* 1996). Genetic and demographic management of canid subpopulations is essential. Demographic management should aim to control possible negative detrimental factors (e.g. sex ratio variation) as well as declines in population size due to stochastic demographic processes (Foose & Ballou 1988). Genetic management aims to reduce the effects of inbreeding and genetic drift to allow for genetic population viability over time. (Lande 1988, Lacy 1997). While metapopulations are governed by extinction and recolonisation rates, reintroduction practitioners have the luxury of artificially choosing immigration sites and numbers through sound metapopulation planning.

3.0 PREVIOUS ATTEMPTS AT REINTRODUCTION

(From: Moehrenschlager & Somers, In press.)

- The first successful wild dog reintroduction was into **Hluhluwe-Umfolozi Park** (HUP) from 1980-1981 (Maddock 1999). A mixture of 24 wild-caught and hand-reared wild dogs were released, which persisted with a mean annual density of 19.9 wild dogs in the 960km^2 reserve. In 1986, 4 semi-tame wild dogs were released into HUP, which left the park (Maddock 1999). As numbers declined after 1993, another 3 wild caught males and 1 female were introduced in 1997. The pack produced 12 pups in 1998 but it split up in 1999 after the alpha female died. The 2 adult males left the park and roamed widely in other reserves and game ranching areas before one was found dead and the other disappeared (Somers 2001). Of the 1997 reintroduction, only one male (brought in as a yearling of the alpha female) still survived in 2003. In 2000 two females were introduced which bonded with two existing males from the original pack. As of March 2003 there were two packs, both of which have had pups in 2001 and 2002. A third pack, consisting of two males and two females from the Northern Province, is currently awaiting release with an unrelated adult female and three juvenile males. This introduction will be the first where unrelated animals of the same sex have been combined and released.

- There were three attempts to reintroduce wild dogs into **Etosha National Park**, Namibia from 1978 to 1990 (Scheepers & Venzke 1995). In 1978, six hand-reared yearlings were released which died within four months, mainly due to starvation (Scheepers & Venzke 1995). In 1989, five adult captive bred wild dogs were released, but all died of unknown causes within three months. After the success of the reintroduction of wild dogs into Hluhluwe-Umfolozi Park, it was decided to try again in 1990. Five captive-bred males (including three adults) and eight females (three adults) were to be released. One adult male and female escaped while being transported to Etosha. The female was shot a week later on a farm. The male formed a pack with two domestic dogs which hunted together until the wild dog was trapped in a reserve 350 km away three weeks after escape. He was returned to the released wild dog pack, which subsequently killed him with bites on the spine and neck. The remaining animals struggled to hunt and lost body condition. Four died of rabies, six were killed by lions and one disappeared.

- Six wild dogs were reintroduced into **Tsavo West National Park**, Kenya, in 1997. They disappeared after 8 days, 4 were then resighted after 2 months, but eventually all animals were killed (Kock *et al.* 1999).

- In 1986 nine captive raised wild dogs were released into the **Matetsi Safari Area** in Zimbabwe and then shot by a local farmer. In Zimbabwe wild dogs have been captured and released successfully in safer areas (Greg Rasmussen pers. comm.).

- In 1975, 3 males and 2 females were reintroduced into South Africa's **Kalahari National Park** which soon split up and disappeared (Frame and Fanshawe 1990, cited in Woodroffe and Ginsberg 1999).

- In 1992 7 male and 7 female wild dogs were reintroduced by a soft release to **Venetia Limpopo Nature Reserve**, South Africa. They bred that year but later left the reserve and some were found poisoned on farmland (van Heerden 1992, Woodroffe and Ginsberg 1999). In January 2002 nine wild dogs were reintroduced, which have subsequently bred.

- In 1995, three wild-caught and three captive-bred individuals were reintroduced via soft release into **Madikwe Game Reserve**, South Africa. They produced two litters of pups; however, 18 of 21 wild dogs died of rabies in 1997. In January 1998 three captive-bred females and two wild caught juvenile males were reintroduced and in July 1998 two captive bred and two wild caught males were added to the wild population. In 2000 new males were added and have since disappeared. In February 2000 another rabies outbreak killed eight of 11 unvaccinated pups but none of the vaccinated adults. There are now three successfully breeding packs in Madikwe and some individuals have been removed to supplement other release areas, including Hluhluwe-Umfolozi Park.

- Nine wild dogs were reintroduced by soft release into **Pilanesberg National Park**, South Africa in 1999 (van Dyk and Slotow 2003). This release again showed that a combination of wild caught and captive-bred wild dogs could successfully be used for wild dog reintroductions. In 2002 another two females were bonded with two present males and two packs now exist in the park. These packs have bred on numerous occasions.

- In 2001, two wild caught males and three captive bred females were reintroduced by soft release into **Karongwe Nature Reserve**, South Africa. One female died soon after release and the two were diagnosed as not being able to digest meat, a result of been reared on domestic dog food. The two males were then put with two other females, but one male did not bond with them. The three were released into Karongwe and successfully bred in 2002.

- Wild dogs are presently in an enclosure awaiting reintroduction into **Marakele National Park** and reintroductions are being planned for other areas such has **Addo Elephant National Park** and **Greater St Lucia Wetland Park**, South Africa.

It is obvious from the above examples that reintroduction's of larger predators are not easy with many factors limiting the success of such operations. Due to the high failure rate of wild dog introductions the IUCN/SSP Canid Specialist Group does not consider the reintroduction of wild dog as a priority project for the survival of the species. They place emphasis on the protection of the remaining viable populations.

As stated earlier it is highly unlikely that wild dogs will naturally re-colonise areas from which they disappeared due to the fragmented distribution, which the dogs survive in. It is therefore imperative that wild dog will have to be introduced to areas where they formally occurred if they are to be re-established in those areas.

4.0 LESSONS FROM CANID REINTRODUCTION PROGRAMS

(From: Moehrenschlager & Somers, In press.)

4.1 Socio-political factors can make or break canid reintroduction programs:

Several authors have pointed out that valuational and organisational aspects are at least as critical for carnivores as biological parameters (Breitenmoser *et al.* 2001, Beck *et al.* 1994, Reading & Miller 1995, Miller *et al.* 1996, Reading & Clark 1996). Since many canids require large home ranges in protected habitats and many prey on livestock or commercially hunted species, numerous stakeholders such as landowners, hunters, the resource-extraction industry, aboriginal groups, regional and federal governments, and conservation organizations may have special interests surrounding the protection of canids. Recovery planning that is inclusive, interdisciplinary, and effective is difficult to achieve, but critical to the protection of canids (Boitani *et al.* in press).

One of the most crucial aspects determining the success of canid reintroductions is the support of affected landowners, or mitigation measures to placate those that resist such efforts. Support for a possible reintroduction of wolves to New Brunswick, Canada, was lowest for sampled individuals that were hunters, feared wolves, or had low levels of formal education. The primary reason why reintroductions would be opposed was that deer availability for hunting would decline (Lohr *et al.* 1996). Opponents to a possible reintroduction of wolves into Colorado, USA, worried about wolf attacks on livestock, financial losses to ranchers, wolves threatening residential areas, and large losses of deer or elk. Proponents believed wolf reintroduction would control deer, elk and rodent populations, restore the environment, and help educate the public about wilderness (Pate *et al.* 1996).

Strong opposition from some factions stalled the reintroduction of wolves to Yellowstone National Park and central Idaho for two decades, until a proposal to reintroduce wolves was accepted as long as it was deemed 'non-essential-experimental' under the United States Endangered Species Act (Fritts *et al.* 1997). Nevertheless a group comprised mostly of farmers and ranchers filed a law suit to stop this reintroduction. Similarly, the New Mexico Cattle Growers Association filed a law suit in the U.S. District Court of New Mexico to stop the reintroduction of Mexican wolves (Parsons 1999).

Careful management of released red wolves and the emerging population involved close public consultation, which has led many landowners to allow wolves on their properties (Phillips *et al.* 1995). 'Defenders of Wildlife', a non-government organization, has compensated ranchers for livestock losses caused by reintroduced Mexican wolves and grey wolves in Yellowstone. In assessing the future of the Mexican wolf, Paquet *et al.* (2001) concluded that human attitude is the primary factor that will determine the viability of this species.

4.2 The taxonomy of historical and potential source populations may determine the feasibility and magnitude of reintroduction programs:

As we attempt to discern which species or subspecies require conservation action, taxonomic classification is of paramount importance. Imperilled species are more likely to receive funding, research, and political protection than subspecies, which in turn are more likely to receive protective measures than geographically depleted populations of generally abundant species. The likelihood that reintroduction or translocation programs will be implemented depends directly on the resolution of genetic questions. This, however, is at present usually of more concern in developed countries where detailed genetic data are available for most endangered species.

At the beginning of the swift fox reintroduction program in Canada, critics cautioned that animals from the central United States should not be used to re-establish northern populations because of a possible mixing of subspecies (Stromberg & Boyce 1986). Reintroductions continued because others doubted such subspecies existed (Herrero *et al.* 1986), and later

testing illustrated that these original subspecies designations are likely unwarranted (Mercure *et al.* 1994). The designation of San Joaquin kit foxes as a distinct subspecies (*Vulpes macrotis mutica*) led to federal listing under the United States Endangered Species Act. This increased protective measures and resulted in a regional reintroduction attempt, which was unsuccessful as 97% of released animals died (Scrivner *et al.* 1993).

Reintroduction and conservation efforts to protect Mexican wolves are taxonomically supported by the fact that Mexican wolves are a genetically distinct subspecies (Garcia-Moreno *et al.* 1996). Mexican wolves were found to have a unique Bgl restriction-site polymorphism and, contrary to distance tree analyses, mitochondrial DNA analysis suggests that Mexican wolves are more similar to old-world wolves than North American conspecifics (Wayne *et al.* 1992). By comparison, the classification of red wolves has been problematic. Mitochondrial DNA analyses demonstrated that the red wolf is either a hybrid form, or that it is a distinct taxon that hybridized with grey wolves or coyotes over much of its geographical range (Wayne & Jenks 1991). Further mtDNA and nuclear DNA analyses support the former hypothesis that red wolves originated through coyote-grey wolf hybridization (Roy *et al.* 1996), likely in the last 2500 years (Reich *et al.* 1999). Although some proponents still use morphometric analyses to argue that red wolves are not wolf-coyote hybrids (Nowak 2002), the genetic evidence has presented a conundrum for reintroduction efforts. Recent genetic evidence that wolves in southeastern Ontario and southern Quebec, Canada, should be classified as the subspecies, *Canis lupus lycaon* (Wilson *et al.* 2000), may be the beginning of similar conservation challenges for these populations.

Through genetic assessments a seemingly abundant population can suddenly be found to a critically endangered species that requires captive breeding, translocation, or reintroduction. The fact that Island foxes, previously thought to be grey foxes, are in fact a distinct species composed of six distinct subspecies (Wayne *et al.* 1991, Wilson & Reeder 1993), has had immediate conservation consequences as captive-breeding and translocation programs have been recently developed. Nevertheless, the Island fox (*Urocyon littoralis*) is not yet recognized as an imperilled species under the United States Endangered Species Act. Similarly, Darwin's fox (*Pseudalopex fulvipes*), was thought to be a subspecies of South american grey foxes (*P. griseus*), but subsequent genetic evaluation has shown that they are a distinct species, and possibly the most critically endangered canid in the world. Given disease and demographic threats to the population, it is now likely that captive-breeding will be initiated.

4.3 Soft-releases and translocations are effective reintroduction techniques:

Captive-bred swift foxes that were released in the fall had higher survival rates than those released in spring (Brechtel *et al.* 1993, Carbyn *et al.* 1994,), but translocated swift foxes were more successful than both captive-release treatments (Carbyn *et al.* 1994; Ginsberg 1994). Survival and reproductive rates were compared between 56 swift foxes that had been born in the Canadian release area to those of 29 Wyoming swift foxes that were translocated from Wyoming between 1994 and 1996 and tracked for up to 850 days after release (Moehrenschlager & Macdonald 2003). Translocated juveniles dispersed less far but survived and reproduced as well as translocated adults, suggesting that juveniles can be used to establish translocated foxes in small, protected areas, while minimising demographic effects on source populations. The fact that survival rates and litter sizes of translocated foxes were similar to those of resident animals indicates that translocation can be an effective reintroduction tool for this endangered species, and possibly other foxes (Moehrenschlager & Macdonald 2003).

Soft releases were used from 1983-1987 and hard releases from 1987 onwards (Herrero *et al.* 1991) because they were less expensive. Later, radio-telemetry revealed that survival and reproductive success were highest for swift foxes with small dispersal distances, suggesting that measures should be taken to acclimate animals to release sites through soft releases (Moehrenschlager & Macdonald 2003). In Idaho, hard-released grey wolves also ranged widely and did not reproduce in the first year, while soft-released wolves in Yellowstone National Park remained close to the release site and bred successfully (Smith, 1999). Survival rates were

highest for red wolves that had been wild-reared with a short acclimation period at the release site (van Manen 1999).

4.4 Released canids can adapt quickly to local conditions:

Reintroduced canids can only establish populations if individuals can establish territories, hunt, avoid predators, find mates, and reproduce. Depending on body size, guild structure, and predator occurrence, the challenges canids face after release differ between species. Pack hunters such as African wild dogs need to develop social and cooperative hunting skills to kill large prey and resist competitive carnivores, while solitary hunters do not. However comparatively small solitary foragers, such as island, swift, kit, and arctic foxes which are preyed upon by predators such as golden eagles (*Aquila chrysaëtos)* may need to develop predator avoidance strategies.

Red wolf releases that consisted of adults accompanied by young pups tended to form cohesive groups, exhibit fewer wide-ranging movements, and were less likely to experience vehicle-related mortalities (van Mannen 1999). Released grey wolves can adapt their hunting skills to local conditions. Only two of 41 studied wolves that had been translocated from Alberta and British Columbia, Canada to Yellowstone National Park had been previously exposed to bison. While elk, which were common in the Canadian areas were also the primary prey item at the release site, eight one-year-old wolves killed an emaciated bison calf 21 days after release, the first adult bison was killed after 25 months during a 9.5 hour long hunt, and subsequently 14 bison kills were documented in a 4 year-span (Smith *et al.* 2000). In comparison, captive-bred Mexican wolves had no previous hunting experiences in the wild when the first three family groups were released in 1998. Nevertheless, three weeks after their release, three sub-adult members of one family killed a mature cow elk and evidence was found to suggest that the other two families had also killed adult elk or elk calves (Parsons 1998).

4.5 Disease can hamper reintroduction attempts

In the planning of any translocations or reintroductions, the risk of accidental transmission of disease into unaffected populations via released animals must be carefully assessed. Woodford and Rossiter (1993) recommend that veterinary involvement in reintroduction projects should begin as early as possible. They point out instances of inadequate disease risk assessment resulting in expensive failures, and the introduction of destructive pathogens into resident wildlife populations by captive-bred and wild-caught animals. Infectious diseases may have short-term or long-term effects on population size and viability by affecting rates and patterns of mortality or reproduction. Assessment procedures should address infectious agents that released animals may be exposed to, or that they might carry to conspecifics and other susceptible species at the release site. (Nowell & Jackson 1996). Although the risk of disease may be deemed higher where domestic dogs are sympatric, in Madikwe Game Reserve wild dogs were killed by a strain of rabies from black-backed jackals (*Canis mesomelas*) (Markus Hofmeyr pers. Comm.).

4.6 Canid restoration can have profound ecosystem effects

Carnivores are thought to be crucial to the maintenance of healthy ecosystems, but the scale of their function is often difficult to evaluate within extant populations. Reintroductions provide unique opportunities to test the impacts of different types of carnivores. While ecosystem impacts of swift fox reintroduction have not been thoroughly explored, the reintroduction of Yellowstone Park wolves elucidates that the re-establishment of a top carnivore can be felt on all ecosystem levels.

The number of coyotes in Yellowstone Park's Northern Range dropped from 80 individuals in 12 packs before wolf reintroduction, to 36 coyotes in 9 packs. Within three years of wolf reintroduction, 25-33% of annual coyote mortality was due to wolves, mean coyote pack size

dropped from 6 to 3.6 adults, and coyote population size dropped by 55% (Crabtree 1998). Functionally, surviving coyotes have increased vigilance behaviours and altered foraging patterns since wolf reintroductions began. While male behaviour was not affected, the vigilance of female bison and elk increased significantly. Among elk this was true for both females with calves, which increased vigilance rates from 20% to 43%, and females that did not have calves, which increased vigilance from 11.5% to 30.5% (Laundre *et al.* 2001). Changes in elk foraging patterns can even be detected on a plant community level. Elk pellet counts were significantly lower in habitats that wolves used frequently than in rarely-used areas. Consequently, aspen sucker height was significantly higher in areas of high wolf-use than regions that wolves used rarely.

5.0 RECOMMENDED REINTRODUCTIONS TECHNIQUES FOR AWD

(from Hofmeyr, 2001)

5.1 Suitable Area for Reintroduction:

5.1.1 Size:

Wild dogs are known to have enormous home ranges. For a population to be viable a minimum of 8 packs needs to be established in a single conservation area (Workshop on wild dog conservation strategy held in Oct. 1997, Pretoria Zoological Gardens). There are very few areas in Africa, which can support such a large population because the area will be in excess of 10 000km^2.

If there were suitable areas like this available than it would mean introducing a number of packs. This will only be realistically possible if captive bred animals were to be used combined with wild caught animals. There are not enough wild caught animals available for such a large introduction. To make the operation successful it must be linked to a breeding project dedicated to the reintroduction program in the conservation area.

Smaller areas are also suitable for wild dog introductions but would not be able to carry a viable self-sustaining population this in turn will mean more intensive management to ensure the survival of the dogs in the long term.

In Madikwe the dogs eventually used a home range of 200km^2 successfully. It is possible to introduce one pack into smaller reserves if adequate fencing and prey are available. The smaller areas require more intensive management of the dogs and will ultimately be more expensive than introducing a number of packs into larger areas and eventually leaving them to survive on their own.

5.1.2 Risk factors in and around the reintroduction area:

All predators are in conflict with livestock farmers.

- It is essential that the area is either large enough to avoid conflict or adequately fenced and that the fence is maintained. Public relations are very important to ensure the successful introduction of wild dog into any area.

- Snaring is one of the most important causes for wild dog mortalities in areas where there is human conflict with wildlife.

Domestic dogs can carry and transmit fatal diseases to wild dog like distemper and rabies. Increased exposure to domestic dogs reduces their survival chances.

Roads kills cause many deaths to wild dog and roads through or near a introduction area, which is used by general traffic, is a major threat to wild dog.

Other predators like lion and spotted hyaena can detrimentally affect a wild dog population. Wild dog rarely occur in areas where there are high lion densities (KNP, Selous, Madikwe). High lion and spotted hyaena densities will affect the final outcome of a reintroduction attempt of wild dog.

The knowledge of local canid disease prevalence is vitally important. The Madikwe and Etosha introduction were detrimentally affected by endemic rabies, which were transmitted by jackal. Preventative immunization will be necessary before the introduction takes place.

5.1.3 Carry capacity:

This is largely dependent on abundance of available prey and competition with other wild dog and larger predators. Smaller well-fenced reserves with high prey densities and low lion and hyaena densities will have a higher carrying capacity than large unfenced areas with higher lion and hyaena densities.

It is impossible to give numbers per hectares but as a rule one can state that wild dog are boom and bust predators and their numbers can fluctuate greatly from year to year. If an area is considered suitable for the reintroduction of dogs then it will be unlikely that the numbers of dogs will have to be regulated after introduction. The survival of the introduced population will be more important to monitor.

5.2 Sources of founder animals:

5.2.1 Captive verses wild caught animals:

AWD are difficult to source from the wild because of their endangered status. Captive animals will provide the only reliable source of dogs for introduction.

The introduction success of wild dog will be greatly enhanced if wild caught animals are used in combination with captive raised individuals. The reintroduction of captive raised individuals is only an option in well-fenced reserves with high prey densities and low densities of other larger predators. In large conservation areas only wild caught or wild caught combined with captive-bred animals are recommended.

Wild caught AWDS are difficult to obtain. Ideally problem packs, which are doomed to be destroyed should be considered before viable natural populations should be used. Problem dogs (e.g. outside conservation areas, which kill livestock) can only be reintroduced where they will not cause problems again. They are usually very difficult to catch because they are often prosecuted by humans and will immediately move if they encounter people.

It will be possible to combine a large number of captive-bred animals with only 2 or more wild caught animals (as shown in HUP introduction). It will therefore be possible to catch small numbers of wild animals and release them with larger numbers of captive animals. This will reduce the impact on the wild populations.

In the future dogs may be available from smaller parks, which are well managed and fenced. These parks like Madikwe will only be able to carry 2 or three packs. Dogs can be removed sustainability for introduction to other areas. Dogs from these reserves will be caught easily because they will be well monitored and habituated to vehicles.

5.2.2 Genetics:

Genetic variation also exists in different areas of their distribution. Source animals should be used that originally came from the genetic subtypes of the areas where they will be introduced. This is, however, quite difficult to achieve in reality because of the severe decline of dogs in the wild and limited diversity of dogs in captivity.

The east African genotype only exists in captivity at the breeding centre in Mkomazi Game Reserve in Tanzania (IUCN/SSP Canid Specialist Group Action Plan For Wild Dog, 1997). Most captive dogs originally came from the southern African genotype. Source animals will therefore have to be selected very carefully and it may mean disregarding the genotype origin of the chosen dogs. It is very important, however, to introduce unrelated sexes in each pack and unrelated packs if the long-term genetic viability is to be enhanced.

5.3.3 Sex / age ratio and numbers:

Wild dog packs are very varied in their numbers and sex and age ratio. It is impossible to say what the golden number per pack should be but as a rule no less than 5 animals should be introduced. The sex ratio can be varied but a minimum of two in a sex should be introduced in case something happens to one of the animals. In Madikwe the combination of 3 females and 3 males worked very well.

Animals must be older than 18 months. Younger dogs must be introduced with at least their mother but preferably with a few adults. Packs in the wild form when a group of females who split from their natal pack meet up with a group of unrelated males who did the same. Wild dog rarely split from their group before they are 18 months of age. This basic principle should be adhered to with the formation of packs under artificial conditions as was done in Madikwe G.R.

5.3 Introduction technique:

5.3.1 Captive breeding of AWD:

This issue is beyond the scope of this document and I refer to the information supplied by De Wildt Endangered Breeding Center. They have extremely successfully bred a number of wild dogs in captivity. They have also had success in breeding other endangered African predators.

5.3.2 Release facilities:

It is strongly recommended to introduce wild dogs into a boma prior to release into the main reserve. The following recommendations on the boma design is made:

- ☐ Size: 100m x 100m
- ☐ Fence: bonnox type from steel, 2.4m high and folded over on the ground towards the inside of the boma for 50cm at least, rocks are packed onto the folded fence, electrification recommended with three live strands on the lower half of the fence, electrification on the outside to prevent other predators getting into the boma
- ☐ Adequate shade must be present but dogs must be easily observed
- ☐ Water which can be drained and filled from the outside of the boma (dogs defecate into the water)
- ☐ A corridor and corner camp must be erected inside the boma. The dogs are fed here. Old carcasses can then be removed without entering the main boma and dogs can be handled if necessary
- ☐ Remote feeding apparatus can be erected to avoid entering the boma unnecessarily.

5.3.3 Introduction of AWD into the release boma:

When the dogs are introduced into the holding boma before release then all animals from the same sex must be introduced at the same time. It is not necessary to introduce both sexes at the same time. Fighting will, however, occur if animals of the same sex are introduced at different times. The different sexes must also be introduced into the same boma from the start and not be kept in bomas adjacent to each other (the two groups must not know each other before introduction into the release boma).

Monitoring of the dogs is essential during the boma period. It is during this time that the hierarchies amongst the different males and females will establish themselves. It is very important that a hierarchy is established amongst the different individuals because a well-established alpha pair and hierarchy will increase the survival chances of the dogs. One of the Etosha releases involved only subadult dogs with no hierarchy. They did not hunt successfully and this could have influenced their success. The Madikwe dogs established a well-defined hierarchy before they were released. They were very confident once they were released and this surely helped them successfully adapt to their new environment. Fighting can take place during the hierarchical struggles and should not be interfered with. Only when it is very obvious that the fighting dogs are going to kill each other (rarely happens) should any intervention take place.

The success of the release does depend on the establishment of a pack and a hierarchical system amongst the dogs when they are in the release bomas before release.

If adult female with offspring are introduced then the introduction of adult males must take place before the sub-adults are 4 months old. From experience in Madikwe Game Reserve, Umfolozi, Pilanesberg National Park, Venetia Game Reserve and Free State consistently newly introduced males were harassed by the sub adults once they were older than 4 months. This behaviour is not clearly understood, but the removal of the initiator of this behaviour usually was enough to stop the problem.

Ideally only animals older than 18months should be used for introductions and opposite sexes should all be introduced as complete groups and same sexes must never be introduced in a staggered manner. If females with offspring are to be used then males from the original pack should be used at the same time or new males must be introduced before the pups are 4 months old.

5.3.4 Feeding:

Only whole carcasses must be fed to the dogs in the release boma. It is important that the captive-bred animals have exposure to whole (not skinned) carcasses. They have to strengthen their neck and jaw muscles when they rip the carcass open, which in turn will aid them during their hunting.

A medium sized antelope (e.g. male impala) fed every 3-4 days will adequately feed up to eight dogs. If the feeding frequency is increased then the dogs will become fat and this is a disadvantage when they are released. If they are surviving on a carcass every 3-4 days then they will be able to cope with a few days of hunger when they are released and do not hunt successfully. This feeding regime was followed in Madikwe for a variety of predators without any problems.

In Madikwe the carcasses were fed from a slide system where the carcass was hoisted over the fence and then run along a pulley and then dropped into the boma. This was done specifically to prevent an association forming between vehicles and food. The dogs, however, quickly learnt that certain vehicles brought the food. It later became apparent that this was an advantage because the dogs could be fed carcasses in the field. This was an advantage because it was possible to attract the dogs to a vehicle, which in turn made their monitoring much easier. During the rabies outbreak at Madikwe this proved to be very useful because all the dogs were attracted to the vehicle and then caught – something, which is very difficult to do with wild and poorly habituated animals. It must be pointed out that the dogs quickly learnt to distinguish between vehicles with food and without food. They also only followed vehicles in the first 2 weeks after their release. Once they were hunting successfully they did not follow vehicles unless they noticed that there was meat on the back.

Proper feeding prior to release is very important as described above.

5.3.5 Vaccination protocols:

Wild dogs are extremely susceptible to diseases like distemper and rabies. Rabies and canine distemper are most definitely the biggest problems because of its widespread distribution and prevalence amongst wild and domestic animals. Examples of rabies outbreaks are well documented in Kenya, Tanzania, Botswana and Madikwe. Distemper can be a problem and wild dogs have died from it (Botswana 1997, Alexander et al 1998, Mkomazi Game Reserve, 2001, Tony Fitzjohn pers.comm.). The problem however seems to be of greater importance in isolated populations than in viable established populations (C. Alaxander, pers. comm.). There are, however, very few areas left in Africa where wild dog can be introduced without potentially being exposed to the abovementioned diseases or other diseases carried by domestic dogs (e.g. parvo virus which has killed wild dogs in captivity). The extinction of wild dog from a lot of their former range areas was due to disease (e.g. Serengeti – Masai system). The safest way to protect the dogs is to vaccinate the wild dogs themselves. Vaccination programs for domestic dogs are often incomplete and not reliable enough to ensure long-term protection to wild dogs in an area. Vaccination of reintroduced dogs is therefore extremely important.

5.3.5.1 Pre – Release:

Rabies vaccination is the minimum vaccination that has to take place. Two vaccinations one month apart are required. Presently only killed vaccines exist and a once off vaccination is totally inadequate (seen in Etosha and Madikwe where dogs died of rabies after receiving a once off vaccination before release). It is advisable that the dogs are still serologically tested before release because there appears to be considerable individual variation in the immune response to the vaccine. It may mean that some dogs need more than 3 initial vaccinations to acquire an adequate immunity to Rabies.

Distemper vaccination is also recommended but could be potentially fatal to wild dog. Wild dogs have died from distemper vaccinations Ideally a monovalent live attenuated distemper vaccine (e.g. VARD5) should be given one month apart. It is not easy to source this vaccine so practically a polyvalent combination vaccination will have to be used. It is recommended that only vaccines with the avian cultured attenuated distemper combination vaccine is used. Only adult dogs can be vaccinated because young dogs (< 6 months old) are more susceptible than adult dogs.

An alternate method is to vaccinate the dogs twice (one month apart) with a killed vaccine and then boost them with a live attenuated vaccine a month after that. Trails are presently being conducted at De Wildt. The results are still pending. There is evidence to suggest that the killed distemper vaccine rarely causes seroconversion and may not be useful unless combined with an attenuated live vaccine. If a known strain of canine distemper is the problem then that vaccine should be developed specifically in the attenuated live form for protection against the that strain. Two dogs were successfully vaccinated with Vanguard 5 (Pfizer) twice a month apart without any ill effect.

Other vaccinations are not necessary but if a combination vaccine is used like Vanguard 5 (Pfizer) for the distemper vaccination then this vaccination can potentially cause protection against other diseases like parvovirus. No detrimental effects of such vaccinations have been recorded.

5.3.5.2 Post Release:

The vaccination of dogs in the wild presents a real problem. It will be essential to vaccinate the released dogs with follow-up rabies and distemper vaccines to ensure lasting protection against the diseases.

Presently there are no oral vaccines available for wild dog. The only reliable option to vaccinate dogs is to immobilize the animals and hand inject them. Dart vaccinations are very unreliable and not recommended.

A protocol, which will be followed in Madikwe, will be to vaccinate the released dogs yearly for at least 2 years against distemper and rabies. Adequate immunity should have been achieved in the original dogs to last them to their death (the average lifespan of wild dog is less than 5 years). After two years some of the offspring will be vaccinated and these dogs will have to be vaccinated one month apart. The same procedure as for the founder dog should be followed (see above). It will not be practical to vaccinate all offspring because of capture difficulties. The idea is to always have a core number of males and females vaccinated adequately but not vaccinating all dogs (due to practical restraints like difficulty of catching wild dog). By not vaccinating all dogs there is still allowance for dogs to become resistant against certain diseases like distemper. This is ideal especially once the population increases significantly thus allowing for natural selection and at the some time having a core of vaccinated dogs, which can absorb the impact of a catastrophic outbreak of a disease amongst unvaccinated dogs. It is therefore not crucial to vaccinate all dogs once the population of reintroduced animals is growing naturally.

Essential aspects for a successful vaccination protocol of free-living dogs will be to have individual identifications of each dog. Wild dogs must be well monitored and habituated to vehicles so that the monitoring team can get close to them to dart them or feed them oral vaccines should these become available.

Once oral vaccinations become available then it would theoretically become possible to vaccinate all dogs as long as they are used to taking food from a vehicle. Active habituation plays an important role here.

An introduced population will have a better survival chance if they are adequately vaccinated against rabies and distemper and the vaccination protocol should form part of the most important aspects of the reintroduction process.

The vaccination of domestic dogs in the immediate vicinity of the reintroduction site is also very important. This will form part of the public relations effort, which should precede any wild dog introduction.

Currently there are trials ongoing to test the viability of using modified live vaccine in chicken heads for oral vaccinations. Preliminary results are promising and the oral route for vaccination will probably be the only long-term practical method of vaccinating dogs against both rabies and distemper. Final results of this study will be available in 2002.

5.3.6 Release:

The dogs should be kept in the boma for at least one month to give any captive raised dogs enough chance to get used to ripping and tearing at a whole carcass. The boma period will also allow a hierarchical system to develop amongst the different pack members – an important aspect of their social behaviour, which will enhance their survival chances in the wild (see above under ' INTRODUCTION OF AWD'). The dogs can then be monitored closely for health and general monitoring.

A carcass can be tied outside the gate of the boma and generally the dogs will come out of boma without any problems. If the dogs are habituated then the presence of people during the

release does not affect their activities. If there are skittish dogs then only the minimum of people must be present. Daylight releases are recommended for wild dog because they are mainly active at dusk and dawn and releasing them into darkness may disadvantage the dogs.

5.3.7 Post release monitoring:

This aspect is one of the most important aspects of a wild dog release but is unfortunately also the most expensive.

Radio collars must be fitted to at least one male and one female. Preferably 2 collars should be placed on each sex in a pack. The reason for a few collars per pack is to be able to easily determine if the pack is still together. If the pack does split (as seen in Zimbabwe and HUP) then the fragmented groups can still be followed. The wild dog outbreak in Madikwe took place over a very short period. The peak of the outbreak occurred 2 weeks after the first dog died. Within a space of 5 days 16 out of 24 original dogs died. Without effective and consistent monitoring the whole episode could have been missed and another mystery disappearance of wild dog would have resulted.

A dedicated person for the tracking of the released dogs will be the ideal scenario. Once weekly sightings of the dogs initially and twice monthly after 6 months should provide enough information on their movements. Increased monitoring is recommended during the mating season as the dogs often fight and packs \may split and during the denning period when the dogs are confined to a small area and can be easily located.

It is absolutely vital that any mortalities be documented, as the causes of mortality will be important guidelines for future introductions into that area and other areas. A disease outbreak can occur over an extremely short period and without intensive monitoring could be missed completely.

Post release monitoring is a very and non-negotiable aspect of a wild dog introduction project.

6.0 SUMMARY OF RECOMMENDATIONS FOR AWD REINTRODUCTION

(from Hofmeyr, 2001)

- ☐ *Large areas with little exposure to human development and their livestock and pets are ideal (>10 000km^2)*
- ☐ *Smaller areas can also be used but must be well-fenced, have high game densities and have low lion and hyaena densities when the dogs are introduced (>200km^2)*
- ☐ *Wild dog from the local genotype must be sourced for introduction, this may be unrealistic due to the limited wild populations and low diversity of captive populations*
- ☐ *Unrelated sexes in a pack and unrelated packs must be introduced to ensure long term genetic viability*
- ☐ *Wild caught dogs combined with captive-bred dogs recommended for introduction*
- ☐ *A minimum of 5 dogs to be introduced in the founder packs*
- ☐ *At least 2 dogs of one sex in any one pack*
- ☐ *At least 2 wild caught dogs in any one pack*

The IUCN/SSP Canid Specialist Group does not consider the reintroduction of wild dog as the highest priority in the protection of the species from extinction. Their highest priority is to promote connections between wildlife areas and mitigating edge effects in existing wildlife areas with viable populations. Another priority is to monitor population trends by continued information gathering. A lower priority according to their action plan is to re-establish extirpated populations.

Without a well-motivated plan for the introduction of wild dog it will be difficult to gain the support of this group. It is advisable to at least try and gain their support because they are very influential in certain conservation circles and may be able to assist with an introduction project.

An unfortunate reality is that the reintroduction is an expensive and long-term project. Without the commitment and support of the local people where the animals are to be introduced it may not be possible to achieve success in the long term.

7.0 FUTURE CHALLENGES AND OPPORTUNITIES

(From: Moehrenschlager & Somers, In press.)

Despite its extinction in the wild, taxonomic controversies, ongoing hybridization with coyotes, and potential conflicts with landowners, the red wolf program is showing ongoing signs of success. Similarly, the grey wolf reintroduction to Yellowstone has been an ecological triumph despite numerous political and legal battles. Reintroduced swift foxes have been de-listed from 'extirpated' to 'endangered' in Canada. Reintroduction attempts of Mexican wolves and African wild dogs are showing increasing promise and the integration of sound metapopulation planning will facilitate population viability in the future. The diversity of biological and organizational challenges that have been successfully overcome to restore canids should truly be celebrated. That said numerous challenges still lie ahead.

Ginsberg (1994) determined that although breeding success in canids is highly variable and captive populations of many imperilled species are too small, some can be successfully reintroduced if adequate animals, habitat, and funds are available. Since that time only the Island fox, for which releases may begin soon, has been added into reintroduction programmes (Timm *et al.* 2002). Although only nine of the world's 36 canid species exist in the USA or Canada, five of the six species involved in reintroductions are from these countries. This raises the question whether canid reintroductions are primarily aimed at species in wealthy countries, while species that are imperilled in poorer regions receive less attention. Reintroductions can be used as a powerful conservation tool to restore canids (Boitani *et al.* 2003), but it is unclear which canids require such assistance in the future. Hence we propose that the status, restoration need, and feasibility of reintroductions should be addressed for all canid species in the next five years.

Captive-bred animals and, to a lesser extent translocated individuals, need to develop hunting and predator-avoidance skills that are pertinent to their release locations. Successful mixed releases of captive-bred and translocated African wild dogs and the recent success of red wolf fostering in the wild, suggest that such techniques can improve the effectiveness of captive-bred animals. While soft-releases have been successfully combined with pre-conditioning experiments in other carnivores (Reading & Clark 1996), canid restoration programs often have not. Experimental designs that rigorously test success differences between fostering practices, pre-release conditioning, and release techniques should become integral programs of canid reintroduction programs in the future. Moreover translocations of African wild dogs, grey wolves, and swift foxes have been used with great success, but noone has thoroughly evaluated the impact of these activities on source populations. If future translocations are used to restore canids, impact evaluations should not only be required in the release areas but also in the source populations.

In the planning phase, or as reintroductions show signs of success, the question continually arises how many individuals need to be restored for the program to be deemed successful (Pyare & Berger 2003). While the answer hinges largely on demographic parameters that determine effective population size, minimum viable population size estimates are also dependent on genetic parameters. Some argue that 50 individuals are sufficient to avoid short-term deleterious effects of inbreeding depression (Soule 1980, Franklin 1980), others believe that 500 is sufficient to maintain genetic variability in quantitative characters (Reed & Bryant 2000), while some believe that 1,000-5,000 individuals may be a safer number to strive for (Lynch & Lande 1998). Tremendous resources are required for canid restorations, many stakeholders are affected, and the viability of reintroduced canids needs to be adequately secured over time. For ecological and political purposes, future minimum viable population size targets need to be more specifically defined for canids in general or, ideally, for specific canid taxa. At the least, future canid conservation efforts would benefit from refined estimates of minimum viable population sizes in pack-living vs. solitary canids.

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Appendix 1:

Principles and Guidelines for the Management of the South African Wild Dog Metapopulation.

February 2003

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The establishment of a second viable wild dog population through the establishment of a metapopulation is presently the most important objective of WAG-SA (Mills et al 1998). A metapopulation is made up by a number of small populations which are managed as a single population. What follows is my evaluation of the present state of affairs and some suggestions for the future direction we should take.

One of the most contentious issues we have had to deal with in regard to the metapopulation has been the procedure and process of selecting areas for wild dog reintroduction for the metapopulation. We have often discussed the question of size and where we should draw the line. Related to this is the number of dogs that an area can support and how this should be managed. I think one of the causes of this conjecture is confusion or differences in interpretation as to what we are hoping to achi eve. We all agree that we are working towards the conservation of the wild dog by setting up the metapopulation, but we do not all agree what we mean by that. Some people equate conservation with sustainable utilisation, others with numbers of animals, others with ecotourism and still others with captive breeding. While these concepts are relevant, they are not the bedrock of conservation. The bedrock of conservation, I believe, is the maintenance of biodiversity.

But what is biodiversity? It is a broad concept incorporating compositional, structural and functional attributes at four levels of organisation; namely landscapes, communities, species and genes (Noss 1990). It should not be interpreted simply as implying species richness or species diversity. Of relevance to wild dogs this incorporates not only the presence of wild dogs in an area, but, crucially, the restoration of their ability to interact with other species and to alter ecosystems. This is the ultimate goal in carnivore conservation (Pyare & Berger In press) and is what we should be striving for in the metapopulation.

It can be argued that the concept of ecological restoration for wild dogs is all very well and good, but is not feasible in the smaller areas available for wild dogs, especially where the objectives of the area are not those of biodiversity conservation. If this is so then I suggest that we should rank reserves in their willingness and/or ability to allow ecological processes for dogs to take place and for them to interact with other species both prey and predator. Areas that are unable or unwilling to allow these natural processes to take place should be seen as less important and peripheral to the metapopulation reserves. At this point I must add that it is difficult to know where this point lies and probably there is no absolute cut off. What I think is important is the willingness to let natural processes occur. It is my conviction that the need to manage small reserves is somewhat over emphasized and that smaller reserves are more robust than they are often given credit for. It was not long ago that even in Kruger it was believed that control of populations was necessary, but today, with the possible exception of elephant, this is not seen to be the case. Ecosystems are given to change and we should not try to manage against natural processes if we are genuinely committed to biodiversity conservation. In droughts some animals die and others increase. This might be reversed in times of high rainfall.

In these priority reserves, metapopulation management should take the form of simulating the natural conditions as closely as possible. The numbers of dogs in each reserve per se, or even in the metapopulation as a whole, should not be that important as we know that wild dog populations are given to much natural fluctuation. The long-term viability of the dogs in each reserve in terms of maintaining there genetic status and reproductive activity, wherever

possible through the translocation of single sex groups which break away from their pack at not younger than 18 months of age, should be the guiding principle.

This does not, of course, mean that wild dog ecotourism should not be a secondary function in these metapopulation reserves, it is just that the driving force behind the management of the dogs must be biodiversity conservation. There is no reason why ecotourism can't flourish and compensate for any financial losses through achieving the biodiversity objective.

What of those reserves that do not wish to or are unable to be guided in their wild dog management by biodiversity principles? These areas can not receive the priority status of the metapopulation reserves. However, if it is in the interests of the metapopulation, wild dogs can be moved into and out of these reserves should the reserve owners wish. They are welcome to attend WAG meetings and to seek advice from WAG should this be requested. However, the metapopulation is not obliged to accommodate their excess dogs, neither would WAG like to see excess dogs from these reserves translocated to unsuitable reserves and at unsuitable stages of their lives, nor would we like to see them land up in captivity. Also unsuitable dogs from captivity should not be introduced into these reserves. A critical point therefore would be the viability of the reserve and the management strategy applied to the dogs. It should not produce pups on an annual basis if the pups can not be absorbed into the wild in some way, nor should it need regular topping up from other reserves merely for the sake of keeping ecotourism ventures going.

To date, as I see it, there are four reserves; namely HUP, Madikwe, Pilansberg and Venetia that may fit the criteria of a metapopulation reserve, with Marekele about to become one. Karongwe does not appear to fit the criteria and, from what we know from the last meeting, neither does Tswalu at this time. Shamwari have expressed interest in introducing wild dogs. In fact recent emails have suggested that Shamwari have gone ahead and negotiated with Karongwe to obtain dogs that, because of their age are not suitable for translocation. Neither has the matter been discussed or agreed to at WAG. We would need to evaluate the situation at Shamwari before we can classify it. Another reserve, Shambala, has reintroduced dogs without it going through WAG. WAG has no authority to approve wild dog reintroductions as it is an advisory body. However, WAG does have the authority to determine what reserves should be included as metapopulation reserves.

References:

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