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GENETIC AND MOLCULAR TECHNIQUES FOR CONSERVING THE AFRICAN WILD DOG, *LYCAON PICTUS*

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Genetic and molecular techniques for conserving the African wild dog, *Lycaon pictus*

by

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SAMEVATTING

Die primêre doel van hierdie studie was om die rol wat genetiese ontleding in die bewaring van die wildehond (*Lycaon pictus*) speel te ondersoek, en om streslose tegnieke te ontwikkel om genetiese materiaal te bekom wat geskik is om 'n teelprogram te beplan. Ek het die status van wildehonde in aanhouding in Suidelike Afrika ondersoek deur 'n stamboek vir hulle saam te stel en vervolgens die demografiese en genetiese inligting daaruit te ontleed. Ek het ook die effektiwiteit van die streslose verkryging van fekale genetiese materiaal van bobbejane (*Papio cynocephalus ursinus*) ondersoek. Die doel van die studie was om verskillende preserveringsmetodes te toets, en om die geldigheid van mikrosatelliet-genotipes vanaf fekale DNA te bevestig. Dit dien ook as 'n model vir toekomstige genetiese werk op wildehonde.

Die mikpunt van teelprogramme in gevangenskap is tweeledig: eerstens om 'n gesonde bevolking in aanhouding te vestig sodat, selfs al sou wildehonde in die natuur uitsterf, daar 'n "noodvoorraad" teel-individue oorbly en, tweedens, om die oorbodige honde in aanhouding te gebruik om getalle in die natuur aan te vul. Teelprogramme in gevangeskap was baie suksesvol in terme van getalle. Daar is egter nog baie ruimte vir verbetering. Die genetiese diversiteit van die bevolking kan verhoog word deur die gelyke genetiese bydraes van honde wat uit die natuur na gevangeskap gebring word en deur uitruilings waarmee gepoog word om onverwante individue te gebruik. Die demografiese ontleding toon dat verbetering in versorging van honde die waargenome vrektes van kleinjies grootliks sal verminder.

Streslose tegnieke stel ons in staat om genetiese monsters van honde in aanhouding en van wilde bevolkings te bekom sonder om hul te beseer of hul sosiale struktuur te ontwrig. 'n Wilde bobbejaanbevolking is gebruik om die nut van hierdie tegnieke te ondersoek. Hierdie loodsstudie het belangrike inligting opgelewer wat nuttig is om die genotipes van wilde honde in gevangenskap te bepaal. Mitokondriale- en nukleêre DNA kan geïsoleer word uit mis wat deur vier verskillende metodes bewaar is. DNA wat deur die polimerase kettingreaksie (PKR) geamplifiseer is het betroubare genotipes gelewer wanneer spesie-spesifieke merkers gebruik is. In teenstelling hiermee is minder suksesvolle amplifikasies verkry wanneer heterospesifieke merkers gebruik is op mikrosatelliete. Hierbenewens is minder konsekwente genotipes verkry as met spesie-spesifieke merkers. My studie beklemtoon die belang van streslose tegnieke en

spesie-spesifieke merkers as ‘n nuttige metode om genealogiese verwantskappe binne wildehondbevolkings vas te stel.

Inligting aangaande bevolkingstruktuur, insluitende demografie, genetiese- en gedragsdata, is belangrik vir die suksesvolle bestuur van bevolkings in gevangenskap. Die aktiewe deelname van alle partye betrokke by die versameling en bewaring van demografiese en genetiese data in ‘n enkele databasis is krities wanneer bewarings- en bestuursbesluite geneem word. Samewerking tussen teel-instansies, navorsers en wildreservaat-eienaars is noodsaaklik om teel- en bewaringsplanne te ontwikkel wat ten doel het om wildehondbevolkings in gevangenskap en in die natuur as ‘n enkele entiteit te bestuur. So ‘n beleid is krities, nie net vir die sukses van wildehond bevolkings in aanhouding nie, maar ook vir die oorlewing van die spesie as ‘n geheel.

ABSTRACT

The primary aim of this study was to explore the role of genetic analysis in African wild dog (*Lycaon pictus*) conservation efforts, and to help develop non-invasive techniques for the acquisition of genetic data useful in wild dog conservation strategies. I addressed the current status of the African wild dog in captive conditions in southern Africa by compiling a studbook for these animals and by analysing the resultant demographic and genetic data. I investigated the effectiveness of molecular genetic analysis using faecal material gathered from a free-ranging baboon (*Papio cynocephalus ursinus*) population using non-invasive techniques. This pilot study using baboon faecal material served as a model for future wild dog studies, and was conducted to evaluate preservation methods and validate microsatellite scores obtained from faecal DNA.

The aims of captive breeding institutions are twofold: firstly to maintain a healthy captive population so that, even if this species were to become extinct in the wild, there is an "emergency stock" of breeding individuals left and, secondly, to use excess captive stock to boost numbers in the wild through re-introductions. Breeding institutions have been successful in maintaining a healthy captive population. However, there is still ample room for improvement to boost the genetic diversity of the population through the even representation of founders in the populations and through exchanges aimed at mating unrelated and appropriate individuals from different breeding stations. The demographic analysis suggested that improvements in husbandry would reduce a large amount of the observed pup mortality.

The use of non-invasive techniques provides the possibility of obtaining genetic material from target subjects in captive and wild populations without harming the animal or disrupting the population's social structure. An investigation into the value of non-invasive molecular genetic techniques was initiated using a free-ranging baboon population. This pilot study revealed important information useful in the development of future attempts to genotype all captive wild dogs. Results suggested mitochondrial and nuclear DNA could be extracted from faeces preserved using four different methods. DNA amplified produced reliable genotypic information, when species-specific primers were used. In contrast, when hetero-specific primers were used to amplify microsatellites, few successful amplifications yielded consistent

genotypes. This emphasises the importance of non-invasive techniques and species-specific primers to establish wild dog intrapopulation relationships.

All aspects concerning population structure, including demographic, molecular genetic and behavioural data play important roles in the successful management of the captive population. We suggest the active participation of all involved parties in gathering and storing demographic and genetic data in a single database that will be used when considering management decisions. Combined efforts among breeding institutions, researchers, and game reserve property owners are necessary to develop management and breeding strategies which will consider the captive wild dog population as one entity. This type of policy would benefit the survival of the species as a whole and not just the success of the captive bred wild dog population.

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CHAPTER I

INTRODUCTION

The genetic and demographic management of any endangered population is of the utmost importance for its survival. Factors responsible for a steady decline in populations include competition for resources, habitat destruction, inbreeding, loss of fertility, disease, persecution by man and road kills (Fanshawe *et al.* 1991). Habitat protection appears to be the most effective way to preserve populations, but in areas where suitable habitat remains threatened or becomes unavailable, co-operative captive breeding and reintroduction programs become essential in the effort to rescue species from extinction. Co-operative breeding programs, which adhere to appropriate genetic and demographic management strategies, can significantly aid in the conservation efforts of most endangered species (Ballou 1992).

The availability of food and habitat, which supports free-ranging populations, has decreased dramatically since 1950. This has had fundamental implications for predator species, which depend for their survival on food distributed over vast areas of undisturbed land. The expansion of human development has resulted in a reduction of available food sources, increased habitat fragmentation, and populations that have become isolated from one another. Due to this insularisation of wild areas, genetic exchange between populations has been reduced and levels of genetic variability have declined due to breeding between close relatives (Ralls *et al.* 1986). In addition, these populations have been subject to stochastic demographic events, which threaten small populations (Foose & Ballou 1988; Lande 1988).

Inbreeding in wild populations is strongly affected by dispersal patterns (Fuller 1992) and in captive populations by appropriate husbandry and management. In many species, generations of inbreeding cause reduction of the mean individual fitness through increased expression of deleterious alleles. This leads to developmental abnormalities, infertility, and increased juvenile mortality (Allendorf and Leary 1986, Wiese *et al.* 1994, Lacy 1997). In addition, the loss of genetic variability due to random genetic drift can diminish adaptability to a changing environment (Lande, 1988) and may also affect the susceptibility of species to epizootics and parasites (Quattro and Vrijenhoek 1989, Lacy 1997).

Disease, in conjunction with the loss of genetic variability within a species, may play an important role in the decline of wild, relocated, and captive populations of endangered species. For example, during 1983 the cheetah population in an Oregon breeding institution was decimated by an epizootic of coronavirus-associated feline infectious peritonitis. O'Brien *et al.* (1985) suggested that hypersensitivity of the cheetah to the viral pathogen might have been attributed to high levels of genetic uniformity, as a consequence of a population bottleneck in the past. This episode stresses the importance of establishing demographically and genetically secure and self-sustaining captive populations.

The African wild dog is one of the most endangered carnivores in Africa, second only to the Ethiopian wolf and it is feared that this species may be doomed to extinction within a period of 10-40 years (Chilvers, 1994 and Hines, 1990). Conservation measures have been undertaken by several captive-breeding institutions in South Africa to ensure the long-term survival of this predator species. The aims of captive breeding programs are twofold. Firstly, to maintain a healthy captive population so that, in the event that this species becomes extinct in the wild, there will be an "emergency stock" left. Secondly, these programs aim to use excess captive stock to boost numbers in the wild through reintroduction (Frankham *et al.* 1986). One problem these institutions face is that single breeding institutions are limited in the number of wild dogs they can sustain. With only a few individuals and no exchange of unrelated genetic material, inbreeding is inevitable. This can be avoided by co-operative measures such as exchanging genetic material among institutions. Institutions have made various attempts at this in the past, but due to the lack of genetic information for each individual, the exchange did not necessarily make the best use of the available individuals.

Genetic diversity is the underlying factor in the long-term survival of a population and for adaptation of that population to environmental changes. In order to retain a true representation of the genetic diversity of a population it is of great importance to study and analyse the genetic structure of the population. With the aid of this information, genetic management decisions can then be made to effectively sustain optimal genetic variability in a population. For example, inbreeding may be minimised among captive populations if genetic relationships among individuals have been determined. If pedigree information is available, breeding pairs may be selected to ensure that founder genetic material is equally represented in offspring. Alternatively individuals may be recommended as subjects for the exchange of genetic material among breeding institutions to simulate natural dispersal patterns among populations. Finally, with pedigree and genotypic information genetic healthy and diverse individuals may be selected for re-introductions into the wild.

Captive breeding programs require demographic knowledge in conjunction with genetic knowledge for successful management. The primary goal of demographic management is to expand a captive population from its founder or initial size to the carrying capacity as rapidly as possible to cultivate a self-sustaining population able to withstand stochastic problems that may afflict the population. Another goal for this type of management is to cultivate a population of sufficient size to contain the full complement of representative genetic diversity in the founder or initial population. Demographic data are crucial in a number of management scenarios. For example, information regarding fertility and survival based on analysis of demographic data can help to develop husbandry strategies to regulate and optimise population growth. Also, information regarding age distributions and biases in sex ratios makes it possible to make decisions about which individuals should be exchanged among breeding institutions to maximise the effective size of the population. Finally, demographic data regarding juvenile mortality may indicate various problems with pup rearing programs and/or the social structure within populations.

In order to obtain genetic and demographic information, a variety of sampling techniques must be used. Behavioural sampling is a method by which data are recorded from observing matings, births and mortality in a population, and is useful in obtaining both demographic and to a lesser degree genetic information. Genetic sampling is a method by which data are obtained from the manipulation of blood, hair, faeces, or tissue samples, and is required to verify pedigree information and phylogenetic relationships. Traditionally most of the genetic analysis was conducted using blood samples collected by invasive means. However, invasive methods may cause detrimental consequences for many individuals. Immobilising animals to perform biopsies exposes them to clinical risks, is time consuming, and may require extensive equipment and previous experience with veterinary procedures.

The African wild dog has been reported to be subjected to a high degree of social stress caused by captive breeding conditions (DeVilliers *pers. comm.).* Therefore the species is highly susceptible to the deleterious effects of captive manipulation and invasive sampling.

This phenomenon has made the use of non-invasive sampling techniques, as reliable as invasive methods, a valuable tool in investigating the genetic structure of these populations. The use of faecal samples in genetic analysis has drawn considerable attention as a source of genetic material that can be obtained without incurring undue stress upon the target animal. One of the following studies outlines our success in amplifying DNA from faecal matter of a free-ranging baboon population to study their genetic composition, as well as to assist in the development of non-invasive techniques for the genetic management of endangered species such as wild dogs.

The first objective of the present study was to address the status of the African wild dog under captive conditions using observational data and limited unpublished molecular genetic data in order to determine the effectiveness of the current management strategies applied in captive breeding institutions throughout South Africa. In chapter 2, an attempt is made to identify the most important genetic and demographic effects that hamper the breeding of wild dogs in captivity. Information gathered from the various breeding institutions, in conjunction with behavioural studies conducted by M.S. de Villiers, was compiled into a database, compatible with the format of the international Conservation Breeding Specialist Group (CBSG). Data were analysed as if the captive wild dog held by various captive-breeding institutions was a single population (Appendix 1).

The second objective was to release this data to the APP (African Preservation Program), in an attempt to form a co-operative captive breeding effort so that all wild dogs available in South Africa could be genetically and demographically managed as one population. It is hoped that through co-operative management and through the sharing of information, mistakes could be avoided and each institution would be able to make a valuable contribution to the conservation of the African wild dog.

The third objective was to compare the effectiveness, tractability, and reliability of four methods used to preserve endogenous DNA in faecal material collected in the field for genetic analysis (Chapter 3). For this purpose, a pilot study was initiated on a free-ranging baboon (*Papio cynocephalus ursinus*) population. This baboon population was chosen as the test group because extensive behavioural data had been collected over a 25-year period for the population. In addition, a number of faecal samples were available for each individual of the population and there were inadequate samples available from the African wild dog population to perform the required genetic analysis. Faecal samples were collected as part of a long-term study on this species' social behaviour and reproductive strategies.

An important goal was to determine whether DNA-amplification from faeces was dependent upon the preservation method. Mitochondrial DNA (mtDNA) and single copy nuclear DNA (scnDNA) amplification success were compared from faeces preserved in Queen's lysis buffer (Seutin *et al.* 1991; Wasser *et al.* 1997), 70% ethanol (Kohn *et al.* 1995;Wasser *et al.* 1997), frozen at -20^{0}C (Foran *et al.* 1997; Reed et al. 1997; and Wasser *et al.* 1997), and dried (Foran *et al.* 1997; Kohn *et al.* 1995; Taberlet *et al.* 1997; and Wasser *et al.* 1997). The relative success of these preservation methods has not been satisfactorily evaluated. These methods must be further investigated since it affects sampling strategy, experimental design and effort in research using molecular scatology.

Molecular genetic techniques such as microsatellites have made it possible to address questions concerning mating systems and social organisation with a high degree of resolution. The fourth objective was therefore to obtain reliable genotypic data that could be used to construct a pedigree of a free-ranging baboon population using microsatellites derived from faecal DNA, in the hope to confirm relationships among the individuals of this baboon group from the Okavango Delta, Botswana.

The fifth objective was to test the feasibility of using human primers, of which many have been published, to amplify microsatellites in baboons. No baboon-specific microsatellites have been published to date. This problem is particularly relevant to the wild dog situation since much more genetic data, including primer sequences, are available for the domestic dog (Ostrander *et al.* 1993) and this could form the basis of a microsatellite-based study of the African wild dog. The use of cross-species primer sequences could offer a crucial technology for generating genealogies of populations in captivity.

The ultimate aim of captive breeding programs is the successful reintroduction of genetically and demographically healthy populations into the wild. As demonstrated, this goal may be obtained only through successful co-operative breeding strategies with appropriate genetic and demographic management of populations. To aid in genetic management, faecal DNA analysis has provided a non-invasive means of obtaining genetic material from target animals in captive and wild populations without disrupting the population's social structure. Once these techniques and breeding strategies have been established, many endangered species may benefit from this, and similar studies to ensure their long-term survival. I hope that this dissertation is a useful contribution in promoting these aims, especially as far as the African wild dog is concerned.

CHAPTER II

THE AFRICAN WILD DOG (Lycaon pictus) IN CAPTIVITY: A PROLIFIC CAPTIVE BREEDING PROGRAM DOES NOT NECESSARILY IMPLY A SUCCESSFUL CONSERVATION PROGRAM

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Abstract

Since 1954 several southern African institutions have established captive breeding programs to ensure the long-term survival of the African wild dog Lycaon pictus. These programs focus on maintaining a healthy captive wild dog population, and the reintroduction of excess captive animals to increase numbers in the wild. To aid the achievement of this goal a studbook was assembled to provide genetic and demographic information for the South African captive populations, which includes the majority of African wild dogs in captivity worldwide. South African captive populations were investigated over three time frames: population during the five year time interval 1985-1990, population during 1991-1996, and population alive by January 1997. The captive-breeding program is successful with a positive population growth, a significant lowering of inbreeding and mean kinship and an increased genetic diversity of the captive population. However, even though the captive breeding program has been successful, genetic variability levels appear lower and levels of inbreeding appear higher compared with wild populations. In addition, there have been no successful long-term re-introductions into the wild using captive-bred dogs. This stems from two reasons: the captive breeding program has not been integrated with the broader conservation strategy for this species, and various reintroduction programs have been unsuccessful due to technical problems that have plagued the release of wild dogs into the wild. Active co-operation between the captive breeding institutions and nature conservation authorities is vital for a successful conservation plan for wild dogs in Africa. The ultimate success of a conservation program not only depends on proper demographic and genetic management of the African wild dog population, but also on the joined efforts of all respective agencies involved.

Introduction

The African wild dog (Lycaon pictus) is critically endangered (Macdonald 1994) and it is unlikely that there are more than 5000 individuals remaining in the wild (Fanshawe et al. 1991). With the expansion of human development and associated habitat fragmentation, remaining free-ranging wild dog packs are in danger of becoming increasingly isolated (Woodroffe et al. 1997). It has been suggested that, due to natural inbreeding avoidance behaviour, captive populations have lower levels of genetic variability than wild populations (Woodroffe et al. 1997). Ideally an overall conservation strategy for these animals should include a captive-breeding program which complements the management of free-ranging populations. To achieve this, genetic and demographic management of the captive populations is essential. Demographic management of captive populations aims to control negative deterministic factors (e.g. neonatal mortality and unequal sex ratios) as well as declines in population size due to stochastic demographic processes (Foose and Ballou 1988). The genetic diversity of an endangered species is important for its long-term survival (Lande 1988). Inbreeding and genetic drift can greatly reduce the genetic variation of endangered populations, which in turn, affects their viability (Allendorf and Leary 1986, Wiese et al. 1994, Lacy 1997) and their adaptability to changing environments (Lande, 1988). Therefore, genetic management should include equal founder representation in the captive population, regulation of family sizes and sex ratios to maximise the effective size of the population, and management of inbreeding coefficients to ensure that survival and fertility would not decline significantly (Foose and Ballou 1988).

Wild dogs have been held in captivity in South Africa since 1954, and in January 1997 the South African population included one-fourth of the wild dogs in captivity worldwide, 107 wild dogs of a total of 427 individuals worldwide (B. Brewer, pers. comm.). This population therefore constitutes the largest local concentration of captive wild dogs in the world. This paper addresses the contribution of the southern African captive wild dog population to the overall conservation program for this species. We identify constraints associated with the current management strategies using breeding records of captive individuals. We also attempt to assess the contribution of the current captive-breeding program towards a successful conservation strategy for African wild dogs in Africa, and make recommendations for the improvement of the overall conservation initiative. We conclude that the southern African captive-breeding program is very successful but that it does not contribute to the overall conservation for this species because the captive population is not included in the conservation plan.

Materials and methods

Data collection and compilation: Records on captive African wild dogs were collected at southern African breeding institutions between 1954 and 1997. These include Cango Croc Ranch & Cheetahland, De Wildt Cheetah Research & Breeding Center, Hartebeespoort Dam Snake and Animal Park, Hoedspruit Cheetah project, Johannesburg Zoological Gardens, National Zoological Gardens of South Africa and Tygerberg Zoopark. Data collected for each individual included origin (wild or captive), birth date, identity of sire and dam, sex, location held, date of transfer and date of death. Data were collated and presented in studbook format of the Conservation Breeding Specialist Group (CBSG), IUCN (Frantzen and De Villiers 1995; de Villiers and Frantzen 1996) using the computer software SPARKS (ISIS 1992). During 1993 D. Girman (pers. comm.) conducted microsatellite analysis on 36 captive dogs (16 individuals from De Wildt, 16 from Hoedspruit, 3 from Namibia, and 1 from Angola). These results were reported to the captive breeding community with the objective to improve the genetic management of the captive wild dog population. We considered three aspects of the data set: 1) All southern African captive individuals alive on January 31st 1997. 2) All individuals alive during five year period 1985-1990, and 3) the period 1991-1996. For calculation purposes, SPARKS (ISIS 1992) considers half of the total number of individuals of unknown sex as male and the other half as female. Based on the data for our captive population we used a hypothetical litter size of 7 individuals in order to calculate pup mortality if no record of the litter size was available. We also assumed that no captive wild dog would live past the age of 15. Information on all attempted releases of captive wild dogs into nature was also collated from the organisation involved.

Data interpretation - a) Demography: The birth flow model DEMOG (ISIS, 1992) was employed to determine the population size, age distribution, and sex structures of the population for each of the above data sets. Age-specific survivorship and fertility were computed and used to construct life tables, which describe age-specific survival and fecundity rates in the specified populations (Foose and Ballou, 1988). These life tables were used to calculate the instantaneous rate of change (r), the net reproductive rate (R_0), the percent of population change per year (λ), pup mortality and the generation time or average age of reproduction (T) for each data set. Statistics were performed on the two temporal data sets using linear regression analysis (Sokal and Rohlf, 1995).

b) Genetics: The simulation program GENES (ISIS, 1992) was used to estimate the extent of existing genetic variability in the captive population and to estimate the chances of future loss of genetic variability due to the loss of genes contributed by various population founders (MacCluer et al. 1986). Gene drop analysis was performed for each of the data sets to estimate inbreeding. During this procedure, two hypothetical alleles were assigned to each founder in a population. As a result, a random genotype was created for each descendant through Mendelian segregation of the parental alleles (MacCluer et al. 1986). The distribution of the amount of genetic material present in the population from each individual founder was calculated as a fractional contribution of each founder to the captive population (ISIS 1992). The effective population size (N_e) was derived from the number of individuals participating in the actual breeding. Lastly, pedigrees derived from Girman's genetic data were compared to those derived from observational data in the studbook (Frantzen and de Villiers 1995).

Results

Demography

Population Size: Between 1954 and 1997, a total of 787 wild dogs (145 males: 134 females: 480 Unknown) were held at seven South African institutions. These included 56 founders, of which 18 were of unknown origin and 22 were wild caught with an unknown capture site. The origin of the rest of the wild-caught founders were as follows: 13 from Namibia, 11 of which were captured in Ethosha National Park, two from the Kruger National Park and one from Angola. The captive wild dog population alive during January 1997 comprised 107 individuals (37 males: 30 females: 40 unknowns). This population included 11 living wild-caught individuals: one male from Angola (Johannesburg Zoological Gardens), three males and three females from Ethosha National Park, Namibia (De Wildt Cheetah Research and Breeding Center), one male and female from outside Etosha (De Wildt, Cheetah Research and Breeding Center), and two males from Kruger National Park (Hoedspruit, Breeding and Research Station for Endangered Species) (Table 1). The captive wild dog population has increased in size since 1954. There was a fairly constant growth in population size from three dogs in 1954 to 40 dogs in 1990, followed by a significant increase in population size to 107 dogs at the start of 1997 (Fig. 1).

Age and sex class distribution: Seventy nine percent of the population alive in January 1997 comprised reproductively mature adults (2-12 yrs. old), relatively few individuals (2%) beyond probable reproductive age (older than twelve years), and the remaining individuals (19%) were reproductively immature sub-adults (Table 1). Males and females were almost equally represented in the population (37 Males: 30 Females: 40 Unknowns) and there was no evidence of a biased sex ratio (binomial $p > 0.22$).

Reproductive history: Between 1954 and January 1997 an estimated 106 litters (715 pups) were born from 40 breeding pairs which produced a mean of 2.65 litters/breeding pair, comprising 6.74 pups/litter. The age of first reproduction was estimated at 2 years and continued until 12 years (Fig 2). The mean age of reproduction (Generation time; T) for males increased significantly over the period 1991-1996. In contrast, the generation time for females within these two time periods (1985-1990 and 1991-1996) has remained relatively stable (Table 2). The birth interval for adult females was 11-14 months when some pups survived. When the litter perished, the interval could be as short as 4-6 months. The mean litter size (range 1-14) and the number of litters per pair per year decreased slightly between 1985-1990, and both values increased slightly during the 1991-1996 period (Table 2). The number of pups produced per year within the two time periods (1985-1990 and 1991-1996) increased only slightly (Table 2). The age specific fecundity depicted in Fig. 2 indicated that an average of 1.45 male and 1.52 female offspring were born to a male and female individual respectively, for each age class from 3 to 12 yrs. However, this does not reflect the fact that the dogs mostly had larger litters with between-litter intervals longer than a single year.

Mortality: The mean lifespan for captive wild dogs was calculated as 10 years. Pup mortality within 30 days of birth averaged 63% between 1954 and 1997 (n=715). When the pups reached sub-adolescence (1 year) there appeared to be a sharp decline in the mortality rate, while a significant increase in mortality was evident after ten years of age (Fig 2).

Rate of population growth: The rate of growth (r), net reproductive rate (R_0), % population change per year (λ), annual lambda, annual crude rate of birth, and the annual crude rate of change indicate a positive population growth for both the 1985-1990 and 1991-1996 periods. The net reproductive rate (R_0) for males increased significantly ($p<0.008$; Fisher test) between 1991-1996. This is also reflected in the % population change per year (λ) for males. Both the annual lambda and the annual crude rate of change have shown a slight decrease for the 1985-1990 period and, a slight increase during the 1991-1996 period, while the annual crude rate of birth appears to have declined slightly for the two periods (Table 2).

Genetics

Gene diversity and effective population size. The gene diversity, measured as the fraction of the original genetic variation remaining, showed a significant increase during the period 1991-1996. The effective population size (N_e) increased slightly between 1991-1996 (Table 2, Fig. 1).

Inbreeding and kinship: Of the 40 active breeding pairs recorded in the studbook, 15 pairs comprised highly related individuals including, full sibs, parent-offspring, and uncle-offspring. Twelve pairs comprised unrelated individuals, and 13 pairs comprised individuals that were possibly related. This was reflected in the inbreeding coefficient, which steadily increased for the 1985-1990 period. However this value significantly decreased between 1991 and 1996. The mean kinship appeared to decrease only slightly during the 1985-1990 period, but showed a significant downward trend during 1991-1996 (Table2).

Founder representation: A significant increase in the number of founders was evident for both the 1985-1990 and 1991-1996 time frames. The captive population alive by January 1997 included contributions by 16 founders of known origin (five of these had died). Founders of unknown origin were excluded from the analysis. A large degree of unevenness in founder representation is evident (Fig. 3): at one extreme an individual wild dog (De Wildt) contributed 21% of the total genetic material of the captive population. At the other extreme, six founders (1 from JHB, 2 from H-spruit, and 3 from De Wildt), all alive, contributed to less than 2% of the captive genetic material. Three of the 16 individuals (2 (alive) from De Wildt and 1 (dead) from elsewhere), are under-represented (3% (target=7.4%), 4% (target=6.9%), and 5% (target=7.4%) respectively) in the captive population, and could potentially be bred in order to boost the genetic diversity levels. One (De Wildt) individual has reached its target level (7%). Finally, five individuals (2 (dead) and 1 (alive) from De Wildt and 2 (dead) dogs (previously exported)) have reached twice their target levels (10%, 12.5% and 13% respectively) and are therefore over-represented in the population (Fig. 3).

Re-introductions using captive animals

Six re-introductions of captive born wild dogs (n=63) to nature reserves in southern Africa have been attempted between 1975 and 1997 (Woodroffe et al. 1997). None of these have been successful in the longer term. Four of the reintroduction attempts consisted solely of captive born wild dogs, another release attempt included 2 wild-caught individuals and 20 captive born dogs, and one other release included 3 wild-caught individuals and 3 captive born wild dogs. The majority of re-introductions failed due to the captive-bred dog's inability to adapt to their environment. This resulted in starvation, lion predation, and/or infectious disease exposure within a few months post reintroduction. Other attempts failed when released animals left the safe boundaries of the nature reserve and became victims of poisonings, or shootings (Hines 1990; Scheepers and Venske 1995; Woodroffe et al. 1997).

Discussion

The southern African captive breeding institutions have been successful in maintaining a significant captive population. However, optimal breeding conditions in captive populations have not been attained. Also, attempts at reintroducing and sustaining surplus individuals into the wild have generally been unsuccessful.

Demography: The main aim of a successful captive-breeding program is to maintain a healthy stock of wild dogs in captivity. An ideal demographic population would sustain constant age-specific survival and fecundity, until a constant growth rate and stable age distribution is established. In addition, the population should also be able to withstand environmental imbalances and survive stochastic demographic catastrophes. Our demographic data seem to indicate that the captive populations experienced a significantly positive population growth between 1991-1996 compared to the 1985-1990 period, due to a relatively high rate of reproduction indicated by a significant increase in the Net Reproductive Rate (R_0) and % population growth (λ) for males between 1991-1996. The relatively even sex ratio and the large numbers of reproductively mature wild dogs (79%) makes it seem probable that, as a result of more intensive management, the population is capable of further growth. One reason for concern appears to be the fact that the pup mortality rates under captive conditions remain high (>60%), as various other studies have also indicated (Burrows et al. 1994; Ginsberg et al. 1995; Maddock and Mills 1994; and van Heerden 1986). An inadequate diet, combined with a high degree of social stress caused by holding groups of animals in adjacent cages, may be associated with excessively high pup mortality.

Genetics: As a general guideline, conservation biologists recommend that a genetically healthy population in captivity should attempt to preserve at least 0.9 of the average heterozygosity of the founders for 200 years (Soulé et al. 1986; Foose and Ballou 1988). Our analysis revealed that there has been a significant improvement in terms of inbreeding, kinship, and genetic diversity between 1991 and 1996. This was mainly the result of the incorporation of a significant number of new founders into the captive- breeding program during the last ten years. Our data suggest several limitations to the current captive-breeding program.

The first limitation is the sub-optimal genetic diversity in the population as a result of uneven founder representation (Fig 3). An increase in genetic diversity would be possible if the founder's genetic material were more equally represented in the population. Sixteen founders of known wild origin have been included in the South African breeding program, but 5 of these never produced offspring. In addition, founders have not been evenly distributed among the different breeding institutions, and at those institutions housing a greater fraction of founders, some have contributed a great number of offspring to the next generation, while others have produced few or no offspring. High kinship values calculated in this study indicated a high level of inbreeding. Inbreeding of wild dogs became common amongst South African institutions due to limited opportunities to obtain wild caught founders, lack of information regarding the relatedness of wild dogs captured from the same area in the wild, and the failure to separate related dogs in breeding enclosures.

Secondly, the effective population size has remained consistently low over time, despite a significant increase in population size (40 to 107 individuals) between 1991-1996. Significant improvement in the effective population size may be attained by implementing a well-co-ordinated breeding plan which would include the genetic testing of potential breeding individuals in the captive population before pairing, and an exchange program of genetic material between institutions. Non-invasive techniques (using DNA extracted from faeces) are currently becoming available, providing both an inexpensive and non-threatening means of acquiring genetic information. The collection of faecal material is a relatively easy way to acquire tissue cells from target subjects with little or no harmful consequence to that individual (Höss et al. 1992; Constable et al. 1995; Gerloff et al. 1995; Kohn et al. 1995; Tikel et al. 1996; Wasser et al. 1997). Molecular genetic analysis of faecal DNA can be used to address questions concerning mating systems and social organisation, which cannot always be determined by observation alone (Gerloff et al. 1995; Reed et al. 1997; Taberlet et al. 1996; Taberlet et al. 1997).

Re-introductions of captive wild dogs into the wild: A major aim of the captive breeding programs should be to contribute towards reintroducing captive stock into the wild. Several attempts have been made to reintroduce captive-bred wild dogs into the wild, but with little success (Woodroffe et al. 1997, this study). Several problems are associated with reintroducing captive wild dogs. Dogs in captivity become dependent on humans for food and are poor hunters when transplanted to the wild, causing them to die from starvation. Creel and Creel (1996), Mills and Gorman (1997) and Gorman et al. (1998) showed that free-ranging wild dogs are susceptible to disturbance and predation from other large predators, and that the wild dogs avoid areas with high densities of large predators. Captive-bred dogs have little experience with inter-species encounters, and they are not conditioned to appropriately react to interactions with other large predators such as lions and hyenas, costing the lives of many captive-bred wild dogs. Close contact with mankind habituated these animals from dangers associated with humans. Therefore, many of these dogs did not attempt to evade people and consequently, were shot, poisoned or killed by cars when they moved outside of game reserves. Unfortunately, the habituation of wild dogs to humans is essential for the tourist-dependent income of many of the breeding institutions. Finally, wild dogs are exposed to the increased possibility of infections from diseases transmitted from domestic dogs, such as rabies and distemper (Laurenson et al. 1997). To overcome these problems, two of the most recent re-introductions (Madikwe) comprised a mixture of captive-bred individuals of one sex with wild-captured individuals of the other sex. However, there is no clear evidence yet that this approach has been successful.

Reintroduced dogs need to be inoculated against diseases that rarely occur in captive conditions, given the opportunity to adapt to their new surroundings, and encouraged to learn how to hunt. The majority of the pack to be reintroduced need to be comprised of adults of both sexes with adequate hunting experience to provide protection against predators, and act as teachers for other less experienced members. Ideally, reintroduced individuals should be unrelated to avoid inbreeding, which requires releasing dogs from different breeding institutions as a single pack. However, this is contrary to the matrilinear pack structure in free-living wild dogs (McNutt 1996, Girman et al. 1997) which comprises wild dogs with close genealogical relationships. Packs of unrelated individuals may therefore be likely to disintegrate. The topic of re-introductions of wild dogs is one that needs intensive experimentation and research. A foremost question that needs to be answered is whether captive-bred dogs are more susceptible to predation by large predators and to diseases when compared to wild-captured individuals. The answer to this question would radically affect the strategy followed during reintroduction.

Towards the integration of captive-bred and wild-living populations in a single conservation plan

The captive breeding institutions: Even though the overall captive breeding initiative has been very successful, the breeding institutions need to change their approach from a number of institute-specific breeding programs to an integrated breeding program. The lack of co-ordination in the overall-breeding program is reflected in the high number of breeding pairs comprised of related individuals, the uneven offspring representation of founders and the relatively large proportion of wild dogs not integrated in captive breeding strategies. The genetic screening of captive dogs using molecular techniques, artificial insemination, the exchange of breeding stock, and the addition of new founders are only four of the approaches which need to be seriously considered by captive wild dog breeders. The second aspect of the captive-breeding program that requires intensive investigation is the high level of neonatal mortality, which indicates that substantial problems with the husbandry of dogs in captivity need to be resolved. The captive breeding institutions need to be able to produce substantial numbers of wild dogs of known genetic provenance which could be used in re-introductions into the wild. This is the most valuable role that the captive breeding institutions could play in the conservation initiative for the African wild dog. Given that the combined programs in southern Africa produce 20-40 pups/yr, these captive breeding institutions are in an excellent position to play this role.

The conservation organisations: Two reasons why the management of free-living wild dog populations should be included in the deployment of captive-bred wild dogs in conservation areas are: Firstly, mortality due to starvation of reintroduced dogs indicates that adult dogs with experience in hunting are crucial for pack survival. This may necessitate the release of wild-captured dogs with the captive-bred animals. Conservation authorities would therefore need to be involved in the supply of wild-captured dogs as well as in the monitoring of the animals after release. Secondly, the continued use of wild captured dogs in unsuccessful reintroduction attempts could threaten the remaining wild populations. Therefore, it is important to include captive-bred individuals in re-introduction programs. In addition, contributions of the captive-breeding institutions are essential for the overall conservation initiative for wild dogs, and one would expect close co-operation between conservation authorities and captive-breeding institutions. However, this has not been realised. First, the majority of wild dog re-introductions listed above did not include wild-captured animals. Second, there is no indication that the conservation authorities regard the captive-breeding program as an integral part of the overall wild dog conservation initiative. Indeed, in the light of the above weaknesses in the captive breeding program, a recent workshop under the auspices of the Species Survival Commission of the IUCN decided that "the current meta-population reintroduction program for the next 5 years be designed to use wild animals as the source for founders. During that time the captive community will have time to decide how they want to organise and manage that population...." (Woodroffe et al. 1997). There are clear differences in approach between the captive breeding community and the conservation organisations.

It is unlikely that without the active participation of both the captive-breeding institutions and the conservation institutions a successful wild dog conservation program can be initiated. An ideal situation would be one in which the captive breeding institutions provide stock for reintroduction into the wild, while the conservation institutions provide a small but steady flow of founders for the captive breeding program. Moreover, the problems that have been encountered in the reintroduction of African wild dogs into the wild cannot be solved without close collaboration between the captive breeding and conservation institutions. This co-operation is likely to be crucial for the success of the conservation initiative for the African wild dog.

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Table 1. Captive wild dog (Lycaon pictus) population under investigation in South Africa. These data include adults and sub-adults of both sexes as well as unknowns and founders (number in brackets include founders dead or exported), pup mortality (%), mean inbreeding coefficients (F), Mean Kinship, Gene diversity, and effective population size (N_e) at South Africa's main breeding institutions. Cango = Cango Croc Ranch & Cheetahland (Oudtshoorn); H-spruit = Hoedspruit Cheetah Project; JHB = Johannesburg Zoological Gardens; Kraai = Tygerberg Zoopark; Pret DW = De Wildt Cheetah Research & Breeding Center; Pretoria = Pretoria National Zoological Gardens, South Africa; Other Institutions = Hartbeespoort Dam Snake & Animal Park, African Game Services, and a private institution.

WILD DOG BREEDING INSTITUTIONS IN SOUTH AFRICA								
	Cango	**H-spruit**	**JHB**	**Kraai**	**Pretoria**	**Pret DW**	**Other Institutions**	**Total**
Adult M (>12 yrs)							1	1
Adult F (>12 yrs)				1				1
Adult UNK (>12 yrs)								0
Mature Adult M(2-12yrs)	10	3	1	1	1	6	9	31
Mature Adult F (2-12yrs)	1	5	1		1	7	10	25
Mature Adult UNK (2-12yrs)						25	4	29
Sub-adults M (1-2yrs)		6						6
Sub-adults F (1-2yrs)		4						4
Sub-adult UNK (1-2yrs)		1				9		10
Total	11	19	2	2	2	47	24	107
Founders		2	1 (2)			8 (2)	(1)	16
Pup Mortality (%)	0	62	69	?	61	66	?	63
Inbreeding coefficient (F)	0.085	0.127	0.125	0.125	0.125	0.031	0.28	0.053
Mean Kinship		0.2630				0.1170		0.0181
Gene diversity		0.7370				0.8830		0.9182
Effective population size (N_e)		4.48				8.05		15

Table 2. Demographic and genetic information for captive African wild dog (Lycaon pictus) in South Africa, and results of the linear regression analysis indicating trends within the time periods 1985-1990 and 1991-1996.

	1985-1990	F_s-value[1]	P-value[2]	1991-1996	F_s-value[1]	P-value[2]	Jan. 1997[3]
Demographic Information							
Population size (N)	40	3.25	>0.146	107	69.64	<0.001	107
# Breeding pairs	17	6.45	>0.064	24	0.02	>0.887	4
Total # litters	30	0.59	>0.485	37	0.04	>0.850	4
Total # pups	202	0.09	>0.783	246	0.28	>0.625	27
# Litters/pair/year	0.352	3.10	>0.153	0.308	0.07	>0.805	N/A
# Litters/pair	1.76	3.10	>0.153	1.54	0.07	>0.805	1
Mean litter size	6.73	0.49	>0.523	6.65	1.75	>0.257	6.75
Mean # litters/yr.	6.0	0.59	>0.485	7.4	0.04	>0.850	N/A
Production (pups/yr.)	40.4	0.09	>0.783	49.2	0.28	>0.625	N/A
% Pup mortality (30 days)	67	0.50	>0.517	61	5.33	>0.082	63
Generation Time males (T)	6.406	0.01	>0.914	5.377	68.1	<0.001	6.027
Generation Time females (T)	5.937	0.12	>0.748	5.162	1.74	>0.258	5.599
Rate of growth males (r)	0.190	1.39	>0.304	0.124	7.26	>0.054	0.182
Rate of growth females (r)	0.164	0.28	>0.624	0.154	1.17	>0.340	0.191
Net reproductive rate males (R_0)	3.373	0.51	>0.515	1.946	24.26	<0.008	2.992
Net reproductive rate females (R_0)	2.645	0.07	>0.799	2.211	5.23	>0.084	2.916
% Population change/yr. males (λ)	1.21	1.16	>0.343	1.13	8.00	<0.047	1.20
% Population change/yr. females (λ)	1.18	0.3	>0.613	1.17	1.23	>0.329	1.21
Annual Lambda	1.04	0.1	>0.769	1.18	0.74	>0.438	N/A
Annual crude rate of birth	0.89	0.06	>0.821	0.74	1.07	>0.360	N/A
Annual crude rate of change	1.04	0.12	>0.746	1.18	0.77	>0.428	N/A
Genetic information							
Genetic diversity	0.8558	4.21	>0.109	0.9220	14.65	<0.019	0.9206
Inbreeding coefficient (F)	0.127	4.15	>0.111	0.050	42.17	<0.003	0.053
Mean Kinship	0.1442	4.21	>0.109	0.0780	14.65	<0.019	0.0794
Founders	11	23.04	<0.009	17	17.51	<0.014	16
N_e	9.10	3.48	>0.135	21.98	6.59	>0.062	15

[1]Fisher test, degrees of freedom (df=4,1).

[2]P-values < 0.05 indicate significant variability.

[3]Indicates data for stationary captive wild dog population alive in January 1997.

Figure 1. Population size (N) and effective population size (N_e) in relation to the number of founders in the captive wild dog (<u>Lycaon</u> <u>pictus</u>) population (1984 – 1996).

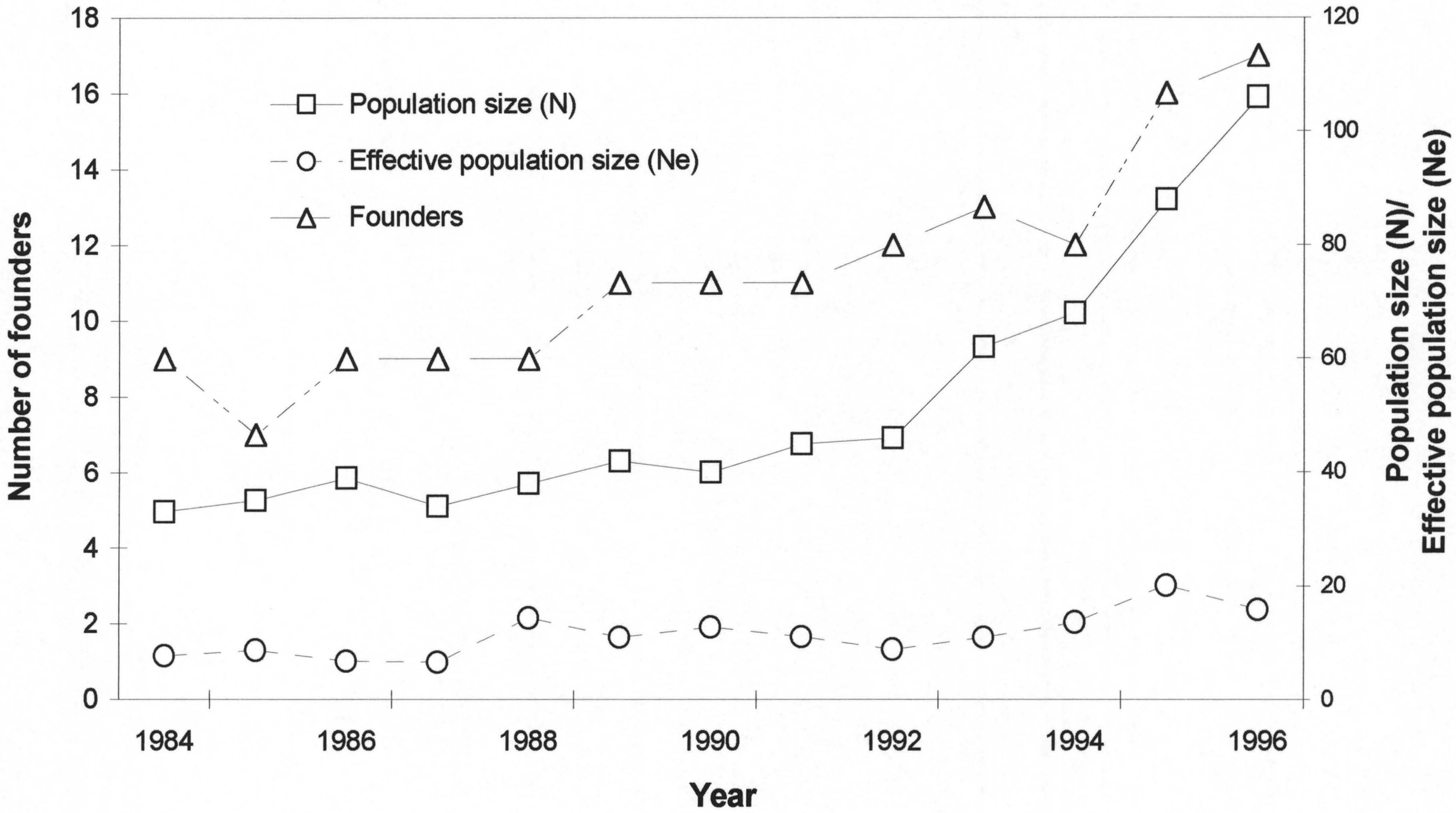


Figure 2. Mortality (fraction of population) and fecundity (number) of males and females in the southern African captive wild dog (Lycaon pictus) population (January 1997) according to age.

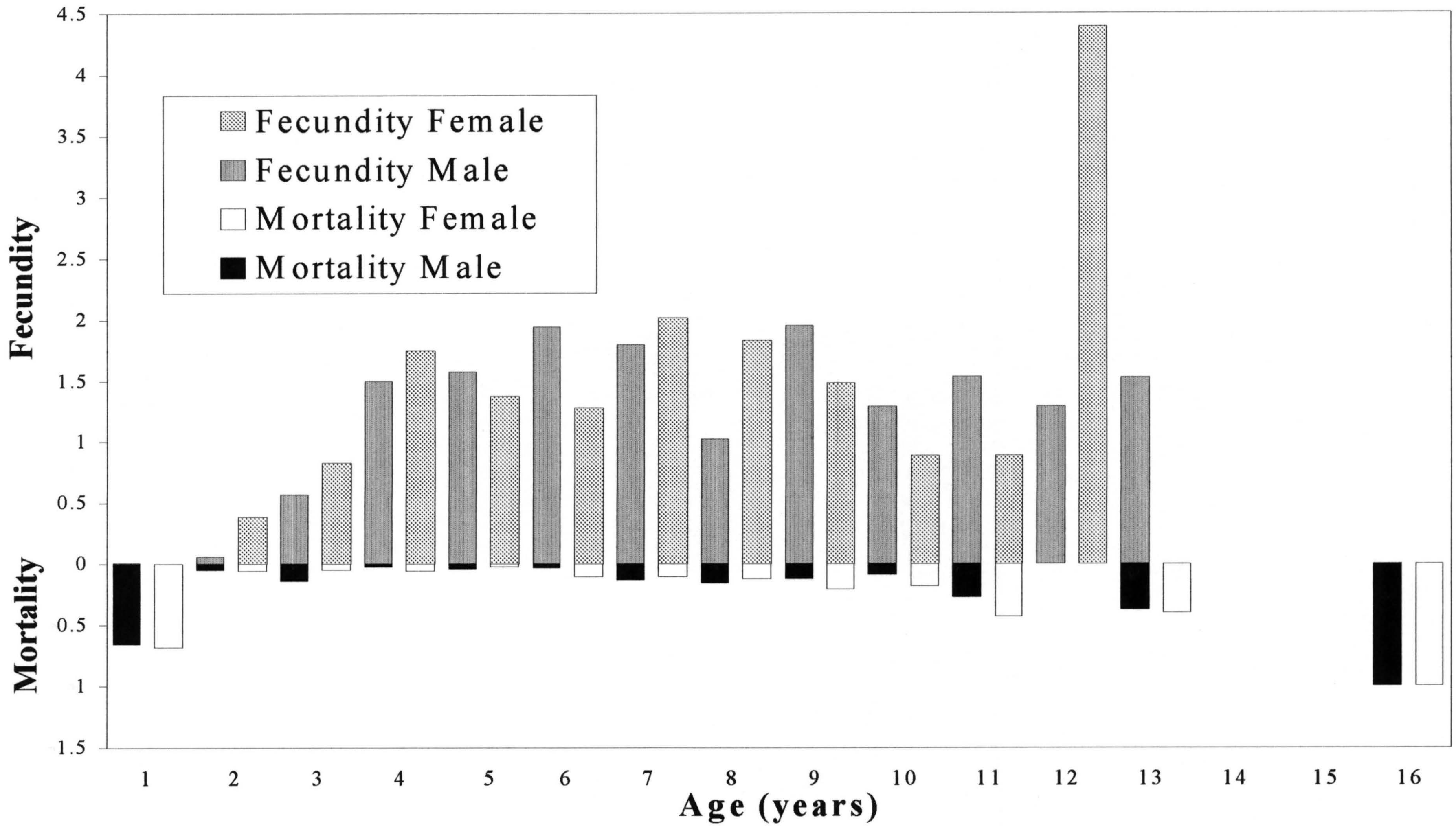
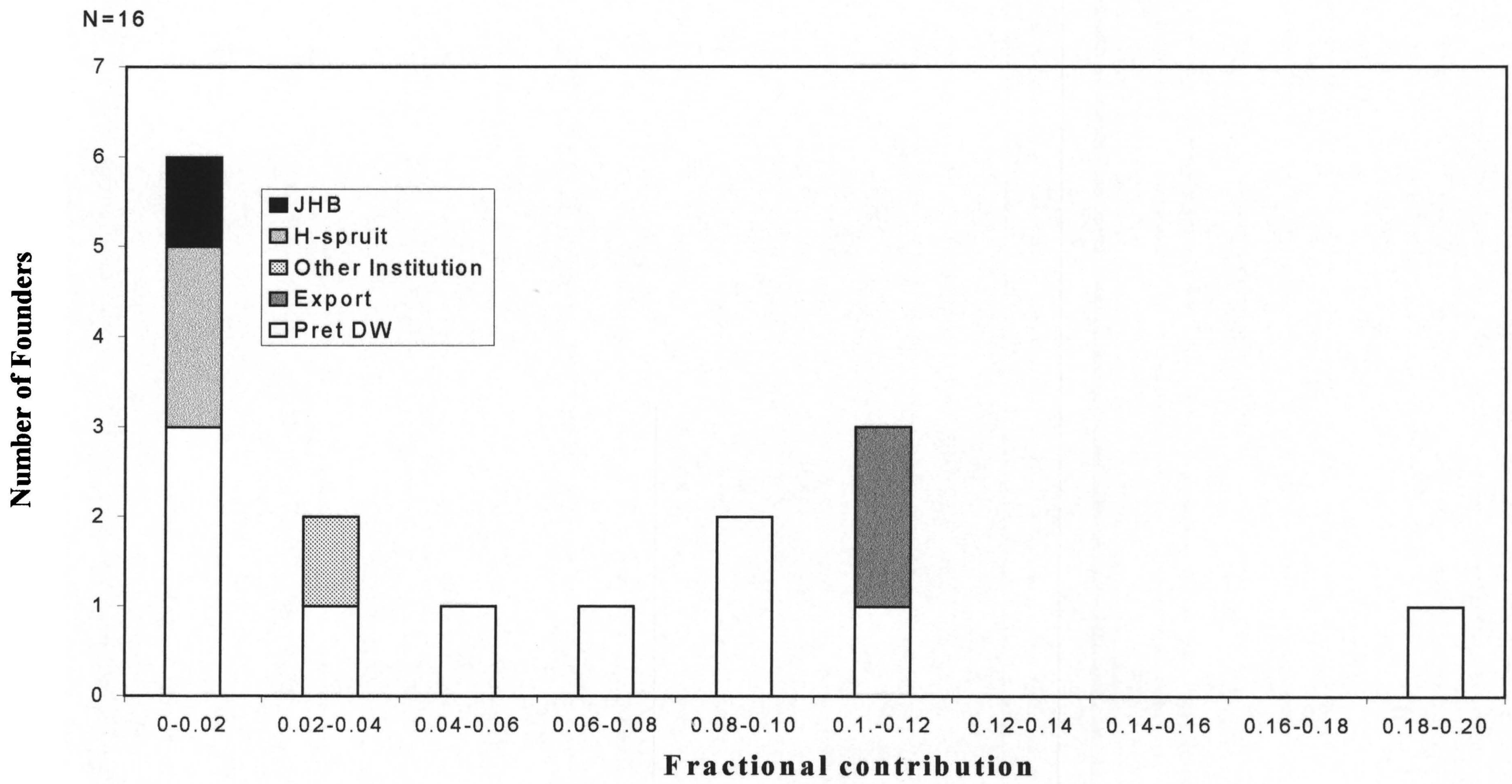


Figure 3. Number of founders and their fractional contribution of genetic material to the southern African captive wild dog (Lycaon pictus) population (January 1997) at Johannesburg Zoological Gardens (JHB); Hoedspruit Cheetah Project (H-spruit); De Wildt Cheetah Research & Breeding Center (Pret DW); Hartbeespoort Dam Snake & Animal Park (Other Institutions), and exported individuals from South Africa (Export).



CHAPTER III

EMPIRICAL EVALUATION OF PRESERVATION METHODS FOR FECAL DNA

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Abstract

We evaluate the relative effectiveness of four methods for preserving fecal samples for DNA analysis. PCR-assays of fresh fecal samples collected from free-ranging baboons showed that amplification success was dependent on preservation method, PCR-product size, and whether nuclear or mitochondrial DNA was assayed. Storage in a DMSO/EDTA/Tris/salt solution (DETs) was most effective for preserving nuclear DNA, but storage in 70% ethanol, freezing at -20^{0}C and drying performed about equally well for mitochondrial DNA and short (<200 bp) nuclear DNA fragments. Because fecal DNA is diluted and degraded, repeated extractions from feces may be necessary and short nuclear markers should be employed for genotyping. A review of molecular scatology studies further suggests that three to six feces per individual should be collected.

Introduction

Noninvasive molecular techniques are increasingly valuable in studies of free-ranging mammals (Woodruff 1993; Morin & Woodruff 1996; Kohn & Wayne 1997). Here we evaluate the relative effectiveness of methods for preserving endogenous DNA in fecal material from free-ranging baboons (*Papio cynocephalus ursinus*) of the Okavango Delta (Botswana). The fecal samples were collected as part of a long-term study on baboon social behavior and reproductive strategies (Silk 1987).

Although DNA has been recovered from feces that were dried (Höss et al. 1992; Kohn et al. 1995; Taberlet et al. 1997; Foran et al. 1997); preserved in 70% ethanol (Höss et al. 1992; Kohn et al. 1995), absolute ethanol (Gerloff et al. 1995); frozen at -20^0C(Reed et al. 1997; Foran et al. 1997) or in liquid nitrogen (Constable et al. 1995), the relative success of these methods has not been evaluated. However, this is critical information as it affects sampling strategy, experimental design, effort and costs associated with molecular scatology projects. We compared mitochondrial DNA (mtDNA) and single-copy nuclear DNA (scnDNA) amplification success from feces frozen (F) or dried (D), or preserved in DMSO/EDTA/Tris/salt solution (DETs), or in 70% ethanol (E70). The objective was to determine if DNA-amplification from feces is dependent on the preservation method. Our experimental approach was based on the assumption that both amplification length and amplification success are correlated with DNA quantity and quality (Pääbo 1989; Handt et al. 1994a; Kohn et al. 1995). We did not attempt to identify factors that determined DNA degradation. However, DNA in feces likely is affected by hydrolytic and oxidative damage, and conceivably enzymatic degradation (e.g. Linn 1981), similar to DNA in ancient tissue and bones (e.g. Lindahl 1993; Höss et al. 1997). Results will possibly vary according to species and ecological conditions at the study site. Therefore, our results should be applied cautiously to other populations and species.

Materials and methods

Sampling

Fecal samples from 22 members of a free-ranging group of baboons were collected immediatly after defecation between June and August 1995. Disposable gloves were used to sample from both the inside and outside of feces, which were subsequently mixed. Each fecal sample was divided into four parts and preserved using four methods: 1) dissolved in DMSO salt solution (DETs; 20% DMSO, 0.25M sodium-EDTA, 100mM Tris pH 7.5, and NaCl to saturation; Seutin et al. (1991)); 2) dissolved in 70% ethanol (E70), 3) frozen (F) in a standard commercial freezer (-20^0C), and 4) air dried (D) on a shelf in a cool, dry room of a thatched shed (complete dessication took between one to two weeks). About 2 g wet weight of sample were added directly to 1 ml of preservant (DETs, E70) kept in 2 ml screw-top vials. Dried and frozen samples were kept in paper bags and ziploc bags, respectively. Feces were shipped to UCLA where DNA analysis started in November 1995. In addition, control baboon blood samples were obtained from J. Dubach (Brookfield Zoo).

DNA extraction

Extractions were carried out in a separate room exclusively dedicated to DNA analysis of feces. Two blanks (reagents only) were included in each extraction to monitor for contamination (Handt et al. 1994b). To insure that differences in the amount of starting fecal material included in the extraction would not affect our subsequent analysis, we desiccated aqueous and frozen samples in a speed vacuum and compared their dry weight; 100 µl of aqueous sample yielded about 30 mg of dried solid sample. Thus, either 100 µl of liquid sample (DETs, E70) or 30 mg solid sample (D, F) was suspended in 1 ml of extraction buffer (5M guanidium thiocyanate [GuSCN]; 0.1M Tris-HCl pH 7.0; 0.2M EDTA pH 7.0; and 1.3% Triton X-100). We employed the silica-based extraction procedure (Boom et al. 1990; Höss & Pääbo 1993) following Kohn et al. (1995).

PCR amplification and DNA sequencing

Each fecal sample was divided into four parts and stored in DETs, E70, frozen, and dried. DNA extracted from these 88 samples was used as template in PCR-amplification of 'short' (100-200 bp), 'medium' (300-400 bp), and 'long' (600-700 bp) mtDNA and scnDNA fragments. Consequently, 528 PCR reactions were scored for presence or absence of product.

Primers for the amplification of fragments of 190 bp, 393 bp and 666 bp from the mtDNA cytochrome *C* oxidase subunit II gene were designed based on Disotell et al. (1992). Similarly, primers for intron 2 of the nuclear apolipoprotein E gene were designed based on Hixon et al. (1988) to amplify segments of increasing length of 149 bp, 365 bp and 614 bp. To reduce the risk of accidental amplification of mtDNA or scnDNA from human template, the heavy strand primer employed for all mtDNA amplifications (H Pcox; Table 1) was designed such that six mismatches could be identified with the homologue human sequence (Disotell et al. 1992) and the forward primer for scnDNA amplification (F apoE; Table 1) is located at a position deleted in the human homologue (Hixon et al. 1988). These markers were chosen because the sequences were already published allowing for the design of species-specific primers.

Wax-mediated hot start PCR reactions were set up as described (Kohn et al. 1995). PCR blanks (reagents only) were included with each experiment. After amplification in a programmable thermal cycler (Perkin Elmer Cetus 480) for 40 cycles with denaturation for 60s at 94^0C, annealing for 60s at the suggested temperature (Table 1), and extension for 60s at 72^0C, products were separated on 6% polyacrylamide mini-gels, visualized under UV light after ethidium bromide staining, and were compared to a 100 bp size ladder (Promega).

Prior to sequencing, PCR products were purified directly from the PCR reaction mixture (Ultrafree-MC 30000 filter units, Millipore Co.) following the supplier's instructions, sequenced using L Pcox (Table 1) following Bachman et al. (1990) with a Sanger DNA sequencing kit (USB), and aligned to the homologue sequences of human (Anderson et al. 1981), *P. c. hymadryas* , and *P. c. anubis* (Disotell et al. 1992).

Data analysis

Successful amplification was measured by the presence of PCR products of the expected size. We ignored intensity of amplification products and unspecific amplification products as long as they were of different size than the expected product. Data were analyzed in a three-step procedure: 1) results were arranged as a three-way contingency table which was analyzed using log-linear models (SYSTAT for Macintosh: *Statistics, Version 5.2 Edition.* Evanson, IL: SYSTAT, Inc., 1992. 724 pp). As factors, we tested the significance of preservation method (DETs, E70, F, and D), fragment length ('short' [100-200 bp], 'medium' [300-400 bp], and 'long' [600-700 bp]), and molecule (mtDNA and scnDNA) including their interaction terms. Pearsons Chi-square and likelihood ratio Chi-square were computed to test for significance of terms; 2) results of attempted amplifications of scnDNA (which should be more sensitive to degradation than mtDNA) from fecal extracts were arranged as randomized blocks and were tested by computing Cochran's Q and comparison to the Chi-square distribution (Sokal & Rohlf 1995); 3) finally, preservation methods were ranked based on their performance (Table 2). Methods ranked as 1 and 2, respectively, were compared with a McNemar test and the G-value was compared to the Chi-square distribution after application of William's correction (Sokal & Rohlf 1995).

Results and Discussion

Sequence authenticity and contamination

A portion of the cytochrome *C* oxidase II gene was sequenced from a baboon fecal sample to verify that amplification products obtained from feces were endogenous. The obtained sequence was distinguished from the human sequence at 27 sites but differed at three positions only from the *P. c. hymadryas* and *P. c. anubis* sequences. No other primate DNA has been isolated in our laboratory previously. If DNA from our positive controls was amplified accidentally, we would have observed high levels of contamination in our PCR controls, extraction blanks, and other scnDNA amplifications throughout our experiments.

Amplification efficacy

We were successful in amplifying baboon DNA in 340 of 528 (64%) PCR attempts. Positive PCR controls consisting of DNA isolated from blood always amplified indicating that the PCR mixture was viable. Preservation method had little effect on success or failure of PCR of mtDNA, regardless of target length. In contrast, amplifications of scnDNA from feces preserved in DETs were more often successful (42%) than amplifications from dried (35%) and frozen (27%) samples, and samples stored in E70 (27%) (Table 2). DETs buffer preserved extracts were the only ones that proved successful in amplifications of medium-sized (7/22) scnDNA fragments. Only dried (2/22) and DETs samples (2/22) produced long-sized PCR fragments.

In general, mtDNA was more easily amplified than scnDNA (96% versus 33%), and when scnDNA was examined separately it was obvious that short fragments were much more frequently amplified than medium and long fragments, respectively (86% versus 8% and 5%). In fact, PCR success dropped by about 91% between short- and medium-length amplifications. In contrast, short, medium and long mtDNA fragments were easily retrieved (92-100%, Table 2). Amplifications of long template generally seemed weaker and in addition to the product of expected length unspecific product of different length was occasionally observed (data not shown).

Statistical analysis showed that all factors (preservation method, molecule, and fragment length) have significantly influenced amplification success and that they were significantly associated (Pearsons Chi-square and likelihood ratio Chi-square; $p<0.05$). Thus, PCR-amplification success depended on the choice of molecule and size of PCR product. Computation of Cochran's Q supported that PCR-amplification success of scnDNA varied between preservation methods ($p<0.05$). As suggested by ranks assigned to preservation methods in Table 2, we found significant support ($p<0.05$) for DETs buffer as the most effective preservation method for scnDNA (Chi-square 4.05 compared to the critical value 3.84; Sokal and Rohlf 1995).

Nuclear loci such as microsatellites are often analyzed when studying paternity and kinship (e.g. Queller et al. 1993). On average, in 86% of attempted amplifications of short scnDNA PCR product was obtained. In general, repeated PCR of extracts which had not yielded product in a first attempt did not yield PCR product (data not shown). However, for all 22 feces (i.e. all members of the troop) further extractions eventually yielded short scnDNA suitable for PCR amplification. On average, we needed 1.16 extractions (range 1-4) per fecal sample (i.e. baboon) to achieve at least one successful amplification of short scnDNA.

Implications for sampling and experimental design

We recommend that DETs buffer should be used to preserve feces collected in the field. Our results are consistent with those of Seutin et al. (1991) who found that DETs buffer was as efficient as cryopreservation (-70^0C) at slowing DNA-degradation in tissue samples and greatly outperformed 70% ethanol. However, as evident from our results and previous studies, other preservation methods are also useful for fecal DNA storage and perform almost equally well for mtDNA or short nuclear DNA analysis (Table 2). For example, PCR amplification of mtDNA and of short scnDNA from dried samples was more often successful (though not significant) than amplification from DETs preserved samples (Table 2). Note, that our drying procedure under field conditions has not been optimal as samples took up to two weeks to dessicate completely. Addition of silica particles to feces causes drying and storage to be more effective (Wasser et al. 1997). Moreover, preservation in 70% ethanol might have been more effective when either less than 2g of sample were mixed with 1 ml of fluid or a higher percentage of ethanol would have been used as the ethanol might have been too diluted. However, Wasser et al. (1997) have found that 70% ethanol was less effective than drying, freezing and DMSO-salt buffer even when mixed at a ratio of 1g per 5 ml fluid. That all methods tested in our study perform well is pertinent information when logistic or other practical obstacles prevent the use of the optimal storage method.

An average of 1.16 extractions (range 1-4) was necessary to achieve at least one successful PCR of short scnDNA. Repeated PCR on the same extraction usually did not result in product when the initial PCR failed. However, replication of PCR may be necessary for verification of results. Elsewhere it has been shown that simply obtaining PCR-product is easier than obtaining a correct sequence or genotype (e.g. at a microsatellite locus), especially when amplifying from very dilute or degraded template (Foulcault et al. 1996, Taberlet et al. 1996; Gagneux et al. 1997).

A review of molecular scatology studies shows that on average 31% of fecal samples did not yield scnDNA or mtDNA, even after repeated extractions (Table 3). Consequently, given a frequency of failure of 0.31, based on the binomial theorem the resulting probability of obtaining no PCR product from three or six samples is <0.05 or <0.01, respectively. Therefore, we recommend that at least three to six feces per individual animal should be collected to ensure recovery of both short scnDNA and mtDNA from at least one of these. However, it was not clear if all previous studies systematically attempted to recover DNA from each sample by repeated extractions, such that our recommendation may be somewhat overcautious. For example, human feces consist of large amounts of intestinal mucosal cells sloughed off during digestion (Despopoulos 1986; Albaugh et al. 1992), thus, if properly preserved, one might expect that every fecal samples should yield sufficient DNA for analysis. Nonetheless, more samples may be preferable, as they provide some margin of error given the variation in preservation conditions, ecological- and species-specific factors influencing DNA preservation and concentration. Based on our findings and data available to date it is yet unclear how to ensure long-term curation of fecal samples. It has been noted that DETs solution is effective for at least 24 weeks (Seutin et al. 1991) and that all storage methods are more effective at -20^{0}C than at room temperature (Wasser et al. 1997).

Molecular scatology may be augmented with fecal steroid hormone analysis (Kohn & Wayne 1997). Either an additional sample can be stored in the appropriate buffer for hormone analysis (Wasser et al. 1991), or a pilot study may determine if a single preservation method is suitable for both DNA- and hormone analysis.

In conclusion, we have confirmed that it is possible to extract both mtDNA and scnDNA from fecal samples preserved in four different ways. Fragments less than 200 bp are more reliably amplified than fragments longer than 300 bp. Our results suggest that the DMSO salt solution (DETs) is the most appropriate method to preserve nuclear fecal DNA if fragments longer than 300 bp are desired products. Investigators should aim to collect three to six feces per individual, anticipate multiple extractions per sample, and employ short scnDNA markers only to ensure effective and accurate genotyping.

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Author Information Box

M. Frantzen is a graduate student of J. Ferguson of the University of Pretoria (South Africa). This pilot study was initiated by J. Silk to investigate which preservation method would be most useful and practical for planned large-scale sampling of baboon feces in the Okavango Delta. The eventual goal is a genetic analysis of the social behavior and reproductive strategies of baboons. The work and analysis were conducted in the lab of R. Wayne by M. Frantzen and M. Kohn. All of the authors are captivated by the possibility of using noninvasive sampling to study evolution, behavior and conservation of free-ranging animal populations.

Table 1. Primer sequences, annealing temperatures, and expected PCR-product sizes. Pcox primers amplify portions of the mitochondrial cytochrome C oxidase subunit II gene. ApoE primers amplify portions of the baboon apolipoprotein gene E. Fragments between 100-200 bp were called 'short', 300-400 bp 'medium' and 600-700 'long'.

Forward primer	Reverse Primer	5' to 3' primer sequence	Annealing temperature (^0C)	Expected product (bp)	length attribute
L Pcox1		TCACATCTCAAGACGTACTAC	53	190	short
L Pcox3		GACAGACGAAATCAATAACC	52	393	medium
L Pcox6		CTCATCCAGTGCAACTAGGC	55	666	long
	H Pcox	TTTAGTGGAATCAGCTCTGC			
F apoE		TGTACTTTGAGTAGGGAAGGG			
	R apoE1	ACTCCTATATTAAGGATGGG	57	149	short
	R apoE3	AGTTAGTCGGGTGTGGTGG	57	365	medium
	R apoE6	TATTGAGTGTCCTTGTGTGC	57	614	long

Table 2. Three-way table summarizing results of 528 PCR-attempts from 'short', 'medium', and 'long' mitochondrial (mt) DNA and single-copy nuclear (scn) DNA isolated from feces. Fecal samples were stored in DMSO/EDTA/Tris/salt solution, (DETs); 70% ethanol, (E70); frozen, (F); and dried, (D). Percentages were rounded to whole numbers and are given in parenthesis.

		Preservation method				
Molecule	**Product**	**DETs**	**E70**	**F**	**D**	**Total**
MtDNA	**short**	22	22	22	22	88 (100)
	medium	22	19	22	22	85 (97)
	long	20	20	19	21	80 (92)
Subtotal		64 (97)	61 (92)	63 (95)	65 (99)	253 (96)
ScnDNA	**short**	19	18	18	21	76 (86)
	medium	7	0	0	0	7 (8)
	long	2	0	0	2	4 (5)
Subtotal		28 (42)	18 (27)	18 (27)	23 (35)	87 (33)
Total		92 (70)	79 (60)	81 (61)	88 (67)	340 (64)
Rank		**1**	**4**	**3**	**2**	

Table 3. Review of recovery-success of mtDNA and scnDNA in molecular scatology studies. The number of fecal samples which yielded DNA (numerator) is compared to the number of fecal samples examined (denominator). Percentages were rounded to whole numbers and are given in parenthesis.

	mtDNA	scnDNA	Successful DNA recovery from fecal samples
This study	x	x	22/22 (100)
Kohn et al. 1995	x	x	8/12 (67)
Gerloff et al. 1995		x	31/33 (94)
Reed et al. 1997		x	156/173 (90)
Taberlet et al. 1997		x	21/105 (20)
average			**238/345 (69)**

CHAPTER IV

VALIDITY OF MICROSATELLITE SCORES OBTAINED FROM PRIMATE (*Papio cynocephalus ursinus*) FAECES

Abstract

The purpose of this study was to determine if DNA amplified from faeces could produce reliable genotypic information for 22 free-ranging baboons from the Okavango Delta, Botswana. Eight extractions were performed on each faecal sample. Mitochondrial (Pcox) and nuclear (ApoE) DNA amplified from the same individuals using species-specific primers resulted in 164 successful amplifications out of 176 attempts. Genotypes obtained from these amplifications were consistently reproducible. In contrast, PCR (polymerase chain reaction) of samples using three human microsatellite loci (D6S311, D7S503 and D13S159) yielded 278 successful amplifications from 528 attempts. However, only 54 of the 278 successful amplifications yielded consistent genotypes when scored. Inconsistencies included suspected allelic dropout, three alleles at one locus in a single amplificon, and the appearance of multiple genotypes per individual per locus. From this study it is evident that faecal DNA analysis is a useful tool in population studies. However, caution should be practised when amplifying microsatellites using hetero-species specific primers and trace amounts of DNA.

Introduction

Technology recently developed to extract faecal DNA, has allowed a non-invasive means of providing DNA to genotype free-ranging mammal populations (Höss *et al.* 1992; Constable *et al.* 1995; Gerloff *et al.* 1995; Kohn *et al.* 1995; Morin and Woodruf 1996; Tikel *et al.* 1996; Foran *et al.* 1997; Reed *et al.* 1997; Wasser *et al.* 1997, Frantzen *et al.* 1998). Safely immobilising animals to perform biopsies is time consuming, and may require extensive equipment and previous experience with veterinary procedures. The collection of faecal material is a relatively easy way to acquire tissue cells from target subjects with little or no harmful consequence to that individual (Höss *et al.* 1992; Constable *et al.* 1995; Gerloff *et al.* 1995; Kohn *et al.* 1995; Tikel *et al.* 1996; Wasser *et al.* 1997). Molecular genetic analysis of faecal DNA can be used to address questions concerning mating systems and social organisation, which cannot always be determined by observation alone (Gerloff *et al.* 1995; Reed *et al.* 1997; Taberlet *et al.* 1996; Taberlet *et al.* 1997).

Scientists are currently experiencing difficulties in obtaining reliable scores from faecal DNA. Many report genetic instability at microsatellite loci causing false homozygotes, allelic drop out, PCR artefacts, and inconsistent genotypes. These results are attributed to the presence of low copy number and degraded DNA (Gerloff *et al.* 1995; Taberlet *et al.* 1996; Gagneux *et al.* 1997). Various components of the faecal matter may also cause PCR inhibition, preventing detection of some alleles or loci (Höss *et al.* 1992).

As part of a long-term study on baboon (*Papio cynocephalus ursinus*) social behaviour and reproductive strategies (Silk 1987), our goal was to obtain reliable genotypic data from a free-ranging baboon population using faecal DNA. To achieve this aim we tested the feasibility of implementing human primers, of which many have been published, for amplifying microsatellites in baboons. However, no baboon-specific microsatellites have been published to date. We hoped to confirm relationships among 22 individuals of a baboon group from the Okavango Delta, Botswana.

Materials and methods

Sampling and DNA extraction

Faecal samples from 22 baboons were collected between June and August 1995. DNA analysis started in November 1995. Baboon blood samples (#32, #34, #52, and #54) were obtained from J. Dubach (Brookfield Zoo). Two human blood samples were used as positive controls. Eight extractions per faecal sample were carried out in a separate room exclusively dedicated to faecal DNA analysis. Two blanks (reagents only) were included in each extraction to monitor for contamination (Handt *et al.* 1994b). We employed the silica-based extraction procedure (Boom *et al.* 1990; Höss & Pääbo 1993) following Kohn *et al.* (1995). To ensure that differences in the amount of starting faecal material would not affect our subsequent analysis, we desiccated aqueous and frozen samples in a speed vacuum and compared their dry weight. About 30 mg of sample was suspended in 1 ml of extraction buffer L6 (5M guanidium thiocyanate [GuSCN]; 0.1M Tris-HCl pH 7.0; 0.2M EDTA pH 8.0; and 1.3% Triton X-100). This was followed by a brief vortex to obtain a thorough suspension of the sample before the solution was incubated for 1 hour at room temperature. After centrifugation at 6000rpm for 2min, approximately 700 µl of supernatant was recovered and transferred to a mixture of 300 µl extraction buffer L6 and 50 µl of DNA binding silica matrix (prepared as in Boom *et al.*, 1990), followed by a 30min incubation at room temperature. After a second centrifugation (6000rpm) the supernatant was discarded and the silica pellet was subsequently washed twice with the washing buffer, L2 (5M GUSCN; 0.1M Tris-HCl (pH 6.4); 0.2M EDTA (pH 8.0) (Boom *et al.*, 1990)), and 70% EtOH respectively. After drying the pellet at 60^0C for approximately 2 hours, the DNA was eluted in 100 µl sterile H_2O at 60^0C for 10min and stored at -20^0C until further use.

PCR amplification of mtDNA and scnDNA

Primers for mtDNA and scnDNA amplification were chosen from published baboon DNA sequences, which made it possible to design species-specific primers. A fragment, approximately 190 bp, from the mtDNA cytochrome C oxidase subunit II gene (Disotell *et* *al.* 1992), and a second fragment, approximately 149 bp, from intron 2 of the nuclear apolipoprotein E gene (Hixon *et al.* 1988) were amplified from the extracts. The mtDNA primer (H Pcox) was designed to amplify sequence from a baboon sample that would differ from the homologue human sequence by 6 nucleotides (Disotell *et al.* 1992). The scnDNA primer (F ApoE) was designed to anneal to a position on the baboon sequence that was non-existent in the homologue human sequence (Hixon *et al.* 1988). These precautions were taken in order to reduce the risk of accidental amplification of mtDNA or scnDNA from human template.

We performed a wax-mediated hot start PCR (Chou *et al.*, 1992), amplifying 1µl of control DNA (blood samples obtained from the Brooksfield Zoo and human controls) and 5µl of faecal DNA per 30µl reaction mixture. Negative PCR controls were also included with each experiment. Reactions were set up in two phases of equal volumes separated by a wax bead. The first phase contained a cocktail consisting of 1.5µl of 10 × Taq buffer (Promega); 0.9µl H_2O and 6.0µl of 5mM $MgCl_2$ (Promega); 0.6µl of a mixture of 0.2 mM of each dNTP (dATP; dGTP; dCTP; and dTTP); 4.0µl of 10 mg/ml BSA (Sigma A-9647) and 1µl of 10µM of each unlabeled primer. Subsequently, the tube was heated to 60^0C to melt the wax, and then allowed to cool down. The top part of the PCR mix consisted of the second half of the total final volume contained the "mix up" (1.5µl of 10 × Taq buffer and 8.35µl H_2O), 0.15µl (0.75 units) of the *Taq Polymerase* enzyme (Promega 5u/µl) and 5µl of faecal DNA or 1µl of control (blood) DNA per reaction. Amplification was performed in a Perkin Elmer Cetus DNA thermal cycler (480). Each of the 40 cycles consists of a denaturation step to separate the DNA strands at 94^0C for 60s, annealing at the suggested temperature (see table 1) for 60s, extension at 72^0C for 60s, and a further cool down to 4^0C. Amplification products were separated on a 6% polyacrylamide mini-gel. One µl of a 100bp molecular weight marker (PROMEGA G210A) and 5 µl of PCR product was run at 150V for approximately 45 min. The gel was stained with Ethidium Bromide for 10 min, and subsequently visualised under a UV light to check for contamination in the PCR and extraction blanks, conformation of fragment size, and to quantify the DNA present.

PCR Amplification of microsatellites

We selected three human microsatellite loci D6S311, D7S503 and D13S159 (Altmann *et al.*, 1996) for the amplification of fragments of 344 bp, 235 bp and 203 bp in size, respectively. In part these loci were chosen because they are situated on different human chromosomes, minimising the possibility of linkage effects (Table1). In addition, each locus has a mean heterozygosity value of > 0.8 in humans (Coote *et al.* 1996). Microsatellite loci in *Papio cynocephalus ursinus* ranged between 230-276 bp (D6S311), 148-180 bp (D7S503), and 169-203 bp (D13S159) in fragment size.

Wax-mediated hot start PCR reactions were set up as described above except for the [$MgCl_2$] which was reduced from 5mM to 0.5mM to increase specificity (Roux, 1995). PCR blanks (reagents only), blood samples and human DNA were included with each experiment. Primers were labelled in a kinase reaction prior to the wax-mediated, hot start PCR. Primers D6S311GT, D7S503GT and D13S159GT were end-labelled with γ-^{32}P (Audotek 3000Ci/mmol) during the PCR reaction. A reaction mixture containing 8µl primer, 2.5µl of 10× T_4 Polynucleotide Kinase reaction buffer, 11.5µl H_2O, 1.5µl T_4 Polynucleotide Kinase (0.75µl kinase enzyme and 0.75µl H_2O) and 2µl γ-^{32}P was incubated in a 37^{0}C waterbath for 45 min. Subsequently, 0.32µl of this labelled primer reaction was added to the mixture above the wax barrier (Morin *et al.*, 1994). Samples were amplified for 40 cycles with denaturation for 60s at 94°C, annealing for 60s at 55°C and extension for 60s at 72°C. Amplification products were resolved in denaturing polyacrylamide (6%) for approximately 3 hours at 55W. Gels were dried for 45min and exposed for up to 72 hours, depending on the activity of the incorporated γ-^{32}P, and visualised by autoradiography. Fragment sizes were compared to a M13 control DNA sequence (Amersham).

Scoring of Microsatellite Data

When multiple genotypes were detected within one locus of an individual, we scored such amplifications as inconsistent. When the same genotype was reproduced exclusively within a locus of an individual, we recorded each amplification as a consistent result. We assigned the term "three alleles" to genotypes composed of three alleles. We suspected allelic drop out when we scored a homozygotic allele which was the same size as one of the two alleles in a heterozygote that appeared at least twice for the same locus. Both "three alleles" and the suspected allelic drop out amplifications were also defined as inconsistencies.

Results

We attempted a minimum of 24 amplifications for each of the 22 faecal samples and four blood positive control samples from captive individuals. We designed species-specific primers to amplify mitochondrial DNA (PCox) and nuclear DNA (ApoE) from all baboon individuals (Frantzen *et al.*, 1998). These primers amplified fragments in the same range as our human primers. We attempted 88 amplifications and were successful 100% of the time when using mtDNA, however our success rate dropped to 86% of all attempts with the scnDNA. The extracted nuclear DNA amplified with human primers yielded successful amplifications in 277 (52%) of 528 PCR attempts.

The number of successful amplifications across microsatellite loci, ranged from eight to 19 out of 24 attempts for each individual (Table 1). Our rates of successful amplification were 64%, 45%, and 48%, and the percentage of resulting consistent genotypes were 27%, 21%, and 7%, for loci D6S311, D7S503, D13S159 respectively (Table 2). Contamination was detected in the PCR blank control on 4 separate acrylamide gels. Therefore, 88 (17%) of the 528 total PCRs were not scored. DNA isolated from the blood of four captive baboons served as positive controls and amplified reliably yielding consistent (repeatable) genotypes every time (Table 1). Human DNA served as positive controls to determine possible human contamination. The human alleles amplified at each attempt, but occasionally the genotype identified fell within baboon allele size ranges. Faecal DNA from 54 (20%) of 277 successful amplifications resulted in consistent genotypes (Table 1). All 80 (100%) amplifications using baboon blood yielded consistent genotypes (Table 2).

Unreliable genotypes expressed per individual ranged between 44% and 100% of the amplifications proving inconsistent (Table 1). There was no correlation between the number of successful amplifications and the percentage of consistent genotypes within an individual. For example, samples from BS and NN both produced 12 successful amplifications, however 0% versus 66% of amplifications, resulted in consistent genotypes respectively (Table 1).

One inconsistency was defined as a false homozygote due to allelic dropout. Allelic dropout was suspected in three individuals. Another inconsistency was due to the occurrence of three alleles for a single locus. The "three allele" inconsistency occurred twice with AL (D6S311) and WA (D6S311). Inconsistencies were observed for 14, 15, and 21 individuals in loci D6S311, D7S503, and D13S159 respectively.

Discussion

The primary objective of this study was to determine if consistent (reliable) genotypes could be obtained when amplifying microsatellites from faecal DNA with heterospecific primers. Our data produced multiple genotypes appearing at one locus, suspected false homozygotes due to allelic dropout, and a number of unsuccessful amplifications, resulting in difficulties in obtaining reliable and consistent data. However, the pilot study involving microsatellites proved useful in identifying those technical improvements in methodology that should be employed in the genotyping of individuals. These include, the quantification of extracted DNA (Gagneux *et al.* 1997, Foulcault *et al.* 1996) used in PCR amplifications, the use of species-specific primers to amplify microsatellites, and the use of reliable positive controls.

Species-specific primers were used to successfully amplify mtDNA from all 22 individuals, opposed to an 86% success rate using scnDNA. However, using human primers to amplify microsatellites from the same individuals decreased this rate to 18%. Species-specific primers had greater PCR amplification success, and yielded 100% consistent genotypes with mtDNA, while microsatellite loci amplified with human primers resulted in decreased amplification success and fewer consistent genotypes (7-27%) (Table 1). We were able to exclude the possibility of contamination when using species- specific primers, but this was not possible when human primers were used because size ranges of baboon and human alleles overlapped (Coote, *et al.* 1996).

Faecal DNA is recovered from epithelial cells sloughed off in the digestive tract. Each cell contains multiple copies of mtDNA (up to 2,500) (Kohn, *et al.* 1997) opposed to the single copy present in nuclear DNA. Therefore, some unsuccessful amplifications and incorrect genotypes could be attributed to the low copy number present in faecal scnDNA. We did not measure extractions for DNA quantity, and therefore were unable to define the threshold amount of DNA that would yield a PCR product. This may be a useful practice in future studies when dealing with such trace amounts of DNA in defining the minimal amount needed for PCR success. In addition, we might lower the occurrence of false homozygotes as a result of allelic drop out, assuming that allelic dropout is a result of low copy numbers of DNA (Gagneux *et al.* 1997).

Blood samples drawn from individuals of a captive group provided ample DNA as positive controls, and routinely demonstrated consistent genotypes. Accompanying faecal samples from these individuals to perform side by side comparisons may have proved useful in the pilot study to confirm that results using faecal DNA are reliable, since it was difficult to obtain consistent microsatellite genotypes using faecal DNA from most individuals of the Okavango group. Therefore, if DNA from faecal and blood sources yielded the same genotypes within the captive group, it would increase levels of confidence that faecal DNA accompanied with behavioural data would be sufficient for genotyping free-ranging baboon populations.

PCR inhibition may cause erroneous results in microsatellite analysis of faecal DNA. Fibrous plant material in faecal matter may inhibit *Taq* polymerase during PCR amplification (Höss *et al.* 1992; Kohn *et al.* 1995; Gerloff *et al.* 1995). It is also possible that bacterial DNA may be amplified, as well as hair or other tissue samples that may be ingested during grooming behaviour (Wasser *et al.* 1997). This emphasises the importance of reliable positive controls, and species-specific primers. These precautions may be useful for preventing erroneous genotypes, and for increasing the likelihood that the intended individual's DNA is amplified.

It further appears that human microsatellite primers are not useful for amplifying baboon microsatellite genotypes from faeces. The hetero-specific approach is therefore not feasible, and one should seriously look into developing species-specific baboon primers, prior to engaging in further studies on baboons.

For future studies involving faecal DNA analysis we suggest faecal samples should be collected in such a manner as to avoid possible human contamination, and species-specific primers should be used. We also advise collection of faeces and additional samples from individuals of a captive population, including hair, tissue, and blood if possible for comparison and positive control purposes alongside faecal samples and behavioural data of free-ranging populations. Quantification of DNA should also be performed on each extract to verify that the minimal amount of DNA is present for reliable amplification success and accurate genotype analysis.

It is evident from this study that microsatellites can be amplified from faeces. This approach could be useful in future captive breeding, and behavioural ecological research.

Table 1. Combined scores of three microsatellite loci (D6S311, D7S503 and D13S159) from faecal DNA analysis of 22 individuals. Data include number of homozygous and heterozygous loci for an individual, inconsistencies present in the population due to wrong genotypes, occurrence of false genotypes, and combinations of multiple genotypes for one individual.

	Individuals																												
	Blood samples				**Faecal samples**																								
Result type	#32	#34	#52	#54	AL	BT	BS	CT	DG	GT	GE	HL	HR	HK	KL	LK	MR	MG	NN	NI	SL	SH	SR	SY	TK	WA	**Total**	**Total (Blood)**	**Total (Faecal)**
PCR Amplifications;																													
Contamination	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	**104**	**16**	**88**
Successful	20	20	20	20	10	11	12	17	16	14	13	11	14	12	13	8	15	9	12	14	10	12	12	12	11	19	**357**	**80**	**277**
Genotypes;																													
Homozygous loci	8	8	8	8	7	9	10	15	10	9	12	10	8	11	12	7	9	7	11	5	8	9	9	10	9	8	**237**	**32**	**205**
Heterozygous loci	12	12	12	12	1	2	2	2	5	4	1	1	6	1	1	1	6	2	1	9	2	3	3	2	2	10	**115**	**48**	**67**
Consistent genotypes	20	20	20	20	0	5	0	6	0	0	3	0	0	4	2	4	8	2	8	0	4	2	0	6	0	0	**134**	**80**	**54**
False Genotypes;																													
Three Alleles					1																				1		**2**	**0**	**2**
Suspected Allelic Dropout					1				1	1																**3**	**0**		**3**
% Consistent	**100**	**100**	**100**	**100**	**0**	**45**	**0**	**35**	**0**	**0**	**23**	**0**	**0**	**33**	**15**	**50**	**53**	**22**	**66**	**0**	**40**	**17**	**0**	**50**	**0**	**0**	**38**	**100**	**19**

Table 2. A summary of 704 PCR-attempts resulting in successful amplification (percentages given in parenthesis) and percent consistent genotypes from amplification of mitochondrial DNA (mtDNA), single-copy nuclear DNA (scnDNA), and microsatellite DNA isolated from faeces. Range of fragment size and origin of primer type are also shown. Percentages are given in parenthesis.

Molecule	**Region Amplified**	**Fragment size**	**Range**	**Primer**	**Successful Amplification**	**% Consistent**
mtDNA	PCox	190 bp	190 bp	Baboon	88 (100%)	**100**
scn DNA	Apo E	149 bp	149 bp	Baboon	76 (86%)	**100**
Microsatellites	D6S311	344 bp	230-276 bp	Human	113 (64%)	**27**
	D7S503	235 bp	148-180 bp	Human	80 (45%)	**21**
	D13S159	203 bp	169-203 bp	Human	85 (48%)	**7**

CHAPTER V

SYNTHESIS AND CONCLUSION

SYNTHESIS AND CONCLUSION

The primary goal of this study was to explore the role of genetic analysis in African wild dog (*Lycaon pictus*) conservation programs. From this perspective, the ultimate success of a conservation program depends on the integration of a number of activities. These include: breeding programs, which incorporate demographic and genetic analysis for the planning of long term survival management strategies, successful reintroduction programs ensuring the survival of captive wild dogs released to wild conditions and, finally, the co-operation among captive breeding institutions, scientific research institutions, conservation organisations and managers of nature reserves as well as the owners of properties surrounding these nature reserves.

The exchange of wild dogs among different captive breeding institutions is crucial for the long-term survival of wild dogs. This study suggests that the African wild dog population in South Africa should be managed as one population, rather than a number of localised demes, one for each captive breeding institution. The genetic analysis of captive dogs revealed that measurable inbreeding exists in the southern African captive populations. Breeding pairs often comprise closely related individuals. In addition, founders are not used optimally as is reflected by an uneven representation of genetic material. Therefore, the current management strategies are likely to result in a loss of important genetic material.

Accurate record keeping of genealogical relationships of breeding pairs is essential in the development of efficient breeding programs. An internationally recognised database must be constructed and maintained with the combined effort of all captive breeding programs and researchers, which would provide demographic and genetic data for all captive wild dogs to any interested party. An assessment of the current captive programs, using limited genetic information, revealed that genetic relatedness of captive wild dogs needs to be an important data item in this database. Genetic information is essential to determine accurate relationships between different individuals in the population in order to determine optimal breeding pairs and retain optimal genetic diversity levels in the population. Standard protocols must be devised which require that the database be consulted before any exchange of captive wild dogs is implemented between captive-breeding institutions. This would ensure that management decisions would consider the long-term effects of a potential exchange on the entire captive wild dog population.

Traditionally, invasive techniques have been the only practical avenue for collecting genetic material for management or for research purposes. Since these procedures are costly and potentially harmful to the captive animals, many wild dogs have not been assayed genetically. Our studies suggest that non-invasive molecular techniques constitute a relatively inexpensive alternative for obtaining genetic information from captive wild dogs. In a pilot study (using baboons) we were successful in extracting and amplifying mitochondrial and nuclear DNA from faecal matter preserved by four methods and using species-specific primers. Therefore, we would recommend the use of species-specific primers in conjunction with this non-invasive technique for future acquisition of genetic information from wild dogs.

A pilot study of baboon microsatellites investigated intrapopulation genealogical relationships. The use of human-specific versus baboon-specific primers may have been the primary cause for our inability to produce reliable data that could be used to construct genetic relationships among the members of the baboon population. Our conclusion was based on our previous success in amplifying faecal nuclear DNA using species-specific primers. This study emphasised the importance of future attempts to generate microsatellite data using species-specific primers (if possible using DNA extracted from faeces) to establish the within-population relationships of captive wild dogs.

Demographic data proved indispensable in our assessment of current captive populations. The breeding programs have maintained viable, self-sustaining populations under captive conditions. However, we also found a high rate of pup mortality prevalent among the entire captive breeding population. Various demographic studies (Burrows *et al.*, 1994; Ginsberg *et al.*, 1995; Maddock and Mills 1994; and van Heerden 1986) have addressed this problem and several divergent causes have been attributed to this phenomenon. However, much more research on this topic needs to be conducted. Intensive demographic studies focusing on captive wild dogs reintroduced into the wild also need to be performed. Wild dogs may survive mild catastrophes when reintroduced due to their resilient breeding habits, but harmful factors that affect reintroduced wild dogs must be studied and counteracted. This is emphasised by the fact that, despite the fairly resilient nature of wild dogs, an alarming rate of failure of re-introductions to the wild has been documented. Reasons for this include inexperience of captive dogs as hunters, starvation, predation by lions, poisoning, disease, and other human-related factors. The data on the causes of failed re-introductions are critical to optimising these programs. However, valuable lessons have been learnt from these failed re-introductions. Firstly, strict criteria need to be applied for selecting candidates for reintroduction. For example, these wild dogs must be able to hunt, be disease resistant, able to socialise with members of their pack, interact with other species of that habitat, and they must be genetically healthy and variable. Secondly, wild-caught animals must accompany any captive born wild dogs that are reintroduced to serve as models for appropriate behaviour in the natural habitat. Thirdly, the habitat in which they are to be released must be well protected from intrusion by disease-infected domesticated animals and poachers. The hunting range must be large enough to support an adequate prey base and the habitat must be closely monitored to ensure that optimal conditions for the wild dogs within the habitat are maintained.

A fourth requirement for successful re-introductions appears to be important. Studies of the failed re-introductions suggest that interference by man is a predominant source of mortality. Public support plays an invaluable role in these reintroduction attempts. Therefore, programs designed to educate local communities about the plight of this endangered animal and to dispel hostility toward the wild dog must precede reintroduction attempts at sites where man and wild dog may come in contact. At these sites, re-introductions must take place only when the local communities are at ease or even positive towards the release of captive wild dogs. Compensation programs for local individuals might be considered in rallying much needed support in areas that appear ideal for re-introductions.

This study achieved two aims. Firstly, it showed that, in contrast with numerous other endangered lagomorph and ungulate taxa, captive African wild dogs can be bred successfully in relatively large numbers. This makes the wild dog a good target species for re-introductions in the wild. Secondly, this study suggests novel molecular techniques that are applicable to the management of these predators, which are rather sensitive to physical handling. From a technical point of view there are few impediments for a successful conservation program for wild dogs. However, the most important limiting factor in the wild dog conservation program does not appear to be biological processes related to population fragmentation, demography or genetics. Two human-related phenomena are paramount. Firstly, it is the (in)ability of human institutions to co-operate in achieving the survival of this species. Input from all involved parties is critical in making decisions that affect the captive wild dog population as a whole. For any of these recommendations to be effectively employed management strategies must involve captive breeding institutions, conservation organisations, scientific research infrastructure, and wildlife reserve property owners. Secondly, enough suitable habitat needs to be located where the interactions between free-roaming wild dogs and humans are few enough to merit re-introductions into the wild. If the human limiting factor could be surmounted, the African wild dog may have a bright future.

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APPENDIX

THE REGIONAL STUDBOOK FOR THE AFRICAN WILD DOG, *Lycaon pictus* (JANUARY 1997)

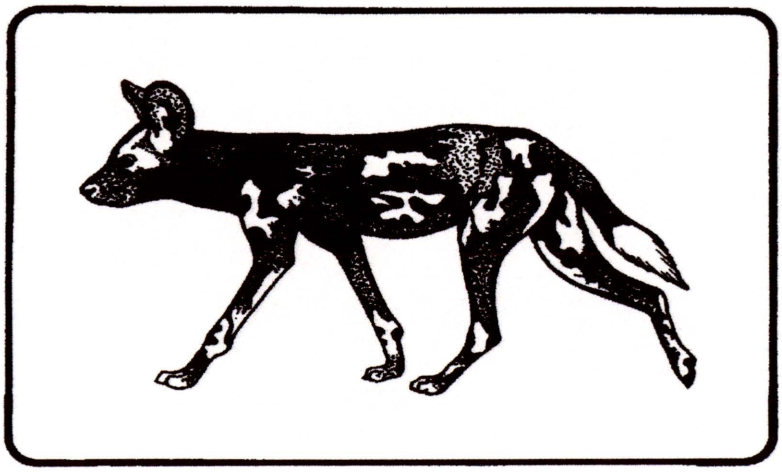
PAAZAB

PAN AFRICAN ASSOCIATION OF ZOOLOGICAL GARDENS AQUARIA AND BOTANICAL GARDENS

APP AFRICAN PRESERVATION PROGRAMME

1997

South African APP Regional Studbook for the African Wild Dog (*Lycaon pictus*)



Compiled by : M.A. J. Frantzen & M.S.de Villiers
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P.O.Box 754
Pretoria
0001

JANUARY 1997

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I. ACKNOWLEDGEMENTS

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Dave Meltzer, Price Forbes Chair, Onderstepoort
Ferdi Schoeman, National Zoological Gardens of South Africa
Sarah Christie, Zoological Society of London.

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OUDTSHORN	Cango Croc Ranch & Cheetahland P.O.Box 559 Oudtshoorn, 2260 Representative: Andrew Ericksen
PRETORIA	National Zoological Gardens of South Africa P.O.Box 754 Pretoria, 0001 Representative: Ferdi Schoeman

III. SYSTEMATICS

CLASS: Mammalia

ORDER: Carnivora

FAMILY: Canidae

SUBFAMILY: Simocyoninae

GENUS & SPECIES: Lycaon pictus

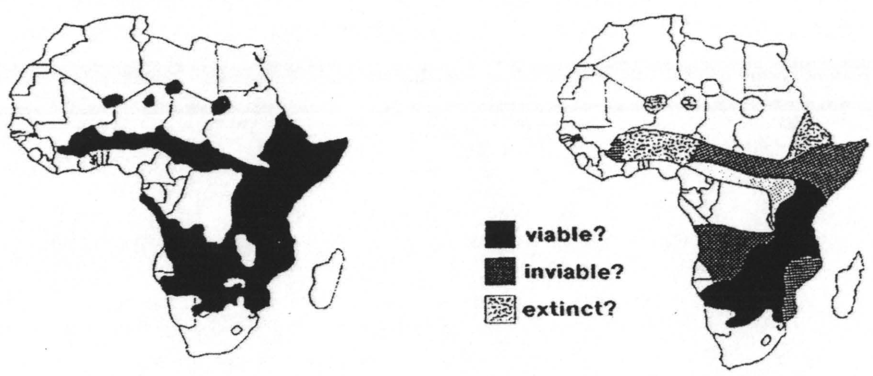
IV. CONSERVATION STATUS AND DISTRIBUTION

Wild dogs are the most endangered carnivores in Africa, second only to the Ethiopian wolf. In 1990, it was estimated that there were approximately 2000 African wild dogs (*Lycaon pictus*) left in protected areas in sub-Saharan Africa (Ginsberg & Macdonald). The species is now extinct in 19 of the 34 countries in which it once existed (Fig 1). Wild dogs were once widely distributed in South Africa but today, the only stable population (about 400 animals) occurs in the Kruger National Park (Fanshawe *et al.* 1991). The factors causing the decline of wild dogs (habitat destruction, disease, hunting by humans, competition from other predators and road kills) (Fanshawe *et al.* 1991) continue unabated, as evidenced by the recent extinction of several wild dog packs in the Serengeti ecosystem (Burrows *et al.* 1994). It has lately been suggested that this endangered species be reclassified as critically endangered (Macdonald 1994).

Summary of Regional Review (from IUCN, CSG, CBSG, SSC 1992)

North Africa: Wild dogs no longer occur on the fringe of the Sahara.
West Africa: Wild dogs may still survive in the Niokolo-Koba National Park in Senegal.
Central Africa: Wild dogs probably persist in Cameroon, Central African Republic, and in Southern Tchad.
East Africa: Kenya and Tanzania support reasonable populations of wild dogs. Ethiopia may still hold a viable population in the South.
South Africa: Zambia, Zimbabwe, Botswana and South Africa support most of the wild dogs remaining on the continent.

FIGURE 1: Past and present distribution of the African wild dog (from Ginsberg & Macdonald 1990)



V. ECOLOGY AND BEHAVIOUR

Wild dogs have catholic habitat requirements, being found in areas of moderately dense bush, open plains habitat and up into the lower forests of Mt. Kenya (Ginsberg & Macdonald 1990). Their distribution appears to be more strictly governed by the availability of their principal food species and/or by interspecific competitors than by habitat. Their diet is usually largely composed of the most abundant ungulate species in an area (Ginsberg & Macdonald 1990). Fanshawe *et al.* (1991) have suggested that competition with hyenas may be a variable responsible for limiting wild dog numbers in the Serengeti while in the Kruger National Park, lion predation is a major cause of pup mortality. Wild dogs also appear to avoid areas utilised by lions, so that the distribution of wild dogs does not coincide with that of their favoured prey (Mills 1995).

Wild dogs are co-operative hunters and are most successful when killing smaller, abundant ungulate prey such as impala and Thompson's gazelle (Fuller & Kat 1993). They are, however, able to hunt larger prey such as blue wildebeest, zebra and eland (Estes &Goddard 1967). Overall hunting success in the Masai Mara area of Kenya was calculated as 51% (Fuller & Kat 1993). The main competitors of wild dogs at kills are the spotted hyenas, although wild dogs usually chase these off, and therefore rarely appropriate wild dog kills (Fuller & Kat 1990). Communal hunting by this species not only improves defence of carcasses from other predators, but also increases the range of prey available to a pack (Fanshawe & Fitzgibbon 1993).

Wild dogs are social canids and live in packs ranging in size from 2 to more than 40 individuals. New packs form by the dispersal of youngsters (often groups of same-age, same-sex siblings) from their natal pack, or the dispersal of subordinate adults from a non-natal pack, or by pack fission (Frame *et al.* 1979). Wild dogs have a well-defined social system with separate, often linear male and female hierarchies headed by a dominant or alpha pair. Relative rank is expressed through day-to-day dominance interactions and through ritualised greeting ceremonies involving most or all pack members (de Villiers *et al.* In prep.). Usually, only the alpha female in a pack breeds while the alpha male monopolises access to her (Frame *et al.* 1979). All pack members participate in pup care, guarding the den and regurgitating food for mother and pups. Pups have priority of access at kills (Malcolm & Marten 1982).

VI. WILD DOGS IN CAPTIVITY

Wild dogs have frequently been bred in captivity (over 200 litters born between 1962 and 1984) but pup mortality is high (over 40%) (Ginsberg & Macdonald 1990). Breeding records sometimes mention that pups disappeared or were eaten by parents (Brand & Cullen 1967, Cade 1967, and Dekker 1968) and maternal neglect of pups is quite common (van Heerden 1986). Abortion, bone disease, heart failure and gastrointestinal ulceration have also been recorded in captive wild dogs (van Heerden 1986). These conditions may be manifestations of excessive stress, caused by conditions of captivity. Recent data indicate that a high degree of social stress caused by holding small groups of animals in adjacent cages may result in pathological behavioural and endocrinological profiles and may be associated with excessively high pup mortality (de Villiers *et al.* In prep.).

Captive wild dogs in South Africa are either wild-caught or are descended from the following unrelated lineages:

(a). DE WILDT LINEAGE: Bred up from Southern African and Namibian founders at the De Wildt Cheetah Breeding Center, beginning in the 1970's.
(b). JHB LINEAGE: Bred up from Southern African founders at the Johannesburg Zoological Gardens, beginning in the 1970's.
(c). PTA LINEAGE: Bred up from founders who were probably Southern African at the National Zoological Gardens, beginning in the 1960's. This line should not be confused with the De Wildt line, although the National Zoo has also held De Wildt animals in the past.
(d). NAMIBIAN LINEAGE: Bred up from Namibian founders at the De Wildt Cheetah Breeding Center, beginning in 1995.

Eastern and Southern African wild dogs appear to belong to different subspecies (Girman *et al.* 1993). Due to the precarious state of the eastern African sub-population, it is imperative that a captive breeding program for this subspecies be initiated. Eastern and southern African wild dogs should not, however, be allowed to interbreed in captivity. Until further information is available on the genetics of the Namibian wild dogs, they too should be managed separately from representatives of other sub-populations in captivity.

A. Co-operative management

The African wild dog has been targeted as a species, which could derive conservation benefit from an organised captive breeding effort. Several international regions have established programs for the captive breeding of this species- North America, Europe, Australia and South Africa. Each region aims to co-ordinate the captive breeding efforts of breeding institutions so that a viable, healthy population of wild dogs can be established in captivity.

The conservation aims of these captive-breeding institutions are twofold. First to maintain a healthy captive population so that even if this species becomes extinct in the wild, there will still be an "emergency stock" left, and second, to use excess captive stock to boost numbers in the wild through relocations. The African Preservation Program (APP) aims to do this by co-ordinating captive breeding efforts for wild dogs, so that all captive dogs are managed as if they were part of one population. This is necessary since single institutions are limited in the number of animals that they can hold. With only a few animals, inbreeding is inevitable. This problem can be avoided by institutions swapping out animals. Institutions can and have done this on their own in the past, but such swaps do not necessarily make the best use of animals available. If information from all institutions was freely available, mistakes could be avoided. The APP can ensure that each institution makes a really valuable contribution to the conservation of wild dogs, through co-operative management and through the sharing of information.

B. Guidelines for holding African wild dogs in captivity

While wild dogs may be held and bred under conditions different to those listed below, these guidelines are aimed at creating optimum conditions for the maintenance of physically, behaviourally, and genetically healthy wild dogs in captivity in South Africa. A complete husbandry manual is being compiled.

1. Housing and enclosure requirements

Size: Minimum enclosure area, 50m x50m (would maintain 4 dogs). Ideally, a 2 ha enclosure (could maintain about 10 dogs). Enclosure should be regularly cleared of bones and faeces.
Capture and handling facilities: A small camp (10m x15m) connected to the main enclosure via a passageway (10m long) with gates at either end.
Containment barriers: 3m high diamond mesh fence, electrified (steel wire, ± 8000V, low amperage), and buried in concrete to a depth of 0.5m.
Shelter requirements: Natural (leafy trees, thickets, etc.) or artificial shelter (roofing, shadecloth, etc.) in both the main enclosure and the capture camp.
Water source: Permanent drinking points (preferably cement dams large enough for a dog to wallow in) in the main enclosure and handling camp. Drinking points cleaned regularly.
Den: Natural dens (e.g. hollowed-out termite mounds) or artificially constructed dens. Den entrance, allowing access to only one animal at a time. Den dark, and lined for warmth. More than one den chamber will allow mother to move pups, should parasite load become high. Observation chambers sight-and sound-proofed.
Isolation from the same and other species: Enclosure isolated from other carnivore enclosures, especially other wild dog enclosures.

2. Animal management

Identification: Profile photographs of the left and right sides of the animal. Transponders.
Capture, handling and restraint: Restraint in a metal crush may risk injuries to animals. Chemical immobilisation by a veterinary surgeon (Zolatil, or Ketamine-Rompun, or Fentanyl-Xylazine).

Immobilisation of alpha animals may result in dominance challenges by other dogs of the same sex. Keepers should not approach pups on foot, should not enter the enclosure alone, and should only enter the enclosure when dogs are well fed.

Crating and transport procedures: Wooden crates, floor rubberised at sides (floor 0.4m x 1.5m, height 1.5m).

3. Behaviour and social organisation

Optimal social groupings: Ideally, 1 or 2 mature females and several mature males. Establish a new pack with a group of siblings of one sex, unrelated group of siblings of the other sex.

Introductions and removals: Introducing a strange animal to an existing group will invariably result in aggression from animals of the same sex as the stranger, which may even be killed. It may become necessary to manipulate the pack in order to maintain pack size, prevent inbreeding, etc. Natural emigration/immigration can then be simulated by removing/introducing groups of siblings of the same age and sex. Removing pups shortly after weaning will prevent them from adults caring for the next litter produced and may negatively affect their own parenting abilities. If an animal must be temporarily removed from the pack, minimise duration of separation- the reintroduction of an animal after a prolonged period of time may cause fighting.

Fights: These will probably only become severe during the mating season. Dominance fights should be allowed to run their course unless serious injuries are inflicted.

Behavioural enrichment (stereotypes): Provided by a rich social environment (interactions with other pack members, including pups) and a rich physical environment (feeding of whole carcasses and bones, provision of a dam, rock piles, termite mounds, etc.).

Parental care: Pack members are protective of pups and will regurgitate food for them and the mother of the litter.

Behavioural indicators of stress: Stereotypic pacing/excessive aggression towards wild dogs in adjacent cages. Hoo-calling may indicate distress at separation from the group.

Killing of young: Killing of own pups by highly stressed animals. Alpha female killing pups of beta female, if both females whelp at the same time (this may be regarded as "natural" infanticide).

4. Nutrition

Feeding schedule: Can vary, e.g. feed once a day, with/without one day of fast per week; or feed every second day. Amount fed will vary accordingly (see below).
Diet: ± 2kg/dog/day. Adjust according to activity levels, to maintain a body weight of 25-30kg for adults. Extra 2kg/day when pups are present, and no day of fast. Meat must be fresh-beef/horse/donkey preferable-chicken diet causes anaemia. Commercial dog food can be used but may cause tooth decay and should preferably be interspersed with whole meat and bones.
Supplements: bonemeal and Calsup, or Biovita vitamin supplement. Continue feeding whole meat when pups are present, to encourage regurgitation (additional behavioural enrichment and strengthening of family bonds). Feeding only a "puppy mix" can be problematical due to instinct of adults to allow pups to feed first - may end up with well-fed pups but starving adults.

5. Health

Inoculation: Parvovirus Duramine KF-11 (parvovirus, killed), Fromm D canine distemper (modified live virus; note that this may not be safe), Imrab or Rabisin (rabies, killed virus).
Parasites: Drontal (deworming); Ovitiol and Program (fleas).
Life span: ± 10 years. Problems: toothwear, reproductive failure (especially females), weight loss, arthritis, and heart disease.

VII. REINTRODUCTIONS

Several re-introductions of wild dogs have been attempted in the past, but with little success (IUCN/CSG &SSC 1992; Chilvers 1994; Skinner, Labuscagne & van Dyk, unpub.; Leipnitz pers. Comm.). Causes of failure include competition from other carnivores, disease and conflict with humans. However, few re-introductions of wild dogs have been preceded by programs to elicit public support, or have been followed by intensive monitoring programs. Consequently, reintroduction attempts have been disadvantaged from the outset, and the causes of failure and the alternative plans for the future remain largely speculative. A comprehensive reintroduction program for wild dogs should address problems associated with the release of large carnivores (Mills 1991) and specifically, of wild dogs (IUCN/CSG & SSC 1992; de Villiers 1995). If successful, such a program will serve as a valuable conservation model for other endangered carnivores, including the severely threatened East African wild dog subspecies. If unsuccessful, an identification of the causes of failure will provide accurate guidelines for future reintroduction attempts.

VIII. STUDBOOK SCOPE

A complete edition of the APP wild dog studbook was produced in 1995 (Frantzen MAJ & de Villiers MS 1995). African Preservation Programme Studbook for the African wild dog, *Lycaon pictus*. Unpub Report). This version contains up to date information on APP specimens, and some additional, but incomplete information on non-APP specimens.

A. GEOGRAPHICAL SCOPE

This studbook contains information on living and dead specimens in captive breeding institutions in South Africa only.

B. TIME SCALE

The time period covered by this studbook is 1954 to present.

C. DESCRIPTION OF DATA FIELDS, AND CONVENTIONS USED

Studbook number: Temporary studbook numbers are assigned a prefix "T". Studbook numbers without this prefix are the same as in the international studbook. Specimens whose studbook numbers are suffixed with "?" are "hypothetical" specimens. Often, the number of pups in a litter is unknown. If such litters were ignored, pup mortality would severely be underestimated. Litter size is thus taken to be 7 (the average litter size in litters with a known number of pups) and these specimens are included in the studbook, but are marked with "?" to distinguish them from "real" pups.

Sex: "M" denotes "male", "F" denotes "female".

Birth Date: Date of birth, estimated as accurately as possible.

Sire: If there was more than one male in a group of animals, the most probable sire is recorded and is usually the alpha male in the group.

Dam: As for "sire".

Location: The location of a specimen at the time of a given event (see location glossary).

Local ID: The identification given to a specimen by the institution at which it occurred.

Event: Events include captures, births, transfers, releases, and deaths.

Birth Origin: Captive or wild born, or unknown

Death date: Date of death, estimated as accurately as possible.

Removal date: The date at which an individual was removed from a given location to a new one, due to an event as described above.

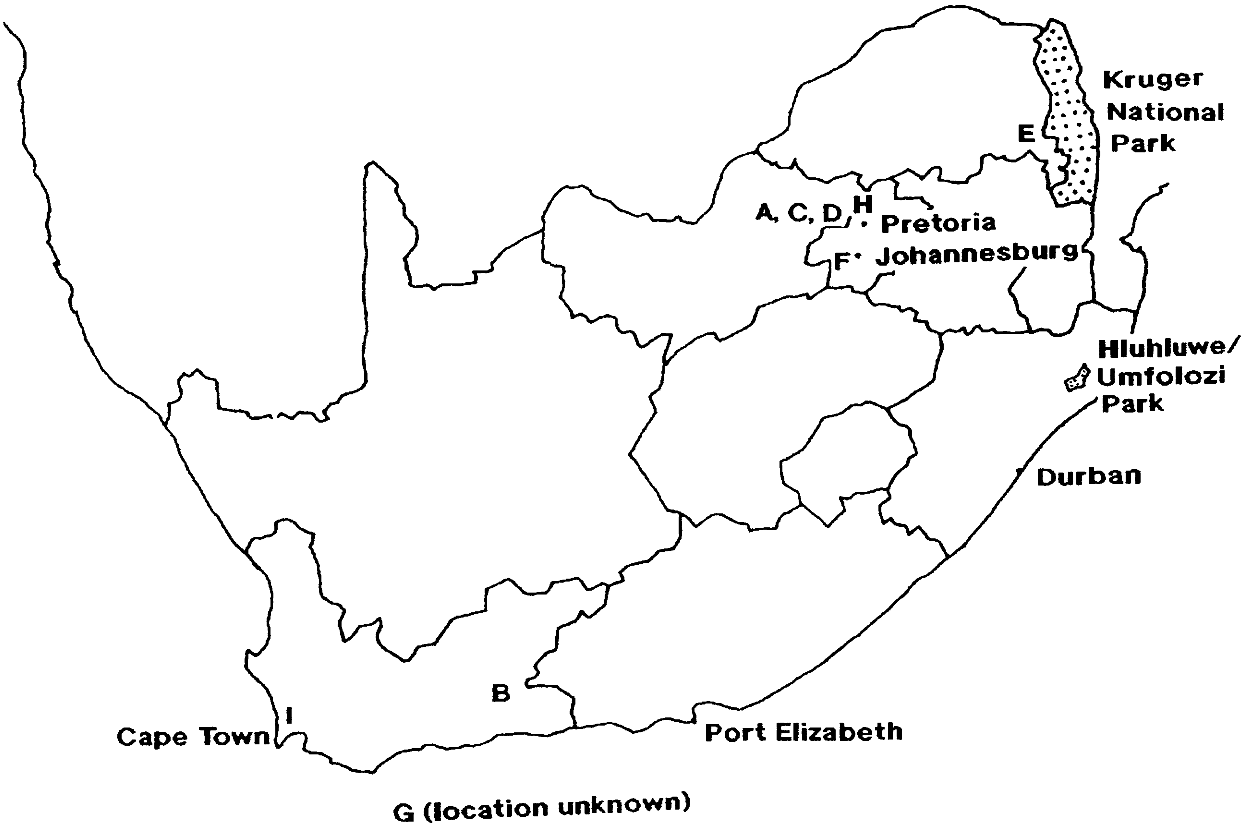
House name: The name given to a specimen by an institution at which it occurred.

Death Note: If cause of death known, this is described according to the format in SPARKS.

IX. LOCATION GLOSSARY

GHIAZZA R	African Game Services (Ricardo Ghiazza) P.O.xBox 536, Lanseria 1748, Gauteng, South Africa, 27 1207 71070
HARTBEES	Hartbeespoort Dam Snake & Animal Park P.O. Box 109, Hartbeespoort 0216, Gauteng, South Africa, 27 1211 30162
HOEDSPRUI	Hoedspruit Breeding & Research Station for Endangered Species P.O. Box 912031, Silverton 0127, Gauteng, South Africa, 27 12 45 2570
JOHANSBRG	Johannesburg Zoological Gardens Jan Smuts Avenue, Parkview, 2193, Gauteng, South Africa, 27 11 646 2000
KRAAIFONT	Tygerberg Zoopark P.O. Box 524, Kraaifontein, 7569, Cape, South Africa, 27 21 8844494
OUDTSHORN	Cango Croc Ranch & Cheetahland P.O.Box 559, Oudtshoorn, 2260, E. Cape, South Africa, 27 443 225593/6
MCADAM	Private Cape, South Africa, 27 21 241100
PRET DW	De Wildt Cheetah Research & Breeding Center P.O. Box 16, De Wildt 0251, South Africa, 27 12 28 6020
PRETORIA	National Zoological Gardens of South Africa P.O.Box 754, Pretoria, 0001, Gauteng, South Africa, 27 12 28 3265

FIGURE 2: Locations of captive breeding institutions in South Africa, currently holding African wild dogs



A: African Game Services

B: Cango Croc Ranch & Cheetahland

C: De Wildt Cheetah Breeding Center

D: Hartebeespoort Snake and Animal Park

E: Hoedspruit Breeding and Research Station for Endangered Species

F: Johannesburg Zoological Gardens

G: Mc Adam, Bill (Private)

H: National Zoological Gardens of South Africa

I: Tygerberg Zoopark

(See Location Glossary, Page 84, for full details of institutions)

AFRICAN WILD DOG STUDBOOK

Restricted to: *Lycaon pictus*

Stud #	Sex	Birth D.	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T1	F	????	UNK	UNK	UNKNOWN	????	31262	Birth	UNK		25/07/'54
					PRETORIA	25/07/'54	31262	Transfer			09/06/'62
					OP	09/06/'62	31262	Transfer		UNK	
T2	M	????	UNK	UNK	UNKNOWN	????	35336	Birth	UNK		05/02/'58
					PRETORIA	05/02/'58	35336	Transfer			09/06/'62
					OP	09/06/'62	35336	Transfer		UNK	
T3	M	18/11/'59	T2	T1	PRETORIA	18/11/'59	37745	Birth	Captive		28/06/'60
					OP	28/06/'60	37745	Transfer		UNK	
T4	M	18/11/'59	T2	T1	PRETORIA	18/11/'59	37746	Birth	Captive		28/06/'60
					OP	28/06/'60	37746	Transfer		UNK	
T5	F	18/11/'59	T2	T1	PRETORIA	18/11/'59	37747	Birth	Captive		28/06/'60
					OP	28/06/'60	37747	Transfer		UNK	
T6	F	18/11/'59	T2	T1	PRETORIA	18/11/'59	37748	Birth	Captive		28/06/'60
					OP	28/06/'60	37748	Transfer		UNK	
T7	F	18/11/'59	T2	T1	PRETORIA	18/11/'59	37749	Birth	Captive		28/06/'60
						28/06/'60		Death		28/06/'60	
(Death by: Euthanasia, Unknown, No Autopsy Planned)											
T8	F	18/11/'59	T2	T1	PRETORIA	18/11/'59	37750	Birth	Captive		28/06/'60
						28/06/'60		Death		28/06/'60	
(Death by: Euthanasia, Unknown, No Autopsy Planned)											
T9	?	09/08/'60	T2	T1	PRETORIA	09/08/'60	UNK	Birth	Captive		09/08/'60
						09/08/'60		Death		09/08/'60	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											
T10	?	09/08/'60	T2	T1	PRETORIA	09/08/'60	UNK	Birth	Captive		09/08/'60
						09/08/'60		Death		09/08/'60	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											
T11	?	09/08/'60	T2	T1	PRETORIA	09/08/'60	UNK	Birth	Captive		09/08/'60
						09/08/'60		Death		09/08/'60	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											
T12	?	09/08/'60	T2	T1	PRETORIA	09/08/'60	UNK	Birth	Captive		09/08/'60
						09/08/'60		Death		09/08/'60	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											
T13	?	09/08/'60	T2	T1	PRETORIA	09/08/'60	UNK	Birth	Captive		09/08/'60
						09/08/'60		Death		09/08/'60	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											
T14	?	09/08/'60	T2	T1	PRETORIA	09/08/'60	UNK	Birth	Captive		09/08/'60
						09/08/'60		Death		09/08/'60	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											
T15	?	09/08/'60	T2	T1	PRETORIA	09/08/'60	UNK	Birth	Captive		09/08/'60
						09/08/'60		Death		09/08/'60	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											
T16	?	09/08/'60	T2	T1	PRETORIA	09/08/'60	UNK	Birth	Captive		09/08/'60
						09/08/'60		Death		09/08/'60	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											
T17	?	09/08/'60	T2	T1	PRETORIA	09/08/'60	UNK	Birth	Captive		09/08/'60
						09/08/'60		Death		09/08/'60	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											
T18	?	09/08/'60	T2	T1	PRETORIA	09/08/'60	UNK	Birth	Captive		09/08/'60
						09/08/'60		Death		09/08/'60	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T19	F	~ 1960	UNK	UNK	UNKNOWN	~ 1960	401427	Birth	UNK		10/04/'62
					PRETORIA	10/04/'62	401427	Transfer			22/07/'70
						22/07/'70		Death		22/07/'70	
(Death by: Unknown means)											
T20	M	????	UNK	UNK	UNKNOWN	????	401428	Birth	UNK		10/04/'62
					PRETORIA	10/04/'62	401428	Transfer			20/10/'71
						20/10/'71		Death		20/10/'71	
(Death by: Unknown means)											
T21	F	20/05/'63	T20	T19	PRETORIA	20/05/'63	42052	Birth	Captive		10/06/'63
						10/06/'63		Death		10/06/'63	
(Death by: Unknown means)											
T22	M	20/05/'63	T20	T19	PRETORIA	20/05/'63	42053	Birth	Captive		10/06/'63
						10/06/'63		Death		10/06/'63	
(Death by: Unknown means)											
T23	M	20/05/'63	T20	T19	PRETORIA	20/05/'63	42054	Birth	Captive		10/06/'63
						10/06/'63		Death		10/06/'63	
(Death by: Unknown means)											
T24	?	~ 10/'63	UNK	UNK	PRETORIA	~ 10/'63	42458	Birth	Captive		21/10/'63
						21/10/'63	42458	Transfer			15/12/'63
						15/12/'63		Death		15/12/'63	
(Death by: Unknown means)											
T25	?	~ 10/'63	UNK	UNK	OP	~ 10/'63	42459	Birth	Captive		21/10/'63
					PRETORIA	21/10/'63	42459	Transfer			15/12/'63
						15/12/'63		Death		15/12/'63	
(Death by: Unknown means)											
T26	?	12/11/'63	T20	T19	PRETORIA	12/11/'63	421579	Birth	Captive		06/01/'64
						06/01/'64		Death		06/01/'64	
(Death by: Unknown means)											
T27	?	12 /11/'63	T20	T19	PRETORIA	12/11/'63	421580	Birth	Captive		24/03/'64
					UNKNOWN	24/03/'64	421580	Transfer		UNK	
T28	?	12/11/'63	T20	T19	PRETORIA	12/11/'63	421581	Birth	Captive		24/03/'64
					UNKNOWN	24/03/'64	421581	Transfer		UNK	
T29	?	12 /11/'63	T20	T19	PRETORIA	12/11/'63	421582	Birth	Captive		~/03/'64
					OP	~ /03/'64	421582	Transfer		UNK	
T30	?	12/11/'63	T20	T19	PRETORIA	12/11/'63	421583	Birth	Captive		~/03/'64
T31	F	12/11/'63	T20	T19	PRETORIA	12/11/'63	421584	Birth	Captive		08/10/'64
						08/10/'64		Death		08/10/'64	
(Death by: Unknown means)											
T32	?	????	UNK	UNK	UNKNOWN	~ 1962	UNK	Birth	UNK		03/07/'65
						03/07/'65	UNK	Transfer		UNK	
T33	?	~/05/'66	WILD	WILD	WILD	~/05/'66	UNK	Birth	Wild		01/07/'66
					PRETORIA	01/07/'66		Death		01/07/'66	
(Death by: Unknown means)											
T34	?	~/05/'66	WILD	WILD	WILD	~/05/'66	UNK	Birth	Wild		06/07/'66
					PRETORIA	06/07/'66		Death		06/07/'66	
(Death by: Unknown means)											
T35	?	~/05/'66	WILD	WILD	WILD	~/05/'66	UNK	Birth	Wild		22/09/'66
					UNKNOWN	22/09/'66	UNK	Transfer		UNK	
T36	?	~/05/'66	WILD	WILD	WILD	~/05/'66	UNK	Birth	Wild		22/09/'66
					UNKNOWN	22/09/'66	UNK	Transfer		UNK	
T37	?	~/07/'66	UNK	UNK	OP	~/07/'66	55996	Birth	Captive		29/09/'66
					PRETORIA	29/09/'66	55996	Transfer		UNK	

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T38	?	~/07/'66	UNK	UNK	OP	~/07/'66	55997	Birth	Captive		29/09/'66
					PRETORIA	29/09/'66	55997	Transfer		UNK	
T39	?	~/07/'66	UNK	UNK	UNKNOWN	~/07/'66	UNK	Birth	UNK		25/09/'66
					PRETORIA	25/09/'66	56060	Transfer			05/10/'66
						05/10/'66		Death		05/10/'66	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T40	?	~/07/'66	UNK	UNK	UNKNOWN	~/07/'66	UNK	Birth	UNK		25/09/'66
					PRETORIA	25/09/'66	56061	Transfer			~/'67
					HARTBEESP	~/'67	56061	Transfer			~/'81
						~/'81		Death		~/'81	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T41	?	06/04/'67	T20	T19	PRETORIA	06/04/'67	56494	Birth	Captive		16/05/'67
						16/05/'67		Death		16/05/'67	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T42	?	06/04/'67	T20	T19	PRETORIA	06/04/'67	56495	Birth	Captive		16/05/'67
						16/05/'67		Death		16/05/'67	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T43	?	06/04/'67	T20	T19	PRETORIA	06/04/'67	56496	Birth	Captive		16/05/'67
						16/05/'67		Death		16/05/'67	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T44	?	06/04/'67	T20	T19	PRETORIA	06/04/'67	56497	Birth	Captive		UNK
T45	?	06/04/'67	T20	T19	PRETORIA	06/04/'67	56498	Birth	Captive		UNK
T46	?	06/04/'67	T20	T19	PRETORIA	06/04/'67	56499	Birth	Captive		UNK
T47	?	~/03/'67	WILD	WILD	WILD	~/03/'67	UNK	Birth	Wild		12/05/'67
					PRETORIA	12/05/'67	56673	Transfer			23/05/'67
						23/05/'67		Death		23/05/'67	
(Death by: Unknown means)											
T48	?	~/03/'67	WILD	WILD	WILD	~/03/'67	UNK	Birth	Wild		12/05/'67
					PRETORIA	12/05/'67	56674	Transfer			23/05/'67
						23/05/'67		Death		23/05/'67	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T49	?	~/03/'67	WILD	WILD	WILD	~/03/'67	UNK	Birth	Wild		12/05/'67
					PRETORIA	12/05/'67	56675	Transfer			23/05/'67
						23/05/'67		Death		23/05/'67	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T50	?	~/03/'67	WILD	WILD	WILD	~/03/'67	UNK	Birth	Wild		12/05/'67
					PRETORIA	12/05/'67	56676	Transfer			23/05/'67
						23/05/'67		Death		23/05/'67	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy) , Unknown (after autopsy))											
T51	?	~/03/'67	WILD	WILD	WILD	~/03/'67	UNK	Birth	Wild		12/05/'67
					PRETORIA	12/05/'67	56677	Transfer		UNK	
T52	?	~/03/'67	WILD	WILD	WILD	~/03/'67	UNK	Birth	Wild		12/05/'67
					PRETORIA	12/05/'67	56678	Transfer		UNK	
T53	?	~/03/'67	WILD	WILD	WILD	~/03/'67	UNK	Birth	Wild		12/05/'67
					PRETORIA	12/05/'67	56679	Transfer		UNK	
T54	?	~/03/'67	WILD	WILD	WILD	~/03/'67	UNK	Birth	Wild		12/05/'67
					PRETORIA	12/05/'67	56680	Transfer		UNK	
T55	?	~/03/'67	WILD	WILD	WILD	~/03/'67	UNK	Birth	Wild		12/05/'67
					PRETORIA	12/05/'67	56681	Transfer		UNK	
T56	?	~/03/'67	WILD	WILD	WILD	~/03/'67	UNK	Birth	Wild		12/05/'67
					PRETORIA	12/05/'67	56682	Transfer		UNK	

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T57	?	~/03/'67	WILD	WILD	WILD	~/03/'67	UNK	Birth	Wild		12/05/'67
					PRETORIA	12/05/'67	56683	Transfer			22/05/'67
						22/05/'67		Death		22/05/'67	
(Death by: Unknown means)											
T58	?	20/08/'67	T20	T19	PRETORIA	20/08/'67	58109	Birth	Captive		01/09/'67
						01/09/'67		Death		01/09/'67	
(Death by: Unknown means)											
T59	?	20/08/'67	T20	T19	PRETORIA	20/08/'67	58110	Birth	Captive		01/09/'67
						01/09/'67		Death		01/09/'67	
(Death by: Unknown means)											
T60	?	20/08/'67	T20	T19	PRETORIA	20/08/'67	58111	Birth	Captive		01/09/'67
						01/09/'67		Death		01/09/'67	
(Death by: Unknown means)											
T61	?	20/08/'67	T20	T19	PRETORIA	20/08/'67	58112	Birth	Captive		01/09/'67
						01/09/'67		Death		01/09/'67	
(Death by: Unknown means)											
T62	?	20/08/'67	T20	T19	PRETORIA	20/08/'67	58113	Birth	Captive		01/09/'67
						01/09/'67		Death		01/09/'67	
(Death by: Unknown means)											
T63	?	20/08/'67	T20	T19	PRETORIA	20/08/'67	58114	Birth	Captive		01/09/'67
						01/09/'67		Death		01/09/'67	
(Death by: Unknown means)											
T64	?	20/08/'67	T20	T19	PRETORIA	20/08/'67	58115	Birth	Captive		01/09/'67
						01/09/'67		Death		01/09/'67	
(Death by: Unknown means)											
T65	?	20/08/'67	T20	T19	PRETORIA	20/08/'67	58116	Birth	Captive		01/09/'67
						01/09/'67		Death		01/09/'67	
(Death by: Unknown means)											
T66	?	20/08/'67	T20	T19	PRETORIA	20/08/'67	58117	Birth	Captive		01/09/'67
						01/09/'67		Death		01/09/'67	
(Death by: Unknown means)											
T67	?	20/08/'67	T20	T19	PRETORIA	20/08/'67	58118	Birth	Captive		01/09/'67
						01/09/'67		Death		01/09/'67	
(Death by: Unknown means)											
T68	?	20/08/'67	T20	T19	PRETORIA	20/08/'67	58119	Birth	Captive		01/09/'67
						01/09/'67		Death		01/09/'67	
(Death by: Unknown means)											
T69	?	20/08/'67	T20	T19	PRETORIA	20/08/'67	58120	Birth	Captive		01/09/'67
						01/09/'67		Death		01/09/'67	
(Death by: Unknown means)											
T70	?	20/08/'67	T20	T19	PRETORIA	20/08/'67	58121	Birth	Captive		01/09/'67
						01/09/'67		Death		01/09/'67	
(Death by: Unknown means)											
T71	?	20/08/'67	T20	T19	PRETORIA	20/08/'67	58122	Birth	Captive		01/09/'67
						01/09/'67		Death		01/09/'67	
(Death by: Unknown means)											
T72	?	18/05/'68	T20	T19	PRETORIA	18/05/'68	58711	Birth	Captive		~/06/'68
						~/06/'68		Death		~/06/'68	
(Death by: Unknown means)											
T73	M	18/05/'68	T20	T19	PRETORIA	18/05/'68	58712	Birth	Captive		24/08/'68
						24/08/'68		Death		24/08/'68	
(Death by: Unknown means)											
T74	?	18/05/'68	T20	T19	PRETORIA	18/05/'68	58713	Birth	Captive		UNK

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T75?	?	06/11/'68	T20	T19	PRETORIA	06/11/'68	UNK	Birth	Captive		18/11/'68
						18/11/'68		Death		18/11/'68	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T76?	?	06/11/'68	T20	T19	PRETORIA	06/11/'68	UNK	Birth	Captive		18/11/'68
						18/11/'68		Death		18/11/'68	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T77?	?	06/11/'68	T20	T19	PRETORIA	06/11/'68	UNK	Birth	Captive		18/11/'68
						18/11/'68		Death		18/11/'68	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned											
T78?	?	06/11/'68	T20	T19	PRETORIA	06/11/'68	UNK	Birth	Captive		18/11/'68
						18/11/'68		Death		18/11/'68	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T79?	?	06/11/'68	T20	T19	PRETORIA	06/11/'68	UNK	Birth	Captive		18/11/'68
						18/11/'68		Death		18/11/'68	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T80?	?	06/11/'68	T20	T19	PRETORIA	06/11/'68	UNK	Birth	Captive		18/11/'68
						18/11/'68		Death		18/11/'68	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T81?	?	06/11/'68	T20	T19	PRETORIA	06/11/'68	UNK	Birth	Captive		18/11/'68
						18/11/'68		Death		18/11/'68	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T82	?	~/02/'69	T20	T19	PRETORIA	~/02/'69	UNK	Birth	Captive		13/02/'69
						13/02/'69		Death		13/02/'69	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T83	?	~/02/'69	T20	T19	PRETORIA	~/02/'69	UNK	Birth	Captive		13/02/'69
						13/02/'69		Death		13/02/'69	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
3003	F	~/'79	WILD	WILD	GAUTENG	~/'79	UNK	Capture	Wild		
					HARTBEESP	~/'79	UNK	Transfer		UNK	
T85	M	~/06/'77	WILD	WILD	ETOSHA	~/08/'77	SWA1M	Capture	Wild		14/12/'77
					PRETORIA	14/12/'77	SWA1M	Transfer			15/12/'77
					PRET DW	15/12/'77	SWA1M	Transfer			16/06/'86
						16/06/'86		Death		16/06/'86	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
3067	M	~/06/'77	WILD	WILD	ETOSHA	~/08/'77	SWA2M	Capture	Wild		14/12/'77
					PRETORIA	14/12/'77	SWA2M	Transfer			15/12/'77
					PRET DW	15/12/'77	SWA2M	Transfer			12/11/'87
						12/11/'87		Death		12/11/'87	
(Death by: Other/Unknown, Given to an Institution: PRET DW, Cardiovascular, Unknown (after autopsy))											
T87	M	~/06/'77	WILD	WILD	ETOSHA	~/08/'77	SWA3M	Capture	Wild		14/12/'77
					PRETORIA	14/12/'77	SWA3M	Transfer			15/12/'77
					PRET DW	15/12/'77	SWA3M	Transfer			UNK
					UMFOLOZI	~/08/'79	UNK	Transfer			~/09/'79
						~/09/'79	UNK	Release			
T88	F	~/06/'77	WILD	WILD	ETOSHA	~/08/'77	SWA1F	Capture	Wild		14/12/'77
					PRETORIA	14/12/'77	SWA1F	Transfer			15/12/'77
					PRET DW	15/12/'77	SWA1F	Transfer			09/07/'87
						09/07/'87		Death		09/07/'87	
(Death by: Other/Unknown, Given to an Institution: PRET DW, Unknown (after Autopsy), Unknown (after autopsy))											
3068	F	~/06/'77	WILD	WILD	ETOSHA	~/08/'77	SWA2F	Capture	Wild		14/12/'77
					PRETORIA	14/12/'77	SWA2F	Transfer			15/12/'77
					PRET DW	15/12/'77	SWA2F	Transfer		UNK	
911	F	~/06/'77	WILD	WILD	ETOSHA	~/08/'77	SWA3F	Capture	Wild		14/12/'77
					PRETORIA	14/12/'77	SWA3F	Transfer			15/12/'77
					PRET DW	15/12/'77	SWA3F	Transfer			25/09/'89
						25/09/'89		Death		25/09/'89	
(Death by: Other/Unknown, Unknown, Digestive, Trauma)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T91	M	~/'78	UNK	UNK	OP	~/'78	UNK	Birth	UNK		29/07/'80
					PRETORIA	29/07/'80	UNK	Transfer			~/08/'80
						~/08/'80		Death		~/08/'80	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T92	M	~/'78	UNK	UNK	OP	~/'78	UNK	Birth	Captive		29/07/'80
					PRETORIA	29/07/'80	UNK	Transfer			11/06/'84
						11/06/'84		Death		11/06/'84	
(Death by: Euthanasia, Unknown, No Autopsy Planned)											
3002	F	~/'78	UNK	UNK	OP	~/'78	UNK	Birth	Captive		29/07/'80
					PRETORIA	29/07/'80	UNK	Transfer			03/12/'86
						03/12/'86		Death		03/12/'86	
(Death by: Unknown means)											
T94	M	~/06/'81	T92	3002	PRETORIA	~/06/'81	UNK	Birth	Captive		05/09/'81
					PRET DW	05/09/'81	UNK	Transfer			~/03/'82
					DENVER	~/03/'82	UNK	Transfer		UNK	
T95	M	~/06/'81	T92	3002	PRETORIA	~/06/'81	UNK	Birth	Captive		05/09/'81
					PRET DW	05/09/'81	UNK	Transfer			~/03/'82
					DENVER	~/03/'82	UNK	Transfer		UNK	
T96	M	~/06/'81	T92	3002	PRETORIA	~/06/'81	UNK	Birth	Captive		05/09/'81
					PRET DW	05/09/'81	UNK	Transfer			12/11/'82
						12/11/'82		Death		12/11/'82	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T97	F	~/06/'81	T92	3002	PRETORIA	~/06/'81	UNK	Birth	Captive		05/09/'81
					PRET DW	05/09/'81	UNK	Transfer			~/03/'82
					DENVER	~/03/'82	UNK	Transfer		UNK	
T98	F	~/06/'81	T92	3002	PRETORIA	~/06/'81	UNK	Birth	Captive		05/09/'81
					PRET DW	05/09/'81	UNK	Transfer		UNK	
T99	F	~/06/'81	T92	3002	PRETORIA	~/06/'81	UNK	Birth	Captive		21/06/'82
						21/06/'82		Death		21/06/'82	
(Death by: Unknown means)											
T100	M	13/05/'82	T92	3002	PRETORIA	13/05/'82	UNK	Birth	Captive		05/10/'82
					E LNDN AQ	05/10/'82	UNK	Transfer		UNK	
T101	M	13/05/'82	T92	3002	PRETORIA	13/05/'82	UNK	Birth	Captive		29/10/'82
					PRET DW	29/10/'82	UNK	Transfer		UNK	
T102	M	13/05/'82	T92	3002	PRETORIA	13/05/'82	UNK	Birth	Captive		02/11/'82
					PRET DW	02/11/'82	UNK	Transfer			25/05/'83
					HARTBEESP	25/05/'83	UNK	Transfer		UNK	
T103	M	13/05/'82	T92	3002	PRETORIA	13/05/'82	UNK	Birth	Captive		02/11/'82
					PRET DW	02/11/'82	UNK	Transfer			25/05/'83
					HARTBEESP	25/05/'83	UNK	Transfer		UNK	
T104	M	13/05/'82	T92	3002	PRETORIA	13/05/'82	UNK	Birth	Captive		02/11/'82
					PRET DW	02/11/'82	UNK	Transfer		UNK	
T105	M	13/05/'82	T92	3002	PRETORIA	13/05/'82	UNK	Birth	Captive		02/11/'82
					PRET DW	02/11/'82	UNK	Transfer		UNK	
3000	M	13/05/'82	T92	3002	PRETORIA	13/05/'82	UNK	Birth	Captive		02/11/'82
					HARTBEESP	02/11/'82	UNK	Transfer		UNK	
3004	M	13/05/'82	T92	3002	PRETORIA	13/05/'82	UNK	Birth	Captive		23/01/'87
					MEDUNSA	23/01/'87	UNK	Transfer			23/01/'87
						23/01/'87		Death		23/01/'87	
(Death by: Euthanasia, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T108	F	13/05/'82	T92	3002	PRETORIA	13/05/'82	UNK	Birth	Captive		29/10/'82
					PRET DW	29/10/'82	UNK	Transfer		UNK	
T109	M	22/04/'83	T92	3002	PRETORIA	22/04/'83	9	Birth	Captive		27/09/'83
					PRET DW	27/09/'83	9	Transfer		UNK	

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T110	M	22/04/'83	T92	3002	PRETORIA	22/04/'83	10	Birth	Captive		27/09/'83
					PRET DW	27/09/'83	10	Transfer		UNK	
T111	M	22/04/'83	T92	3002	PRETORIA	22/04/'83	11	Birth	Captive		27/09/'83
					PRET DW	27/09/'83	11	Transfer		UNK	
T112	M	22/04/'83	T92	3002	PRETORIA	22/04/'83	12	Birth	Captive		27/09/'83
					PRET DW	27/09/'83	12	Transfer		UNK	
T113	M	22/04/'83	T92	3002	PRETORIA	22/04/'83	14	Birth	Captive		30/09/'83
					PRET DW	30/09/'83	14	Transfer		UNK	
T114	M	22/04/'83	T92	3002	PRETORIA	22/04/'83	15	Birth	Captive		30/09/'83
					PRET DW	30/09/'83	15	Transfer		UNK	
T115	M	22/04/'83	T92	3002	PRETORIA	22/04/'83	16	Birth	Captive		30/09/'83
					PRET DW	30/09/'83	16	Transfer		UNK	
T116	M	22/04/'83	T92	3002	PRETORIA	22/04/'83	17	Birth	Captive		30/09/'83
					PRET DW	30/09/'83	17	Transfer		UNK	
T117	M	22/04/'83	T92	3002	PRETORIA	22/04/'83	18	Birth	Captive		22/09/'83
						22/09/'83		Death		22/09/'83	
(Death by: Unknown means)											
T118	F	22/04/'83	T92	3002	PRETORIA	22/04/'83	13	Birth	Captive		27/09/'83
					PRET DW	27/09/'83	13	Transfer		UNK	
T119	F	22/04/'83	T92	3002	PRETORIA	22/04/'83	19	Birth	Captive		27/09/'83
					PRET DW	27/09/'83	19	Transfer		UNK	
T120	F	12/04/'84	3004	3002	PRETORIA	12/04/'84	20	Birth	Captive		11/09/'84
					PRET DW	11/09/'84	20	Transfer		UNK	
T121	F	12/04/'84	3004	3002	PRETORIA	12/04/'84	20	Birth	Captive		11/09/'84
						11/09/'84		Death		11/09/'84	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T122	F	09/03/'85	3004	3002	PRETORIA	09/03/'85	UNK	Birth	Captive		29/03/'85
						29/03/'85		Death		29/03/'85	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T123	?	07/03/'85	3004	3002	PRETORIA	0/03/'85	UNK	Birth	Captive		28/03/'85
						28/03/'85		Death		28/03/'85	
(Death by: Env. or Beh. Conditions, Unknown , No Autopsy Planned)											
T124	?	07/03/'85	3004	3002	PRETORIA	0/03/'85	UNK	Birth	Captive		28/03/'85
						28/03/'85		Death		28/03/'85	
(Death by: Env. or Beh. Conditions, Unknown , No Autopsy Planned)											
T125	M	07/03/'85	3004	3002	PRETORIA	07/03/'85	UNK	Birth	Captive		06/06/'85
						06/06/'85		Death		06/06/'85	
(Death by: Infection Associated, Unknown, Nervous, Viral)											
T126	F	07/03/'85	3004	3002	PRETORIA	07/03/'85	UNK	Birth	Captive		06/06/'85
						06/06/'85		Death		06/06/'85	
(Death by: Infection Associated, Unknown, Nervous, Viral)											
T127	F	07/03/'85	T3004	3002	PRETORIA	07/03/'85	UNK	Birth	Captive		06/06/'85
						06/06/'85		Death		06/06/'85	
(Death by: Infection Associated, Unknown, Nervous, Viral)											
T128	F	07/03/'85	3004	3002	PRETORIA	07/03/'85	UNK	Birth	Captive		06/06/'85
						06/06/'85		Death		06/06/'85	
(Death by: Infection Associated, Unknown, Nervous, Viral)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T129	F	01/10/'85	3004	3002	PRETORIA	01/10/'85	UNK	Birth	Captive		02/06/'86
					NATAL	02/06/'86	UNK	Transfer			12/06/'86
					PRETORIA	12/06/'86	UNK	Transfer			19/06/'86
					PRET DW	19/06/'86	UNK	Transfer			19/06/'86
					KRAAIFONT	19/06/'86	UNK	Transfer			~/'92
						~/'92		Death		~'92	
(Death by: Unknown means)											
2048	M	01/10/'85	3004	3002	PRETORIA	01/10/'85	UNK	Birth	Captive		02/06/'86
					NATAL	02/06/'86	UNK	Transfer			12/06/'86
					PRETORIA	12/06/'86	UNK	Transfer			19/06/'86
					PRET DW	19/06/'86	UNK	Transfer			10/07/'86
					KRAAIFONT	10/07/'86	860003	Transfer			
T131	F	01/10/'85	3004	3002	PRETORIA	01/10/'85	UNK	Birth	Captive		02/06/'86
					NATAL	02/06/'86	UNK	Transfer			12/06/'86
					PRETORIA	12/06/'86	UNK	Transfer			19/06/'86
					PRET DW	19/06/'86	UNK	Transfer			19/06/'86
					KRAAIFONT	19/06/'86	UNK	Transfer			~/'92
						~/'92		Death		~'92	
(Death by: Unknown means)											
T132	?	01/10/'85	3004	3002	PRETORIA	01/10/'85	UNK	Birth	Captive		07/11/'85
						07/11/'85		Death		07/11/'85	
(Death by: Unknown means)											
T133	M	~/'84	UNK	UNK	PRET DW	~/'84	UNK	Birth	Captive		10/02/'87
					PRETORIA	10/02/'87	UNK	Transfer			26/09/'88
					POLAND	26/09/'88	UNK	Transfer		UNK	
T134	F	~'84	UNK	UNK	PRET DW	~/'84	UNK	Birth	Captive		10/02/'87
					PRETORIA	10/02/'87	UNK	Transfer			26/09/'88
					POLAND	26/09/'88	UNK	Transfer		UNK	
T135?	?	09/06/'87	T133	T134	PRETORIA	09/06/'87	UNK	Birth	Captive		09/06/'87
						09/06/'87	Death			09/06/'87	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T136?	?	09/06/'87	T133	T134	PRETORIA	09/06/'87	UNK	Birth	Captive		09/06/'87
						09/06/'87	Death			09/06/'87	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T137?	?	09/06/'87	T133	T134	PRETORIA	09/06/'87	UNK	Birth	Captive		09/06/'87
						09/06/'87	Death			09/06/'87	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T138?	?	09/06/'87	T133	T134	PRETORIA	09/06/'87	UNK	Birth	Captive		09/06/'87
						09/06/'87	Death			09/06/'87	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T139?	?	09/06/'87	T133	T134	PRETORIA	09/06/'87	UNK	Birth	Captive		09/06/'87
						09/06/'87	Death			09/06/'87	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T140?	?	09/06/'87	T133	T134	PRETORIA	09/06/'87	UNK	Birth	Captive		09/06/'87
						09/06/'87	Death			09/06/'87	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T141?	M	09/06/'87	T133	T134	PRETORIA	09/06/'87	UNK	Birth	Captive		20/01/'88
						20/01/'88		Death		20/01/'88	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T142	?	28/05/'88	T133	T134	PRETORIA	28/05/'88	UNK	Birth	Captive		28/05/'88
						28/05/'88		Death		28/05/'88	
(Death by: Unknown means)											
T143	?	28/05/'88	T133	T134	PRETORIA	28/05/'88	UNK	Birth	Captive		28/05/'88
						28/05/'88		Death		28/05/'88	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T144	?	28/05/'88	T133	T134	PRETORIA	28/05/'88	UNK	Birth	Captive		28/05/'88
						28/05/'88		Death		28/05/'88	
(Death by: Unknown means)											
T145	?	28/05/'88	T133	T134	PRETORIA	28/05/'88	UNK	Birth	Captive		28/05/'88
						28/05/'88		Death		28/05/'88	
(Death by: Unknown means)											
T146	?	28/05/'88	T133	T134	PRETORIA	28/05/'88	UNK	Birth	Captive		28/05/'88
						28/05/'88		Death		28/05/'88	
(Death by: Unknown means)											
T147	?	28/05/'88	T133	T134	PRETORIA	28/05/'88	UNK	Birth	Captive		28/05/'88
						28/05/'88		Death		28/05/'88	
(Death by: Unknown means)											
T148	?	09/06/'79	T85	T88	PRET DW	09/06/'79	UNK	Birth	Captive		01/08/'79
					UMFOLOZI	01/08/'79	UNK	Transfer			~/09/'79
						~/09/'79	UNK	Release			
T149	?	09/06/'79	T85	T88	PRET DW	09/06/'79	UNK	Birth	Captive		01/08/'79
					UMFOLOZI	01/08/'79	UNK	Transfer			~/09/'79
						~/09/'79	UNK	Release			
T150	?	09/06/'79	T85	T88	PRET DW	09/06/'79	UNK	Birth	Captive		01/08/'79
					UMFOLOZI	01/08/'79	UNK	Transfer			~/09/'79
						~/09/'79	UNK	Release			
T151	?	09/06/'79	T85	T88	PRET DW	09/06/'79	UNK	Birth	Captive		01/08/'79
					UMFOLOZI	01/08/'79	UNK	Transfer			~/09/'79
						~/09/'79	UNK	Release			
T152	?	09/06/'79	T85	T88	PRET DW	09/06/'79	UNK	Birth	Captive		01/08/'79
					UMFOLOZI	01/08/'79	UNK	Transfer			~/09/'79
						~/09/'79	UNK	Release			
T153	?	09/06/'79	T85	T88	PRET DW	09/06/'79	UNK	Birth	Captive		01/08/'79
					UMFOLOZI	01/08/'79	UNK	Transfer			~/09/'79
						~/09/'79	UNK	Release			
T154	?	09/06/'79	T85	T88	PRET DW	09/06/'79	UNK	Birth	Captive		01/08/'79
					UMFOLOZI	01/08/'79	UNK	Transfer			~/09/'79
						~/09/'79	UNK	Release			
T155	?	09/06/'79	T85	T88	PRET DW	09/06/'79	UNK	Birth	Captive		01/08/'79
					UMFOLOZI	01/08/'79	UNK	Transfer			~/09/'79
						~/09/'79	UNK	Release			
T156	M	11/06/'79	3067	3068	PRET DW	11/06/'79	UNK	Birth	Captive		11/06/'79
						11/06/'79		Death		11/06/79	
(Death by: Unknown means)											
T157	M	11/06/'79	3067	3068	PRET DW	11/06/'79	UNK	Birth	Captive		11/06/'79
						11/06/'79		Death		11/06/79	
(Death by: Unknown means)											
T158	M	11/06/'79	3067	3068	PRET DW	11/06/'79	UNK	Birth	Captive		11/06/'79
						11/06/'79		Death		11/06/79	
(Death by: Unknown means)											
T159	M	11/06/'79	3067	3068	PRET DW	11/06/'79	UNK	Birth	Captive		11/06/'79
						11/06/'79		Death		11/06/79	
(Death by: Unknown means)											
T160	M	11/06/'79	3067	3068	PRET DW	11/06/'79	UNK	Birth	Captive		11/06/'79
						11/06/'79		Death		11/06/79	
(Death by: Unknown means)											
T161	M	11/06/'79	3067	3068	PRET DW	11/06/'79	UNK	Birth	Captive		11/06/'79
						11/06/'79		Death		11/06/79	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T162	F	11/06/'79	3067	3068	PRET DW	11/06/'79	UNK	Birth	Captive		11/06/'79
						11/06/'79		Death		11/06/79	
(Death by: Unknown means)											
T163	F	11/06/'79	3067	3068	PRET DW	11/06/'79	UNK	Birth	Captive		11/06/'79
						11/06/'79		Death		11/06/79	
(Death by: Unknown means)											
903	M	~/'78	WILD	WILD	GAUTENG	~/'78	UNK	Capture	Wild		12/07/'79
					PRET DW	12/07/'79	D92473	Transfer			09/07/'90
						09/07/'90		Death		09/07/'90	
(Death by: Euthanasia, Unknown, No Autopsy Planned)											
T165	M	~/'78	WILD	WILD	GAUTENG	~/'78	UNK	Capture	Wild		12/07/'79
					PRET DW	12/07/'79	D92473	Transfer			23/07/'85
						23/07/'85		Death		23/07/'85	
(Death by: Euthanasia, Unknown, No Autopsy Planned)											
T166	F	~/'78	WILD	WILD	GAUTENG	~/'78	UNK	Capture	Wild		12/07/'79
					PRET DW	12/07/'79	D92473	Transfer			01/08/'79
					UMFOLOZI	01/08/'79	UNK	Transfer			~/09/'79
						~/09/'79	UNK	Release			
T167	F	~/'78	WILD	WILD	GAUTENG	~/'78	UNK	Capture	Wild		12/07/'79
					PRET DW	12/07/'79	UNK	Transfer			05/08/'87
						05/08/'87		Death		05/08/'87	
(Death by: Infection Associated, Given to an Institution: PRET DW, Nervous, Trauma)											
T168	?	12/05/'80	T165	T167	PRET DW	12/05/'80	UNK	Birth	Captive	UNK	
T169	?	12/05/'80	T165	T167	PRET DW	12/05/'80	UNK	Birth	Captive	UNK	
T170	?	12/05/'80	T165	T167	PRET DW	12/05/'80	UNK	Birth	Captive	UNK	
T171	?	12/05/'80	T165	T167	PRET DW	12/05/'80	UNK	Birth	Captive	UNK	
T172	?	12/05/'80	T165	T167	PRET DW	12/05/'80	UNK	Birth	Captive	UNK	
T173	?	12/05/'80	T165	T167	PRET DW	12/05/'80	UNK	Birth	Captive	UNK	
T174	?	12/05/'80	T165	T167	PRET DW	12/05/'80	UNK	Birth	Captive		17/05/'80
						17/05/'80		Death		17/05/'80	
(Death by: Unknown means)											
T175	?	12/05/'80	T165	T167	PRET DW	12/05/'80	UNK	Birth	Captive		18/05/'80
						18/05/'80		Death		18/05/'80	
(Death by: Unknown means)											
T176?	?	12/05/'80	T85	T88	PRET DW	12/05/'80	UNK	Birth	Captive		15/05/'80
						15/05/'80		Death		15/05/'80	
(Death by: Unknown means)											
T177?	?	12/05/'80	T85	T88	PRET DW	12/05/'80	UNK	Birth	Captive		15/05/'80
						15/05/'80		Death		15/05/'80	
(Death by: Unknown means)											
T178?	?	12/05/'80	T85	T88	PRET DW	12/05/'80	UNK	Birth	Captive		15/05/'80
						15/05/'80		Death		15/05/'80	
(Death by: Unknown means)											
T179?	?	12/05/'80	T85	T88	PRET DW	12/05/'80	UNK	Birth	Captive		15/05/'80
						15/05/'80		Death		15/05/'80	
(Death by: Unknown means)											
T180?	?	12/05/'80	T85	T88	PRET DW	12/05/'80	UNK	Birth	Captive		15/05/'80
						15/05/'80		Death		15/05/'80	
(Death by: Unknown means)											
T181?	?	12/05/'80	T85	T88	PRET DW	12/05/'80	UNK	Birth	Captive		15/05/'80
						15/05/'80		Death		15/05/'80	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T182?	?	12/05/'80	T85	T88	PRET DW	12/05/'80	UNK	Birth	Captive		15/05/'80
						15/05/'80		Death		15/05/'80	
(Death by: Unknown means)											
T183?	?	19/04/'81	T165	T167	PRET DW	19/04/'81	UNK	Birth	Captive		19/04/'81
						19/04/'81		Death		19/04/'81	
(Death by: Unknown means)											
T184?	?	19/04/'81	T165	T167	PRET DW	19/04/'81	UNK	Birth	Captive		19/04/'81
						19/04/'81		Death		19/04/'81	
(Death by: Unknown means)											
T185?	?	19/04/'81	T165	T167	PRET DW	19/04/'81	UNK	Birth	Captive		19/04/'81
						19/04/'81		Death		19/04/'81	
(Death by: Unknown means)											
T186?	?	19/04/'81	T165	T167	PRET DW	19/04/'81	UNK	Birth	Captive		19/04/'81
						19/04/'81		Death		19/04/'81	
(Death by: Unknown means)											
T187?	?	19/04/'81	T165	T167	PRET DW	19/04/'81	UNK	Birth	Captive		19/04/'81
						19/04/'81		Death		19/04/'81	
(Death by: Unknown means)											
T188?	?	19/04/'81	T165	T167	PRET DW	19/04/'81	UNK	Birth	Captive		19/04/'81
						19/04/'81		Death		19/04/'81	
(Death by: Unknown means)											
T189?	?	19/04/'81	T165	T167	PRET DW	19/04/'81	UNK	Birth	Captive		19/04/'81
						19/04/'81		Death		19/04/'81	
(Death by: Unknown means)											
T190	?	19/04/'81	T165	T167	PRET DW	19/04/'81	UNK	Birth	Captive		26/01/'82
						26/01/'82		Death		26/01/'82	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T191?	?	28/04/'81	T85	T88	PRET DW	28/04/'81	UNK	Birth	Captive		01/05/'81
						01/05/'81		Death		01/05/'81	
(Death by: Unknown means)											
T192?	?	28/04/'81	T85	T88	PRET DW	28/04/'81	UNK	Birth	Captive		01/05/'81
						01/05/'81		Death		01/05/'81	
(Death by: Unknown means)											
T193?	?	28/04/'81	T85	T88	PRET DW	28/04/'81	UNK	Birth	Captive		01/05/'81
						01/05/'81		Death		01/05/'81	
(Death by: Unknown means)											
T194?	?	28/04/'81	T85	T88	PRET DW	28/04/'81	UNK	Birth	Captive		01/05/'81
						01/05/'81		Death		01/05/'81	
(Death by: Unknown means)											
T195?	?	28/04/'81	T85	T88	PRET DW	28/04/'81	UNK	Birth	Captive		01/05/'81
						01/05/'81		Death		01/05/'81	
(Death by: Unknown means)											
T196?	?	28/04/'81	T85	T88	PRET DW	28/04/'81	UNK	Birth	Captive		01/05/'81
						01/05/'81		Death		01/05/'81	
(Death by: Unknown means)											
T197?	?	28/04/'81	T85	T88	PRET DW	28/04/'81	UNK	Birth	Captive		01/05/'81
						01/05/'81		Death		01/05/'81	
(Death by: Unknown means)											
T198	M	19/05/'81	3067	3068	PRET DW	19/05/'81	UNK	Birth	Captive		19/05/'81
						19/05/'81		Death		19/05/'81	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T199	M	19/05/'81	3067	3068	PRET DW	19/05/'81	UNK	Birth	Captive		19/05/'81
						19/05/'81		Death		19/05/'81	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T200	M	19/05/'81	3067	3068	PRET DW	19/05/'81	UNK	Birth	Captive		19/05/'81
						19/05/'81		Death		19/05/'81	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T201	M	19/05/'81	3067	3068	PRET DW	19/05/'81	UNK	Birth	Captive		19/05/'81
						19/05/'81		Death		19/05/'81	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T202	M	19/05/'81	3067	3068	PRET DW	19/05/'81	UNK	Birth	Captive		19/05/'81
						19/05/'81		Death		19/05/'81	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T203	F	19/05/'81	3067	3068	PRET DW	19/05/'81	UNK	Birth	Captive		19/05/'81
						19/05/'81		Death		19/05/'81	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T204	F	19/05/'81	3067	3068	PRET DW	19/05/'81	UNK	Birth	Captive		19/05/'81
						19/05/'81		Death		19/05/'81	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T205	F	19/05/'81	3067	3068	PRET DW	19/05/'81	UNK	Birth	Captive		19/05/'81
						19/05/'81		Death		19/05/'81	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T206	M	28/05/'81	903	911	PRET DW	28/05/'81	UNK	Birth	Captive		09/08/'84
						09/08/'84		Death		09/08/'84	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T207	F	28/05/'81	903	911	PRET DW	28/05/'81	UNK	Birth	Captive		13/03/'85
						13/03/'85		Death		13/03/'85	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T208	?	28/05/'81	903	911	PRET DW	28/05/'81	UNK	Birth	Captive	UNK	
T209	?	28/05/'81	903	911	PRET DW	28/05/'81	UNK	Birth	Captive	UNK	
T210	?	28/05/'81	903	911	PRET DW	28/05/'81	UNK	Birth	Captive	UNK	
T211	?	28/05/'81	903	911	PRET DW	28/05/'81	UNK	Birth	Captive		16/11/'82
						16/11/'82		Death		16/11/'82	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T212	?	28/05/'81	903	911	PRET DW	28/05/'81	UNK	Birth	Captive		13/09/'81
						13/09/'81		Death		13/09/'81	
(Death by: Infection Associated, Unknown, No Autopsy Planned)											
T213	?	28/05/'81	903	911	PRET DW	28/05/'81	UNK	Birth	Captive		14/09/'82
						14/09/'82		Death		14/09/'82	
(Death by: Other/Unknown, Unknown, Nervous, Unknown (after autopsy))											
T214	?	08/04/'82	T165	T167	PRET DW	08/04/'82	UNK	Birth	Captive	UNK	
T215	?	08/04/'82	T165	T167	PRET DW	08/04/'82	UNK	Birth	Captive	UNK	
T216	?	08/04/'82	T165	T167	PRET DW	08/04/'82	UNK	Birth	Captive	UNK	
T217	?	08/04/'82	T165	T167	PRET DW	08/04/'82	UNK	Birth	Captive	UNK	
T218	?	08/04/'82	T165	T167	PRET DW	08/04/'82	UNK	Birth	Captive	UNK	
T219?	?	17/04/'82	T85	T88	PRET DW	17/04/'82	UNK	Birth	Captive		17/04/'82
						17/04/'82		Death		17/04/'82	
(Death by: Unknown means)											
T220?	?	17/04/'82	T85	T88	PRET DW	17/04/'82	UNK	Birth	Captive		17/04/'82
						17/04/'82		Death		17/04/'82	
(Death by: Unknown means)											
T221?	?	17/04/'82	T85	T88	PRET DW	17/04/'82	UNK	Birth	Captive		17/04/'82
						17/04/'82		Death		17/04/'82	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T222?	?	17/04/'82	T85	T88	PRET DW	17/04/'82	UNK	Birth	Captive		17/04/'82
						17/04/'82		Death		17/04/'82	
(Death by: Unknown means)											
T223?	?	17/04/'82	T85	T88	PRET DW	17/04/'82	UNK	Birth	Captive		17/04/'82
						17/04/'82		Death		17/04/'82	
(Death by: Unknown means)											
T224?	?	17/04/'82	T85	T88	PRET DW	17/04/'82	UNK	Birth	Captive		17/04/'82
						17/04/'82		Death		17/04/'82	
(Death by: Unknown means)											
T225?	?	17/04/'82	T85	T88	PRET DW	17/04/'82	UNK	Birth	Captive		17/04/'82
						17/04/'82		Death		17/04/'82	
(Death by: Unknown means)											
936	M	14/05/'82	3067	3068	PRET DW	14/05/'82	UNK	Birth	Captive		24/11/'83
					SANDIEGOZ	24/11/'83	UNK	Transfer		UNK	
937	M	14/05/'82	3067	3068	PRET DW	14/05/'82	UNK	Birth	Captive		24/11/'83
					SANDIEGOZ	24/11/'83	UNK	Transfer		UNK	
938	F	14/05/'82	3067	3068	PRET DW	14/05/'82	UNK	Birth	Captive		24/11/'83
					SANDIEGOZ	24/11/'83	UNK	Transfer		UNK	
939	F	14/05/'82	3067	3068	PRET DW	14/05/'82	UNK	Birth	Captive		24/11/'83
					SANDIEGOZ	24/11/'83	UNK	Transfer		UNK	
T230	?	14/05/'82	3067	3068	PRET DW	14/05/'82	UNK	Birth	Captive	UNK	
T231?	?	13/07/'82	903	911	PRET DW	13/07/'82	UNK	Birth	Captive		15/07/'82
						15/07/'82		Death		15/07/'82	
(Death by: Unknown means)											
T232?	?	13/07/'82	903	911	PRET DW	13/07/'82	UNK	Birth	Captive		15/07/'82
						15/07/'82		Death		15/07/'82	
(Death by: Unknown means)											
T233?	?	13/07/'82	903	911	PRET DW	13/07/'82	UNK	Birth	Captive		15/07/'82
						15/07/'82		Death		15/07/'82	
(Death by: Unknown means)											
T234?	?	13/07/'82	903	911	PRET DW	13/07/'82	UNK	Birth	Captive		15/07/'82
						15/07/'82		Death		15/07/'82	
(Death by: Unknown means)											
T235?	?	13/07/'82	903	911	PRET DW	13/07/'82	UNK	Birth	Captive		15/07/'82
						15/07/'82		Death		15/07/'82	
(Death by: Unknown means)											
T236?	?	13/07/'82	903	911	PRET DW	13/07/'82	UNK	Birth	Captive		15/07/'82
						15/07/'82		Death		15/07/'82	
(Death by: Unknown means)											
T237?	?	13/07/'82	903	911	PRET DW	13/07/'82	UNK	Birth	Captive		15/07/'82
						15/07/'82		Death		15/07/'82	
(Death by: Unknown means)											
T238?	?	12/04/'83	T165	T167	PRET DW	12/04/'83	UNK	Birth	Captive		12/04/'83
						12/04/'83		Death		12/04/'83	
(Death by: Unknown means)											
T239?	?	12/04/'83	T165	T167	PRET DW	12/04/'83	UNK	Birth	Captive		12/04/'83
						12/04/'83		Death		12/04/'83	
(Death by: Unknown means)											
T240?	?	12/04/'83	T165	T167	PRET DW	12/04/'83	UNK	Birth	Captive		12/04/'83
						12/04/'83		Death		12/04/'83	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T241?	?	12/04/’83	T165	T167	PRET DW	12/04/’83	UNK	Birth	Captive		12/04/’83
						12/04/’83		Death		12/04/’83	
(Death by: Unknown means)											
T242?	?	12/04/’83	T165	T167	PRET DW	12/04/’83	UNK	Birth	Captive		12/04/’83
						12/04/’83		Death		12/04/’83	
(Death by: Unknown means)											
T243?	?	12/04/’83	T165	T167	PRET DW	12/04/’83	UNK	Birth	Captive		12/04/’83
						12/04/’83		Death		12/04/’83	
(Death by: Unknown means)											
T244?	?	12/04/’83	T165	T167	PRET DW	12/04/’83	UNK	Birth	Captive		12/04/’83
						12/04/’83		Death		12/04/’83	
(Death by: Unknown means)											
T245?	?	30/05/’83	903	911	PRET DW	30/05/’83	UNK	Birth	Captive		03/06/’83
						03/06/’83		Death		03/06/’83	
(Death by: Unknown means)											
T246?	?	30/05/’83	903	911	PRET DW	30/05/’83	UNK	Birth	Captive		03/06/’83
						03/06/’83		Death		03/06/’83	
(Death by: Unknown means)											
T247?	?	30/05/’83	903	911	PRET DW	30/05/’83	UNK	Birth	Captive		03/06/’83
						03/06/’83		Death		03/06/’83	
(Death by: Unknown means)											
T248?	?	30/05/’83	903	911	PRET DW	30/05/’83	UNK	Birth	Captive		03/06/’83
						03/06/’83		Death		03/06/’83	
(Death by: Unknown means)											
T249?	?	30/05/’83	903	911	PRET DW	30/05/’83	UNK	Birth	Captive		03/06/’83
						03/06/’83		Death		03/06/’83	
(Death by: Unknown means)											
T250?	?	30/05/’83	903	911	PRET DW	30/05/’83	UNK	Birth	Captive		03/06/’83
						03/06/’83		Death		03/06/’83	
(Death by: Unknown means)											
T251?	?	30/05/’83	903	911	PRET DW	30/05/’83	UNK	Birth	Captive		03/06/’83
						03/06/’83		Death		03/06/’83	
(Death by: Unknown means)											
T252?	?	09/09/’83	903	911	PRET DW	09/09/’83	UNK	Birth	Captive		17/09/’83
						17/09/’83		Death		17/09/’83	
(Death by: Unknown means)											
T253?	?	09/09/’83	903	911	PRET DW	09/09/’83	UNK	Birth	Captive		17/09/’83
						17/09/’83		Death		17/09/’83	
(Death by: Unknown means)											
T254?	?	09/09/’83	903	911	PRET DW	09/09/’83	UNK	Birth	Captive		17/09/’83
						17/09/’83		Death		17/09/’83	
(Death by: Unknown means)											
T255?	?	09/09/’83	903	911	PRET DW	09/09/’83	UNK	Birth	Captive		17/09/’83
						17/09/’83		Death		17/09/’83	
(Death by: Unknown means)											
T256?	?	09/09/’83	903	911	PRET DW	09/09/’83	UNK	Birth	Captive		17/09/’83
						17/09/’83		Death		17/09/’83	
(Death by: Unknown means)											
T257?	?	09/09/’83	903	911	PRET DW	09/09/’83	UNK	Birth	Captive		17/09/’83
						17/09/’83		Death		17/09/’83	
(Death by: Unknown means)											
T258?	?	09/09/’83	903	911	PRET DW	09/09/’83	UNK	Birth	Captive		17/09/’83
						17/09/’83		Death		17/09/’83	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T259?	?	23/03/’84	903	911	PRET DW	23/03/’84	UNK	Birth	Captive		24/03/’84
						24/03/’84		Death		24/03/’84	
(Death by: Unknown means)											
T260?	?	23/03/’84	903	911	PRET DW	23/03/’84	UNK	Birth	Captive		24/03/’84
						24/03/’84		Death		24/03/’84	
(Death by: Unknown means)											
T261?	?	23/03/’84	903	911	PRET DW	23/03/’84	UNK	Birth	Captive		24/03/’84
						24/03/’84		Death		24/03/’84	
(Death by: Unknown means)											
T262?	?	23/03/’84	903	911	PRET DW	23/03/’84	UNK	Birth	Captive		24/03/’84
						24/03/’84		Death		24/03/’84	
(Death by: Unknown means)											
T263?	?	23/03/’84	903	911	PRET DW	23/03/’84	UNK	Birth	Captive		24/03/’84
						24/03/’84		Death		24/03/’84	
(Death by: Unknown means)											
T264?	?	23/03/’84	903	911	PRET DW	23/03/’84	UNK	Birth	Captive		24/03/’84
						24/03/’84		Death		24/03/’84	
(Death by: Unknown means)											
T265?	?	23/03/’84	903	911	PRET DW	23/03/’84	UNK	Birth	Captive		24/03/’84
						24/03/’84		Death		24/03/’84	
(Death by: Unknown means)											
T266?	?	10/05/’84	3067	3068	PRET DW	10/05/’84	UNK	Birth	Captive		14/05/’84
						14/05/’84		Death		14/05/’84	
(Death by: Unknown means)											
T267?	?	10/05/’84	3067	3068	PRET DW	10/05/’84	UNK	Birth	Captive		14/05/’84
						14/05/’84		Death		14/05/’84	
(Death by: Unknown means)											
T268?	?	10/05/’84	3067	3068	PRET DW	10/05/’84	UNK	Birth	Captive		14/05/’84
						14/05/’84		Death		14/05/’84	
(Death by: Unknown means)											
T269?	?	10/05/’84	3067	3068	PRET DW	10/05/’84	UNK	Birth	Captive		14/05/’84
						14/05/’84		Death		14/05/’84	
(Death by: Unknown means)											
T270?	?	10/05/’84	3067	3068	PRET DW	10/05/’84	UNK	Birth	Captive		14/05/’84
						14/05/’84		Death		14/05/’84	
(Death by: Unknown means)											
T271?	?	10/05/’84	3067	3068	PRET DW	10/05/’84	UNK	Birth	Captive		14/05/’84
						14/05/’84		Death		14/05/’84	
(Death by: Unknown means)											
T272?	?	10/05/’84	3067	3068	PRET DW	10/05/’84	UNK	Birth	Captive		14/05/’84
						14/05/’84		Death		14/05/’84	
(Death by: Unknown means)											
T273	?	21/05/’84	T165	T167	PRET DW	21/05/’84	UNK	Birth	Captive		09/06/’84
						09/06/’84		Death		09/06/’84	
(Death by: Unknown means)											
T274	M	21/05/’84	T165	T167	PRET DW	21/05/’84	UNK	Birth	Captive		15/06/’84
						15/06/’84		Death		15/06/’84	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T275	M	21/05/’84	T165	T167	PRET DW	21/05/’84	D92475	Birth	Captive		08/06/’94
						08/06/’94		Death		08/06/’94	
(Death by: Euthanasia, Unknown, Nervous, Unknown (after autopsy))											
T276	F	21/05/’84	T165	T167	PRET DW	21/05/’84	UNK	Birth	Captive		13/06/’84
						13/06/’84		Death		13/06/’84	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T277	F	21/05/'84	T165	T167	PRET DW	21/05/'84	D92476	Birth	Captive		29/06/'90
					PRETORIA	29/06/'90	UNK	Transfer			05/07/'90
					MEDUNSA	05/07/'90	UNK	Transfer			05/07/'90
					PRET DW	05/07/'90	D92476	Transfer			08/06/'94
						08/06/'94		Death		08/06/'94	
(Death by: Euthanasia Unknown No Autopsy Planned)											
T278	F	21/05/'84	T165	T167	PRET DW	21/05/'84	UNK	Birth	Captive	UNK	
T279	F	21/05/'84	T165	T167	PRET DW	21/05/'84	UNK	Birth	Captive	UNK	
T280?	?	16/07/'84	903	911	PRET DW	16/07/'84	UNK	Birth	Captive		16/07/'84
						16/07/'84		Death		16/07/'84	
(Death by: Unknown means)											
T281?	?	16/07/'84	903	911	PRET DW	16/07/'84	UNK	Birth	Captive		16/07/'84
						16/07/'84		Death		16/07/'84	
(Death by: Unknown means)											
T282?	?	16/07/'84	903	911	PRET DW	16/07/'84	UNK	Birth	Captive		16/07/'84
						16/07/'84		Death		16/07/'84	
(Death by: Unknown means)											
T283?	?	16/07/'84	903	911	PRET DW	16/07/'84	UNK	Birth	Captive		16/07/'84
						16/07/'84		Death		16/07/'84	
(Death by: Unknown means)											
T284?	?	16/07/'84	903	911	PRET DW	16/07/'84	UNK	Birth	Captive		16/07/'84
						16/07/'84		Death		16/07/'84	
(Death by: Unknown means)											
T285?	?	16/07/'84	903	911	PRET DW	16/07/'84	UNK	Birth	Captive		16/07/'84
						16/07/'84		Death		16/07/'84	
(Death by: Unknown means)											
T286?	?	16/07/'84	903	911	PRET DW	16/07/'84	UNK	Birth	Captive		16/07/'84
						16/07/'84		Death		16/07/'84	
(Death by: Unknown means)											
T287?	?	27/06/'85	903	911	PRET DW	27/06/'85	UNK	Birth	Captive		28/06/'85
						28/06/'85		Death		28/06/'85	
(Death by: Unknown means)											
T288?	?	27/06/'85	903	911	PRET DW	27/06/'85	UNK	Birth	Captive		28/06/'85
						28/06/'85		Death		28/06/'85	
(Death by: Unknown means)											
T289?	?	27/06/'85	903	911	PRET DW	27/06/'85	UNK	Birth	Captive		28/06/'85
						28/06/'85		Death		28/06/'85	
(Death by: Unknown means)											
T290?	?	27/06/'85	903	911	PRET DW	27/06/'85	UNK	Birth	Captive		28/06/'85
						28/06/'85		Death		28/06/'85	
(Death by: Unknown means)											
T291?	?	27/06/'85	903	911	PRET DW	27/06/'85	UNK	Birth	Captive		28/06/'85
						28/06/'85		Death		28/06/'85	
(Death by: Unknown means)											
T292?	?	27/06/'85	903	911	PRET DW	27/06/'85	UNK	Birth	Captive		28/06/'85
						28/06/'85		Death		28/06/'85	
(Death by: Unknown means)											
T293?	?	27/06/'85	903	911	PRET DW	27/06/'85	UNK	Birth	Captive		28/06/'85
						28/06/'85		Death		28/06/'85	
(Death by: Unknown means)											
T294	M	02/04/'86	903	911	PRET DW	02/04/'86	UNK	Birth	Captive		10/01/'88
						10/01/'88		Death		10/01/'88	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T295	M	02/04/'86	903	911	PRET DW	02/04/'86	UNK	Birth	Captive		13/07/'88
						13/07/'88		Death		13/07/'88	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T296	F	02/04/'86	903	911	PRET DW	02/04/'86	UNK	Birth	Captive		29/03/'87
						29/03/'87		Death		29/03/'87	
(Death by: Injury from Exhibit Mate, Unknown , No Autopsy Planned)											
T297	F	02/04/'86	903	911	PRET DW	02/04/'86	UNK	Birth	Captive		27/11/'87
						27/11/'87		Death		27/11/'87	
(Death by: Anesth./Restraint Assoc., Unknown, No Autopsy Planned)											
T298	F	02/04/'86	903	911	PRET DW	02/04/'86	UNK	Birth	Captive		19/01/'88
						19/01/'88		Death		19/01/'88	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T299	F	02/04/'86	903	911	PRET DW	02/04/'86	UNK	Birth	Captive		05/09/'88
					ETOSHA	05/09/'88	UNK	Transfer			~/10/'88
						~/10/'88	UNK	Release			
912	F	02/04/'86	903	911	PRET DW	02/04/'86	D92478	Birth	Captive		08/06/'94
						08/06/'94		Death		08/06/'94	
(Death by: Euthanasia, Unknown, No Autopsy Planned)											
T301	M	~/'84	UNK	UNK	UNKNOWN	~/'84	UNK	Birth	Captive		27/06/'88
					PRET DW	27/06/'88		Death		27/06/'88	
(Death by: Anesth./Restraint Assoc., Unknown, No Autopsy Planned)											
3009	M	~/'88	3000	3003	HARTBEESP	~/'88	UNK	Birth	Captive		
T303?	?	02/05/'87	3067	T277	PRET DW	02/05/'87	UNK	Birth	Captive		04/05/'87
						04/05/'87		Death		04/05/'87	
(Death by: Unknown means)											
T304?	?	02/05/'87	3067	T277	PRET DW	02/05/'87	UNK	Birth	Captive		04/05/'87
						04/05/'87		Death		04/05/'87	
(Death by: Unknown means)											
T305?	?	02/05/'87	3067	T277	PRET DW	02/05/'87	UNK	Birth	Captive		04/05/'87
						04/05/'87		Death		04/05/'87	
(Death by: Unknown means)											
T306?	?	02/05/'87	3067	T277	PRET DW	02/05/'87	UNK	Birth	Captive		04/05/'87
						04/05/'87		Death		04/05/'87	
(Death by: Unknown means)											
T307?	?	02/05/'87	3067	T277	PRET DW	02/05/'87	UNK	Birth	Captive		04/05/'87
						04/05/'87		Death		04/05/'87	
(Death by: Unknown means)											
T308?	?	02/05/'87	3067	T277	PRET DW	02/05/'87	UNK	Birth	Captive		04/05/'87
						04/05/'87		Death		04/05/'87	
(Death by: Unknown means)											
T309?	?	02/05/'87	3067	T277	PRET DW	02/05/'87	UNK	Birth	Captive		04/05/'87
						04/05/'87		Death		04/05/'87	
(Death by: Unknown means)											
T310?	?	03/11/'87	3067	T277	PRET DW	03/11/'87	UNK	Birth	Captive		03/11/'87
						03/11/'87		Death		03/11/'87	
(Death by: Unknown means)											
T311?	?	03/11/'87	3067	T277	PRET DW	03/11/'87	UNK	Birth	Captive		03/11/'87
						03/11/'87		Death		03/11/'87	
(Death by: Unknown means)											
T312?	?	03/11/'87	3067	T277	PRET DW	03/11/'87	UNK	Birth	Captive		03/11/'87
						03/11/'87		Death		03/11/'87	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T313?	?	03/11/’87	3067	T277	PRET DW	03/11/’87	UNK	Birth	Captive		03/11/’87
						03/11/’87		Death		03/11/’87	
(Death by: Unknown means)											
T314?	?	03/11/’87	3067	T277	PRET DW	03/11/’87	UNK	Birth	Captive		03/11/’87
						03/11/’87		Death		03/11/’87	
(Death by: Unknown means)											
T315?	?	03/11/’87	3067	T277	PRET DW	03/11/’87	UNK	Birth	Captive		03/11/’87
						03/11/’87		Death		03/11/’87	
(Death by: Unknown means)											
T316?	?	03/11/’87	3067	T277	PRET DW	03/11/’87	UNK	Birth	Captive		03/11/’87
						03/11/’87		Death		03/11/’87	
(Death by: Unknown means)											
T317	M	02/06/’88	903	911	PRET DW	02/06/’88	UNK	Birth	Captive		07/11/’88
					PRETORIA	07/11/’88	901237	Transfer			05/07/’89
					PRET DW	05/07/’89	D92481	Transfer			09/10/’89
					PRETORIA	09/10/’89	D92481	Transfer			~/11/’89
					MON FARON	~/11/’89	D92481	Transfer		UNK	
T318	M	02/06/’88	903	911	PRET DW	02/06/’88	UNK	Birth	Captive		07/11/’88
					PRETORIA	07/11/’88	UNK	Transfer			22/06/’89
						22/06/’89		Death		22/06/’89	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T319	M	02/06/’88	903	911	PRET DW	02/06/’88	UNK	Birth	Captive		01/12/’88
					PRETORIA	01/12/’88	UNK	Transfer			06/12/’88
					PRET DW	06/12/’88	UNK	Transfer			04/06/’89
					KRAAIFONT	~/06/’89	UNK	Transfer		UNK	
T320	F	02/06/’88	903	911	PRET DW	02/06/’88	UNK	Birth	Captive		07/11/’88
					PRETORIA	07/11/’88	UNK	Transfer			22/11/’88
					PRET DW	22/11/’88	UNK	Transfer			04/06/’89
					KRAAIFONT	~/06/’89	UNK	Transfer		UNK	
T321	M	02/06/’88	903	911	PRET DW	02/06/’88	UNK	Birth	Captive		07/11/’88
					ETOSHA	07/11/’88	UNK	Transfer			~/12/’88
						~/12/’88	UNK	Release			
T322	M	02/06/’88	903	911	PRET DW	02/06/’88	UNK	Birth	Captive		07/11/’88
					ETOSHA	07/11/’88	UNK	Transfer			~/12/’88
						~/12/’88	UNK	Release			
1950	M	02/06/’88	903	911	PRET DW	02/06/’88	D92479	Birth	Captive		27/05/’93
					PRETORIA	27/05/’93	903711	Transfer			
T324	F	02/06/’88	903	911	PRET DW	02/06/’88	UNK	Birth	Captive		07/11/’88
					ETOSHA	07/11/’88	UNK	Transfer			~/12/’88
T325	F	02/06/’88	903	911	PRET DW	02/06/’88	D92480	Birth	Captive		0709/’94
						07/09/’94		Death		07/09/’94	
(Death by: Euthanasia, Unknown, Generalized, New Growths)											
904	M	~/08/’87	903	911	PRET DW	~/08/’87	D92475	Birth	Captive		
T327	M	10/04/’89	903	911	PRET DW	10/04/’89	UNK	Birth	Captive		12/07/’89
					TSAUBIS	12/07/’89	UNK	Transfer		UNK	
T328	F	10/04/’89	903	911	PRET DW	10/04/’89	UNK	Birth	Captive		12/07/’89
					TSAUBIS	12/07/’89	UNK	Transfer		UNK	
T329	F	10/04/’89	903	911	PRET DW	10/04/’89	UNK	Birth	Captive		09/10/’89
					MON FARON	09/10/’89	UNK	Transfer		UNK	
910	F	10/04/’89	903	911	PRET DW	10/04/’89	D92483	Birth	Captive		31/03/’93
					KRAAIFONT	31/03/’93	UNK	Transfer			21/11/’94
					CANGO	21/11/’94	930021	Transfer			~/07/’95
						~/07/’95		Death		~/07/’95	
(Death by: Anesth./Restraint Assoc., Unknown, Unknown (after Autopsy), Trauma)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T331	F	10/04/'89	903	911	PRET DW	10/04/'89	D92484	Birth	Captive		27/05/'93
					PRETORIA	27/05/'93	903712	Transfer			~/02/'95
						~/01/'95		Death		~/01/'95	
(Death by: Infection Associated, Unknown, Reproductive, Unknown (after autopsy))											
1951	F	10/04/'89	903	911	PRET DW	10/04/'89	D92485	Birth	Captive		11/02/'95
						11/02/'95		Death		11/02/'95	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T333	M	10/04/'89	903	911	PRET DW	10/04/'89	D92482	Birth	Captive	UNK	
T334	?	10/04/'89	903	911	PRET DW	10/04/'89	UNK	Birth	Captive	UNK	
1028	F	~/'84	UNK	UNK	UNKNOWN	~/'84	UNK	Birth	UNK		
					BLOEMFNTN	~/'85	UNK	Transfer			05/07/'89
					PRETORIA	05/07/'89	900129	Transfer			12/12/'89
					PRET DW	12/12/'89	D92477	Transfer			21/01/'93
						21/01/'93		Death		21/01/'93	
(Death by: Euthanasia, Unknown, No Autopsy Planned)											
T336?	?	15/06/'89	UNK	UNK	PRET DW	15/06/'89	UNK	Birth	Captive		21/06/'89
						21/06/'89		Death		21/06/'89	
(Death by: Unknown means)											
T337?	?	15/06/'89	UNK	UNK	PRET DW	15/06/'89	UNK	Birth	Captive		21/06/'89
						21/06/'89		Death		21/06/'89	
(Death by: Unknown means)											
T338?	?	15/06/'89	UNK	UNK	PRET DW	15/06/'89	UNK	Birth	Captive		21/06/'89
						21/06/'89		Death		21/06/'89	
(Death by: Unknown means)											
T339?	?	15/06/'89	UNK	UNK	PRET DW	15/06/'89	UNK	Birth	Captive		21/06/'89
						21/06/'89		Death		21/06/'89	
(Death by: Unknown means)											
T340?	?	15/06/'89	UNK	UNK	PRET DW	15/06/'89	UNK	Birth	Captive		21/06/'89
						21/06/'89		Death		21/06/'89	
(Death by: Unknown means)											
T341?	?	15/06/'89	UNK	UNK	PRET DW	15/06/'89	UNK	Birth	Captive		21/06/'89
						21/06/'89		Death		21/06/'89	
(Death by: Unknown means)											
T342?	?	15/06/'89	UNK	UNK	PRET DW	15/06/'89	UNK	Birth	Captive		21/06/'89
						21/06/'89		Death		21/06/'89	
(Death by: Unknown means)											
T343	M	~/05/'90	T275	T277	PRET DW	~/05/'90	UNK	Birth	Captive		09/05/'90
						09/05/'90		Death		09/05/'90	
(Death by: Unknown means)											
T344	M	~/05/'90	T275	T277	PRET DW	~/05/'90	UNK	Birth	Captive		09/05/'90
						09/05/'90		Death		09/05/'90	
(Death by: Unknown means)											
T345	M	~/05/'90	T275	T277	PRET DW	~/05/'90	UNK	Birth	Captive		09/05/'90
						09/05/'90		Death		09/05/'90	
(Death by: Unknown means)											
T346	F	~/05/'90	T275	T277	PRET DW	~/05/'90	UNK	Birth	Captive		09/05/'90
						09/05/'90		Death		09/05/'90	
(Death by: Unknown means)											
T347	F	~/05/'90	T275	T277	PRET DW	~/05/'90	UNK	Birth	Captive		09/05/'90
						09/05/'90		Death		09/05/'90	
(Death by: Unknown means)											
T348	F	~/05/'90	T275	T277	PRET DW	~/05/'90	UNK	Birth	Captive		09/05/'90
						09/05/'90		Death		09/05/'90	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T349	?	15/05/'90	903	T325	PRET DW	15/05/'90	UNK	Birth	Captive		15/05/'90
						15/05/'90		Death		15/05/'90	
(Death by: Unknown means)											
T350	?	15/05/'90	903	T325	PRET DW	15/05/'90	UNK	Birth	Captive		15/05/'90
						15/05/'90		Death		15/05/'90	
(Death by: Unknown means)											
T351	?	15/05/'90	903	T325	PRET DW	15/05/'90	UNK	Birth	Captive		15/05/'90
						15/05/'90		Death		15/05/'90	
(Death by: Unknown means)											
T352	?	15/05/'90	903	T325	PRET DW	15/05/'90	UNK	Birth	Captive		15/05/'90
						15/05/'90		Death		15/05/'90	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T353	?	15/05/'90	903	T325	PRET DW	15/05/'90	UNK	Birth	Captive		15/05/'90
						15/05/'90		Death		15/05/'90	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T354	?	15/05/'90	903	T325	PRET DW	15/05/'90	UNK	Birth	Captive		15/05/'90
						15/05/'90		Death		15/05/'90	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
913	F	27/10/'90	904	912	PRET DW	27/10/'90	D92486	Birth	Captive		
T356	?	04/06/'91	T333	T277	PRET DW	04/06/'91	UNK	Birth	Captive		~/06/'91
						~/06/'91		Death		~/06/'91	
(Death by: Unknown means)											
T357	?	04/06/'91	T333	T277	PRET DW	04/06/'91	UNK	Birth	Captive		~/06/'91
						~/06/'91		Death		~/06/'91	
(Death by: Unknown means)											
T358	?	04/06/'91	T333	T277	PRET DW	04/06/'91	UNK	Birth	Captive		27/06/'91
						27/06/'91		Death		27/06/'91	
(Death by: Infection Associated, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T359	?	04/06/'91	T333	T277	PRET DW	04/06/'91	UNK	Birth	Captive		27/06/'91
						27/06/'91		Death		27/06/'91	
(Death by: Infection Associated, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T360	?	27/06/'91	904	912	PRET DW	27/06/'91	UNK	Birth	Captive		~/06/'91
						~/06/'91		Death		~/06/'91	
(Death by: Infection Associated, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T361	?	27/06/'91	904	912	PRET DW	27/06/'91	UNK	Birth	Captive		~/06/'91
						~/06/'91		Death		~/06/'91	
(Death by: Infection Associated, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T362	?	27/06/'91	904	912	PRET DW	27/06/'91	UNK	Birth	Captive		~/06/'91
						~/06/'91		Death		~/06/'91	
(Death by: Infection Associated, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T363	F	20/06/'91	904	912	PRET DW	20/06/'91	D92489	Birth	Captive		07/01/'92
						07/01/'92		Death		07/01/'92	
(Death by: Self Inflicted Injuries, Unknown, Respiratory, Trauma)											
3010	M	20/06/'91	904	912	PRET DW	20/06/'91	D92487	Birth	Captive		
1947	F	20/06/'91	904	912	PRET DW	20/06/'91	D92488	Birth	Captive		16/02/'93
					PRETORIA	16/02/'93	903589	Transfer			08/03/'93
					PRET DW	08/03/'93	D92488	Transfer			
						~/03/'95		Death		~/03/'95	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T366	M	20/02/'92	904	912	PRET DW	20/02/'92	D92490	Birth	Captive		19/10/'92
						19/10/'92		Death		19/10/'92	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T367	F	20/02/'92	904	912	PRET DW	20/02/'92 19/10/'92	D92491	Birth Death	Captive	 19/10/'92	19/10/'92
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T368	F	20/02/'92	904	912	PRET DW	20/02/'92 19/10/'92	D92492	Birth Death	Captive	 19/10/'92	19/10/'92
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T369	F	20/02/'92	904	912	PRET DW	20/02/'92 04/05/'92	D92493	Birth Death	Captive	 04/05/'92	04/05/'92
(Death by: Other/Unknown,Given to an Institution: PRET DW,Unknown (after Autopsy), Unknown (after autopsy))											
T370	F	29/05/'92	1950	913	PRET DW	29/05/'92 08/06/'94	D92494	Birth Death	Captive	 08/06/'94	08/06/'94
(Death by: Euthanasia, Unknown, No Autopsy Planned)											
T371	?	29/05/'92	1950	913	PRET DW	29/05/'92 30/05/'92	D92496	Birth Death	Captive	 30/05/'92	30/05/'92
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T372	?	29/05/'92	1950	913	PRET DW	29/05/'92 30/05/'92	D92495	Birth Death	Captive	 30/05/'92	30/05/'92
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T373	?	29/05/'92	1950	913	PRET DW	29/05/'92 30/05/'92	D92497	Birth Death	Captive	 30/05/'92	30/05/'92
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T374	?	29/05/'92	1950	913	PRET DW	29/05/'92 30/05/'92	D92498	Birth Death	Captive	 30/05/'92	29/05/'92
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T375	?	29/05/'92	1950	913	PRET DW	29/05/'92 30/05/'92	D92499	Birth Death	Captive	 30/05/'92	29/05/'92
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T376	?	29/05/'92	1950	913	PRET DW	29/05/'92 30/05/'92	D92500	Birth Death	Captive	 30/05/'92	29/05/'92
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T377	?	29/05/'92	1950	913	PRET DW	29/05/'92 30/05/'92	D92501	Birth Death	Captive	 30/05/'92	29/05/'92
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T378	?	29/05/'92	1950	913	PRET DW	29/05/'92 30/05/'92	D92502	Birth Death	Captive	 30/05/'92	29/05/'92
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T379	?	29/05/'92	1950	913	PRET DW	29/05/'92 30/05/'92	D92503	Birth Death	Captive	 30/05/'92	29/05/'92
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T380	M	09/03/'93	904	912	PRET DW MCADAM	09/03/'93 04/10/'94	D92548 UNK	Birth Transfer	Captive		04/10/'94
1992	M	09/03/'93	904	912	PRET DW MCADAM	09/03/'93 04/10/'94	D92549 UNK	Birth Transfer	Captive		04/10/'94
1993	F	09/03/'93	904	912	PRET DW	09/03/'93	D92549	Birth	Captive		
1983	M	~/'89	WILD	WILD	GAUTENG PRET DW	~/09/'92 07/09/'92	UNK D92564	Capture Transfer	Wild		07/09/'92
1994	F	03/05/'93	1983	913	PRET DW MODIKWE	03/05/'93 07/02/'95	D92570 UNK	Birth Transfer	Captive		07/02/'95
1995	F	03/05/'93	1983	913	PRET DW	03/05/'93	D92571	Birth	Captive		
1996	F	03/05/'93	1983	913	PRET DW MODIKWE	03/05/'93 07/02/'95	D92572 UNK	Birth Transfer	Captive		07/02/'95

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
1997	F	03/05/'93	1983	913	PRET DW	03/05/'93	D92573	Birth	Captive		07/02/'95
					MODIKWE	07/02/'95	UNK	Transfer			
1998	F	03/05/'93	1983	913	PRET DW	03/05/'93	D92574	Birth	Captive		11/08/'93
						11/08/'93		Death		11/08/'93	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T389	?	14/05/'93	3010	1947	PRET DW	14/05/'93	UNK	Birth	Captive		~/05/'93
						~/05/'93		Death		~/05/'93	
(Death by: Unknown means)											
T390	?	14/05/'93	3010	1947	PRET DW	14/05/'93	UNK	Birth	Captive		~/05/'93
						~/05/'93		Death		~/05/'93	
(Death by: Unknown means)											
T391	?	14/05/'93	3010	1947	PRET DW	14/05/'93	UNK	Birth	Captive		~/05/'93
						~/05/'93		Death		~/05/'93	
(Death by: Euthanasia, Unknown, No Autopsy Planned)											
T392	?	14/05/'93	3010	1947	PRET DW	14/05/'93	UNK	Birth	Captive		~/05/'93
						~/05/'93		Death		~/05/'93	
(Death by: Euthanasia, Unknown, No Autopsy Planned)											
T393	?	14/05/'93	3010	1947	PRET DW	14/05/'93	UNK	Birth	Captive		~/05/'93
						~/05/'93		Death		~/05/'93	
(Death by: Euthanasia, Unknown, No Autopsy Planned)											
T394	?	14/05/'93	3010	1947	PRET DW	14/05/'93	UNK	Birth	Captive		~/05/'93
						~/05/'93		Death		~/05/'93	
(Death by: Euthanasia, Unknown, No Autopsy Planned)											
T395	?	14/05/'93	3010	1947	PRET DW	14/05/'93	UNK	Birth	Captive		~/05/'93
						~/05/'93		Death		~/05/'93	
(Death by: Euthanasia, Unknown, No Autopsy Planned)											
T396	?	18/05/'93	T275	T277	PRET DW	18/05/'93	UNK	Birth	Captive		18/05/'93
						18/05/'93		Death		18/05/'93	
(Death by: Unknown means)											
1982	M	~/'87	WILD	WILD	ETOSHA	~/05/'93	UNK	Capture	Wild		21/05/'93
					PRET DW	21/05/'93	D92565	Transfer			
1984	M	~/'92	WILD	WILD	ETOSHA	~/05/'93	UNK	Capture	Wild		21/05/'93
					PRET DW	21/05/'93	D92566	Transfer			
1985	F	~/'92	WILD	WILD	ETOSHA	~/05/'93	UNK	Capture	Wild		21/05/'93
					PRET DW	21/05/'93	D92567	Transfer			
1986	F	~/'92	WILD	WILD	ETOSHA	~/05/'93	UNK	Capture	Wild		21/05/'93
					PRET DW	21/05/'93	D92568	Transfer			
1987	F	~/'92	WILD	WILD	ETOSHA	~/05/'93	UNK	Capture	Wild		21/05/'93
					PRET DW	21/05/'93	D92569	Transfer			
2034	F	~/'90	WILD	WILD	NAMIBIA	~/'93	UNK	Capture	Wild		~/'93
					OKAHANDJA	~/'93	UNK	Transfer			21/12/'93
					PRET DW	21/12/'93	D92593	Transfer			
2035	M	~/'90	WILD	WILD	NAMIBIA	~/'93	UNK	Capture	Wild		~/'93
					OKAHANDJA	01/01/'93	UNK	Transfer			21/12/'93
					PRET DW	21/12/'93	D92594	Transfer			
T404?	?	~/06/'94	1983	913	PRET DW	~/06/'94	UNK	Birth	Captive		01/06/'94
						~/06/'94		Death		01/06/'94	
(Death by: Unknown means)											
T405?	?	~/06/'94	1983	913	PRET DW	~/06/'94	UNK	Birth	Captive		01/06/'94
						~/06/'94		Death		01/06/'94	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T406?	?	~/06/'94	1983	913	PRET DW	~/06/'94	UNK	Birth	Captive		01/06/'94
						~/06/'94		Death		01/06/'94	
(Death by: Unknown means)											
T407?	?	~/06/'94	1983	913	PRET DW	~/06/'94	UNK	Birth	Captive		01/06/'94
						~/06/'94		Death		01/06/'94	
(Death by: Unknown means)											
T408?	?	~/06/'94	1983	913	PRET DW	~/06/'94	UNK	Birth	Captive		01/06/'94
						~/06/'94		Death		01/06/'94	
(Death by: Unknown means)											
T409?	?	~/06/'94	1983	913	PRET DW	~/06/'94	UNK	Birth	Captive		01/06/'94
						~/06/'94		Death		01/06/'94	
(Death by: Unknown means)											
T410?	?	~/06/'94	1983	913	PRET DW	~/06/'94	UNK	Birth	Captive		01/06/'94
						~/06/'94		Death		01/06/'94	
(Death by: Unknown means)											
T411?	?	~/06/'94	1982	1985	PRET DW	~/06/'94	UNK	Birth	Captive		~/06/'94
						~/06/'94		Death		~/06/'94	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T412?	?	~/06/'94	1982	1985	PRET DW	~/06/'94	UNK	Birth	Captive		~/06/'94
						~/06/'94		Death		~/06/'94	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T413?	?	~/06/'94	1982	1985	PRET DW	~/06/'94	UNK	Birth	Captive		~/06/'94
						~/06/'94		Death		~/06/'94	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T414?	?	~/06/'94	1982	1985	PRET DW	~/06/'94	UNK	Birth	Captive		~/06/'94
						~/06/'94		Death		~/06/'94	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T415?	?	~/06/'94	1982	1985	PRET DW	~/06/'94	UNK	Birth	Captive		~/06/'94
						~/06/'94		Death		~/06/'94	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T416?	?	~/06/'94	1982	1985	PRET DW	~/06/'94	UNK	Birth	Captive		~/06/'94
						~/06/'94		Death		~/06/'94	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T417?	?	~/06/'94	1982	1985	PRET DW	~/06/'94	UNK	Birth	Captive		~/06/'94
						~/06/'94		Death		~/06/'94	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T418	?	04/04/'94	1950	T331	PRETORIA	04/04/'94	UNK	Birth	Captive		04/04/'94
						04/04/'94		Death		04/04/'94	
(Death by: Unknown means)											
T419	?	04/04/'94	1950	T331	PRETORIA	04/04/'94	UNK	Birth	Captive		04/04/'94
						04/04/'94		Death		04/04/'94	
(Death by: Unknown means)											
T420	?	04/04/'94	1950	T331	PRETORIA	04/04/'94	UNK	Birth	Captive		04/04/'94
						04/04/'94		Death		04/04/'94	
(Death by: Unknown means)											
T421	?	04/04/'94	1950	T331	PRETORIA	04/04/'94	UNK	Birth	Captive		04/04/'94
						04/04/'94		Death		04/04/'94	
(Death by: Unknown means)											
T422	?	04/04/'94	1950	T331	PRETORIA	04/04/'94	UNK	Birth	Captive		04/04/'94
						04/04/'94		Death		04/04/'94	
(Death by: Unknown means)											
T423	?	04/04/'94	1950	T331	PRETORIA	04/04/'94	UNK	Birth	Captive		04/04/'94
						04/04/'94		Death		04/04/'94	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T424	?	04/04/'94	1950	T331	PRETORIA	04/04/'94	UNK	Birth	Captive		04/04/'94
						04/04/'94		Death		04/04/'94	
(Death by: Unknown means)											
T425	?	04/04/'94	1950	T331	PRETORIA	04/04/'94	UNK	Birth	Captive		04/04/'94
						04/04/'94		Death		04/04/'94	
(Death by: Unknown means)											
T426	?	04/04/'94	1950	T331	PRETORIA	04/04/'94	UNK	Birth	Captive		04/04/'94
						04/04/'94		Death		04/04/'94	
(Death by: Unknown means)											
T427	?	04/04/'94	1950	T331	PRETORIA	04/04/'94	UNK	Birth	Captive		04/04/'94
						04/04/'94		Death		04/04/'94	
(Death by: Unknown means)											
3014	F	~/12/'94	1983	913	PRET DW	~/12/'94	UNK	Birth	Captive		
					HOEDSPRUI	~/01/'96	UNK	Transfer			
3015	?	~/12/'94	1983	913	PRET DW	~/12/'94	UNK	Birth	Captive		
3016	?	~/12/'94	1983	913	PRET DW	~/12/'94	UNK	Birth	Captive		
T431	?	~/12/'94	1983	913	PRET DW	~/12/'94	UNK	Birth	Captive		
T432	?	~/12/'94	1983	913	PRET DW	~/12/'94	UNK	Birth	Captive		
T433	?	~/12/'94	1983	913	PRET DW	~/12/'94	UNK	Birth	Captive		
3017	M	~/'83	3000	3003	HARTBEESP	~/'83	UNK	Birth	Captive		
2031	M	~/'77	WILD	WILD	GAUTENG	~/06/'79	UNK	Capture	Wild		13/07/'79
					JOHANSBRG	13/07/'79	UNK	Transfer			17/09/'86
					RAVENSDAM	17/09/'86	UNK	Transfer		UNK	
2032	F	~/'77	WILD	WILD	GAUTENG	~/06/'79	UNK	Capture	Wild		13/07/'79
					JOHANSBRG	13/07/'79	UNK	Transfer			17/09/'86
					RAVENSDAM	17/09/'86	UNK	Transfer		UNK	
T437	M	03/06/'80	2031	2032	JOHANSBRG	03/06/'80	UNK	Birth	Captive		13/06/'80
						13/06/'80		Death		13/06/'80	
(Death by: Env. or Beh. Conditions, Unknown, Unknown (after Autopsy), Nutrition)											
T438	M	03/06/'80	2031	2032	JOHANSBRG	03/06/'80	UNK	Birth	Captive		13/06/'80
						13/06/'80		Death		13/06/'80	
(Death by: Env. or Beh. Conditions, Unknown, Unknown (after Autopsy), Nutrition)											
T439	M	03/06/'80	2031	2032	JOHANSBRG	03/06/'80	UNK	Birth	Captive		13/06/'80
						13/06/'80		Death		13/06/'80	
(Death by: Env. or Beh. Conditions, Unknown, Unknown (after Autopsy), Nutrition)											
T440	M	03/06/'80	2031	2032	JOHANSBRG	03/06/'80	UNK	Birth	Captive		13/06/'80
						13/06/'80		Death		13/06/'80	
(Death by: Env. or Beh. Conditions, Unknown, Unknown (after Autopsy), Nutrition)											
T441	M	03/06/'80	2031	2032	JOHANSBRG	03/06/'80	UNK	Birth	Captive		13/06/'80
						13/06/'80		Death		13/06/'80	
(Death by: Env. or Beh. Conditions, Unknown, Unknown (after Autopsy), Nutrition)											
T442	F	03/06/'80	2031	2032	JOHANSBRG	03/06/'80	UNK	Birth	Captive		13/06/'80
						13/06/'80		Death		13/06/'80	
(Death by: Env. or Beh. Conditions, Unknown, Unknown (after Autopsy), Nutrition)											
T443	F	03/06/'80	2031	2032	JOHANSBRG	03/06/'80	UNK	Birth	Captive		13/06/'80
						13/06/'80		Death		13/06/'80	
(Death by: Env. or Beh. Conditions, Unknown, Unknown (after Autopsy), Nutrition)											
T444	F	03/06/'80	2031	2032	JOHANSBRG	03/06/'80	UNK	Birth	Captive		13/06/'80
						13/06/'80		Death		13/06/'80	
(Death by: Env. or Beh. Conditions, Unknown, Unknown (after Autopsy), Nutrition)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T445	F	03/06/'80	2031	2032	JOHANSBRG	03/06/'80	UNK	Birth	Captive		13/06/'80
						13/06/'80		Death		13/06/'80	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T446	M	11/05/'81	2031	2032	JOHANSBRG	11/05/'81	UNK	Birth	Captive		20/05/'81
						20/05/'81		Death		20/05/'81	
(Death by: Env. or Beh. Conditions _ Unknown _ Unknown (after Autopsy) _ Nutrition)											
T447?	?	11/05/'81	2031	2032	JOHANSBRG	11/05/'81	UNK	Birth	Captive		20/05/'81
						20/05/'81		Death		20/05/'81	
(Death by: Unknown means)											
T448?	?	11/05/'81	2031	2032	JOHANSBRG	11/05/'81	UNK	Birth	Captive		20/05/'81
						20/05/'81		Death		20/05/'81	
(Death by: Unknown means)											
T449?	?	11/05/'81	2031	2032	JOHANSBRG	11/05/'81	UNK	Birth	Captive		20/05/'81
						20/05/'81		Death		20/05/'81	
(Death by: Unknown means)											
T450?	?	11/05/'81	2031	2032	JOHANSBRG	11/05/'81	UNK	Birth	Captive		20/05/'81
						20/05/'81		Death		20/05/'81	
(Death by: Unknown means)											
T451?	?	11/05/'81	2031	2032	JOHANSBRG	11/05/'81	UNK	Birth	Captive		20/05/'81
						20/05/'81		Death		20/05/'81	
(Death by: Unknown means)											
T452?	?	11/05/'81	2031	2032	JOHANSBRG	11/05/'81	UNK	Birth	Captive		20/05/'81
						20/05/'81		Death		20/05/'81	
(Death by: Unknown means)											
T453	?	20/04/'82	2031	2032	JOHANSBRG	20/04/'82	UNK	Birth	Captive		17/10/'82
						17/10/'82		Death		17/10/'82	
(Death by: Infection Associated, Unknown, Generalized, Unknown (after autopsy))											
T454	?	20/04/'82	2031	2032	JOHANSBRG	20/04/'82	UNK	Birth	Captive		17/10/'82
						17/10/'82		Death		17/10/'82	
(Death by: Infection Associated, Unknown, Generalized, Unknown (after autopsy))											
T455	?	20/04/'82	2031	2032	JOHANSBRG	20/04/'82	UNK	Birth	Captive		17/10/'82
						17/10/'82		Death		17/10/'82	
(Death by: Infection Associated, Unknown, Generalized, Unknown (after autopsy))											
T456	?	20/04/'82	2031	2032	JOHANSBRG	20/04/'82	UNK	Birth	Captive		19/10/'82
						19/10/'82		Death		19/10/'82	
(Death by: Infection Associated, Unknown, Respiratory, Unknown (after autopsy))											
T457	M	20/04/'82	2031	2032	JOHANSBRG	20/04/'82	UNK	Birth	Captive		20/08/'82
						20/08/'82		Death		20/08/'82	
(Death by: Injury from Predator, Unknown, Unknown (after Autopsy), Trauma)											
T458	M	20/04/'82	2031	2032	JOHANSBRG	20/04/'82	UNK	Birth	Captive		11/05/'88
						11/05/'88		Death		11/05/'88	
(Death by: Anesth./Restraint Assoc., Unknown, No Autopsy Planned)											
3006	M	20/04/'82	2031	2032	JOHANSBRG	20/04/'82	UNK	Birth	Captive		08/05/'90
					AGS	08/05/'90	UNK	Transfer		UNK	
T460	F	16/05/'83	2031	2032	JOHANSBRG	16/05/'83	UNK	Birth	Captive		02/08/'83
						02/08/'83		Death		02/08/'83	
(Death by: Unknown means)											
T461	?	16/05/'83	2031	2032	JOHANSBRG	16/05/'83	UNK	Birth	Captive		02/08/'83
						02/08/'83		Death		02/08/'83	
(Death by: Unknown means)											
T462	?	16/05/'83	2031	2032	JOHANSBRG	16/05/'83	UNK	Birth	Captive		12/08/'83
						12/08/'83		Death		12/08/'83	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T463	F	16/05/'83	2031	2032	JOHANSBRG	16/05/'83	UNK	Birth	Captive		13/08/'83
						13/08/'83		Death		13/08/'83	
(Death by: Unknown means)											
T464	?	16/05/'83	2031	2032	JOHANSBRG	16/05/'83	UNK	Birth	Captive		13/08/'83
						13/08/'83		Death		13/08/'83	
(Death by: Unknown means)											
T465	M	16/05/'83	2031	2032	JOHANSBRG	16/05/'83	UNK	Birth	Captive		23/04/'86
					NATAL PB	23/04/'86	UNK	Transfer			23/04/'86
					S LUCIA	~/04/'86	UNK	Release			
T466	M	16/05/'83	2031	2032	JOHANSBRG	16/05/'83	UNK	Birth	Captive		23/04/'86
					NATAL PB	23/04/'86	UNK	Transfer			23/04/'86
					S LUCIA	~/04/'86	UNK	Release			
T467	F	16/05/'83	2031	2032	JOHANSBRG	16/05/'83	UNK	Birth	Captive		23/04/'86
					NATAL PB	23/04/'86	UNK	Transfer			23/04/'86
					S LUCIA	~/04/'86	UNK	Release			
T468	F	16/05/'83	2031	2032	JOHANSBRG	16/05/'83	UNK	Birth	Captive		23/04/'86
					NATAL PB	23/04/'86	UNK	Transfer			23/04/'86
					S LUCIA	~/04/'86	UNK	Release			
T469	F	16/05/'83	2031	2032	JOHANSBRG	16/05/'83	UNK	Birth	Captive		23/04/'86
					NATAL PB	23/04/'86	UNK	Transfer			23/04/'86
					S LUCIA	~/04/'86	UNK	Release			
T470	F	16/05/'83	2031	2032	JOHANSBRG	16/05/'83	UNK	Birth	Captive		23/04/'86
					NATAL PB	23/04/'86	UNK	Transfer			23/04/'86
					S LUCIA	~/04/'86	UNK	Release			
T471	F	~/'82	UNK	UNK	JOHANSBRG	~/04/'84	UNK	Transfer	UNK		09/11/'87
						09/11/'87		Death		09/11/'87	
(Death by: Euthanasia, Mounted or Preserved: JOHANSBRG, Unknown (after Autopsy), Unknown (after autopsy))											
2021	M	01/07/'84	2031	2032	JOHANSBRG	01/07/'84	UNK	Birth	Captive		~/01/'91
					KLASERIE	~/01/'91	UNK	Transfer			~/01/'91
						~/01/'91		Death		~/01/'91	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
3008	F	01/07/'84	2031	2032	JOHANSBRG	01/07/'84	UNK	Birth	Captive		03/08/'88
						03/08/'88		Death		03/08/'88	
(Death by: Injury from Exhibit Mate, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
2022	F	01/07/'84	2031	2032	JOHANSBRG	01/07/'84	UNK	Birth	Captive		20/07/'90
						20/07/'90		Death		20/07/'90	
(Death by: Other/Unknown, Unknown, Reproductive, Unknown (after autopsy))											
T475	F	01/07/'84	2031	2032	JOHANSBRG	01/07/'84	UNK	Birth	Captive		~/05/'88
						~/05/'88		Death		~/05/'88	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T476	M	~/'83	UNK	UNK	JOHANSBRG	~/09/'85	UNK	Transfer	UNK		23/04/'86
					NATAL PB	23/04/'86	UNK	Transfer			30/04/'86
					S LUCIA	~/04/'86	UNK	Release			
T477	?	30/04/'86	2031	2032	JOHANSBRG	30/04/'86	UNK	Birth	Captive		~/05/'86
						~/05/'86		Death		~/05/'86	
(Death by: Unknown means)											
T478?	?	30/04/'86	2031	2032	JOHANSBRG	30/04/'86	UNK	Birth	Captive		02/05/'86
						02/05/'86		Death		02/05/'86	
(Death by: Injury from Exhibit Mate, Unknown, Unknown (after Autopsy), Trauma)											
T479?	?	30/04/'86	2031	2032	JOHANSBRG	30/04/'86	UNK	Birth	Captive		02/05/'86
						02/05/'86		Death		02/05/'86	
(Death by: Injury from Exhibit Mate, Unknown, Unknown (after Autopsy), Trauma)											
T480?	?	30/04/'86	2031	2032	JOHANSBRG	30/04/'86	UNK	Birth	Captive		02/05/'86
						02/05/'86		Death		02/05/'86	
(Death by: Injury from Exhibit Mate, Unknown, Unknown (after Autopsy), Trauma)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T481?	?	30/04/’86	2031	2032	JOHANSBRG	30/04/’86	UNK	Birth	Captive		02/05/’86
						02/05/’86		Death		02/05/’86	
(Death by: Injury from Exhibit Mate, Unknown, Unknown (after Autopsy), Trauma)											
T482?	?	30/04/’86	2031	2032	JOHANSBRG	30/04/’86	UNK	Birth	Captive		02/05/’86
						02/05/’86		Death		02/05/’86	
(Death by: Injury from Exhibit Mate, Unknown, Unknown (after Autopsy), Trauma)											
T483?	?	30/04/’86	2031	2032	JOHANSBRG	30/04/’86	UNK	Birth	Captive		02/05/’86
						02/05/’86		Death		02/05/’86	
(Death by: Injury from Exhibit Mate, Unknown, Unknown (after Autopsy), Trauma)											
T484?	?	01/05/’86	T458	T475	JOHANSBRG	01/05/’86	UNK	Birth	UNK		01/05/’86
						01/05/’86		Death		01/05/’86	
(Death by: Unknown means)											
T485?	?	01/05/’86	T458	T475	JOHANSBRG	01/05/’86	UNK	Birth	UNK		01/05/’86
						01/05/’86		Death		01/05/’86	
(Death by: Unknown means)											
T486?	?	01/05/’86	T458	T475	JOHANSBRG	01/05/’86	UNK	Birth	UNK		01/05/’86
						01/05/’86		Death		01/05/’86	
(Death by: Unknown means)											
T487?	?	01/05/’86	T458	T475	JOHANSBRG	01/05/’86	UNK	Birth	UNK		01/05/’86
						01/05/’86		Death		01/05/’86	
(Death by: Unknown means)											
T488?	?	01/05/’86	T458	T475	JOHANSBRG	01/05/’86	UNK	Birth	UNK		01/05/’86
						01/05/’86		Death		01/05/’86	
(Death by: Unknown means)											
T489?	?	01/05/’86	T458	T475	JOHANSBRG	01/05/’86	UNK	Birth	UNK		01/05/’86
						01/05/’86		Death		01/05/’86	
(Death by: Unknown means)											
T490?	?	01/05/’86	T458	T475	JOHANSBRG	01/05/’86	UNK	Birth	UNK		01/05/’86
						01/05/’86		Death		01/05/’86	
(Death by: Unknown means)											
T491	?	01/05/’86	3006	3008	JOHANSBRG	01/05/’86	UNK	Birth	Captive		10/06/’86
						10/06/’86		Death		10/06/’86	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T492	?	01/05/’86	3006	3008	JOHANSBRG	01/05/’86	UNK	Birth	Captive		10/06/’86
						10/06/’86		Death		10/06/’86	
(Death by: Unknown means)											
T493	M	01/05/’86	3006	3008	JOHANSBRG	01/05/’86	UNK	Birth	Captive		17/09/’86
					RAVENSDAM	17/09/’86	UNK	Transfer		UNK	
T494	F	01/05/’86	3006	3008	JOHANSBRG	01/05/’86	UNK	Birth	Captive		17/09/’86
					RAVENSDAM	17/09/’86	UNK	Transfer		UNK	
T495	F	01/05/’86	3006	3008	JOHANSBRG	01/05/’86	UNK	Birth	Captive		17/09/’86
					RAVENSDAM	17/09/’86	UNK	Transfer		UNK	
T496	M	01/05/’86	3006	3008	JOHANSBRG	01/05/’86	UNK	Birth	Captive		02/06/’87
					DELFTS	02/06/’87	UNK	Transfer		UNK	
T497	M	01/05/’86	3006	3008	JOHANSBRG	01/05/’86	UNK	Birth	Captive		02/06/’87
					DELFTS	02/06/’87	UNK	Transfer		UNK	
T498	M	01/05/’86	3006	3008	JOHANSBRG	01/05/’86	UNK	Birth	Captive		08/05/’90
					AGS	08/05/’90	UNK	Transfer		UNK	

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T499	M	01/05/'86	3006	3008	JOHANSBRG	01/05/'86	UNK	Birth	Captive		01/08/'89
					RIETVLEI	01/08/'89	UNK	Transfer			~/01/'91
					KLASERIE	~/01/'91	UNK	Transfer			~/02/'91
						~/04/'91	UNK	Release			
						~/05/'91	UNK	Capture			~/05/'91
						~/05/'91		Death		~/05/'91	
(Death by: Anesth./Restraint Assoc., Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T500	F	01/05/'86	3006	3008	JOHANSBRG	01/05/'86	UNK	Birth	Captive		19/03/'87
						19/03/'87		Death		19/03/'87	
(Death by: Unknown means)											
T501	F	01/05/'86	3006	3008	JOHANSBRG	01/05/'86	UNK	Birth	Captive		13/10/'87
					GRANOVER	13/10/'87	UNK	Transfer		UNK	
T502	F	01/05/'86	3006	3008	JOHANSBRG	01/05/'86	UNK	Birth	Captive		13/10/'87
					GRANOVER	13/10/'87	UNK	Transfer		UNK	
T503	M	02/05/'86	3006	3008	JOHANSBRG	02/05/'86	UNK	Birth	Captive		~/05/'86
						~/05/'86		Death		~/05/'86	
(Death by: Infection Associated, Unknown, Respiratory, Bacterial)											
T504?	?	20/06/'85	2031	T471	JOHANSBRG	20/06/'85	UNK	Birth	Captive		20/06/'85
						20/06/'85		Death		20/06/'85	
(Death by: Unknown means)											
T505?	?	20/06/'85	2031	T471	JOHANSBRG	20/06/'85	UNK	Birth	Captive		20/06/'85
						20/06/'85		Death		20/06/'85	
(Death by: Unknown means)											
T506?	?	20/06/'85	2031	T471	JOHANSBRG	20/06/'85	UNK	Birth	Captive		20/06/'85
						20/06/'85		Death		20/06/'85	
(Death by: Unknown means)											
T507?	?	20/06/'85	2031	T471	JOHANSBRG	20/06/'85	UNK	Birth	Captive		20/06/'85
						20/06/'85		Death		20/06/'85	
(Death by: Unknown means)											
T508?	?	20/06/'85	2031	T471	JOHANSBRG	20/06/'85	UNK	Birth	Captive		20/06/'85
						20/06/'85		Death		20/06/'85	
(Death by: Unknown means)											
T509?	?	20/06/'85	2031	T471	JOHANSBRG	20/06/'85	UNK	Birth	Captive		20/06/'85
						20/06/'85		Death		20/06/'85	
(Death by: Unknown means)											
T510?	?	20/06/'85	2031	T471	JOHANSBRG	20/06/'85	UNK	Birth	Captive		20/06/'85
						20/06/'85		Death		20/06/'85	
(Death by: Unknown means)											
T511	?	02/06/'85	2031	2032	JOHANSBRG	02/06/'85	UNK	Birth	Captive		02/06/'85
						02/06/'85		Death		02/06/'85	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T512	?	02/06/'85	2031	2032	JOHANSBRG	02/06/'85	UNK	Birth	Captive		02/06/'85
						02/06/'85		Death		02/06/'85	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T513	?	02/06/'85	2031	2032	JOHANSBRG	02/06/'85	UNK	Birth	Captive		02/06/'85
						02/06/'85		Death		02/06/'85	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T514	?	02/06/'85	2031	2032	JOHANSBRG	02/06/'85	UNK	Birth	Captive		02/06/'85
						02/06/'85		Death		02/06/'85	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T515	?	02/06/'85	2031	2032	JOHANSBRG	02/06/'85	UNK	Birth	Captive		02/06/'85
						02/06/'85		Death		02/06/'85	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T516	F	~/06/'95	3065	3064	GHIAZZA R	~/06/'95	UNK	Birth	Captive		~/06/'95
T517	M	15/05/'87	3006	2022	JOHANSBRG	15/05/'87	UNK	Birth	Captive		13/10/'87
					GRANOVER	13/10/'87	UNK	Transfer		UNK	
T518	M	15/05/'87	3006	2022	JOHANSBRG	15/05/'87	UNK	Birth	Captive		13/10/'87
					GRANOVER	13/10/'87	UNK	Transfer		UNK	
T519	M	15/05/'87	3006	2022	JOHANSBRG	15/05/'87	UNK	Birth	Captive		13/10/'87
					GRANOVER	13/10/'87	UNK	Transfer		UNK	
T520	M	15/05/'87	3006	2022	JOHANSBRG	15/05/'87	UNK	Birth	Captive		13/10/'87
					GRANOVER	13/10/'87	UNK	Transfer		UNK	
T521	M	15/05/'87	3006	2022	JOHANSBRG	15/05/'87	UNK	Birth	Captive		13/10/'87
					GRANOVER	13/10/'87	UNK	Transfer		UNK	
T522	M	15/05/'87	3006	2022	JOHANSBRG	15/05/'87	UNK	Birth	Captive		13/10/'87
					GRANOVER	13/10/'87	UNK	Transfer		UNK	
T523	M	15/05/'87	3006	2022	JOHANSBRG	15/05/'87	UNK	Birth	Captive		13/10/'87
					GRANOVER	13/10/'87	UNK	Transfer		UNK	
T524	M	15/05/'87	3006	2022	JOHANSBRG	15/05/'87	UNK	Birth	Captive		01/08/'89
					RIETVLEI	01/08/'89	UNK	Transfer			~/01/'91
					KLASERIE	~/01/'91	UNK	Transfer			~/01/'91
						~/01/'91	UNK	Release			
						~/05/'91	UNK	Capture			~/05/'91
					HOEDSPRUI	~/05/'91	UNK	Transfer			
						~/01/'95		Death		~/01/'95	
(Death by: Euthanasia, Unknown, No Autopsy Planned)											
3005	M	15/05/'87	3006	2022	JOHANSBRG	15/05/'87	UNK	Birth	Captive		01/08/'89
					RIETVLEI	01/08/'89	UNK	Transfer			~/01/'91
					KLASERIE	~/01/'91	UNK	Transfer			~/01/'91
						~/02/'91	UNK	Release			
						~/05/'91	UNK	Capture			~/05/'91
					HOEDSPRUI	~/05/'91	UNK	Transfer			
						~/01/'95		Death		~/01/'95	
(Death by: Euthanasia, Unknown, No Autopsy Planned)											
T526	F	15/05/'87	3006	2022	JOHANSBRG	15/05/'87	UNK	Birth	Captive		13/10/'87
					GRANOVER	13/10/'87	UNK	Transfer		UNK	
T527	F	15/05/'87	3006	2022	JOHANSBRG	15/05/'87	UNK	Birth	Captive		13/10/'87
					GRANOVER	13/10/'87	UNK	Transfer		UNK	
T528	F	15/05/'87	3006	2022	JOHANSBRG	15/05/'87	UNK	Birth	Captive		13/10/'87
					GRANOVER	13/10/'87	UNK	Transfer		UNK	
T529?	?	28/05/'87	3006	3008	JOHANSBRG	28/05/'87	UNK	Birth	Captive		28/05/'87
						28/05/'87		Death		28/05/'87	
(Death by: Unknown means)											
T530?	?	28/05/'87	3006	3008	JOHANSBRG	28/05/'87	UNK	Birth	Captive		28/05/'87
						28/05/'87		Death		28/05/'87	
(Death by: Unknown means)											
T531?	?	28/05/'87	3006	3008	JOHANSBRG	28/05/'87	UNK	Birth	Captive		28/05/'87
						28/05/'87		Death		28/05/'87	
(Death by: Unknown means)											
T532?	?	28/05/'87	3006	3008	JOHANSBRG	28/05/'87	UNK	Birth	Captive		28/05/'87
						28/05/'87		Death		28/05/'87	
(Death by: Unknown means)											
T533?	?	28/05/'87	3006	3008	JOHANSBRG	28/05/'87	UNK	Birth	Captive		28/05/'87
						28/05/'87		Death		28/05/'87	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T534?	?	28/05/'87	3006	3008	JOHANSBRG	28/05/'87	UNK	Birth	Captive		28/05/'87
						28/05/'87		Death		28/05/'87	
(Death by: Unknown means)											
T535?	?	28/05/'87	3006	3008	JOHANSBRG	28/05/'87	UNK	Birth	Captive		28/05/'87
						28/05/'87		Death		28/05/'87	
(Death by: Unknown means)											
T536	?	20/04/'88	2021	2022	JOHANSBRG	20/04/'88	UNK	Birth	Captive		22/04/'88
						22/04/'88		Death		22/04/'88	
(Death by: Unknown means)											
3018	M	20/04/'88	2021	2022	JOHANSBRG	20/04/'88	UNK	Birth	Captive		01/08/'89
					RIETVLEI	01/08/'89	UNK	Transfer			~/01/'91
					KLASERIE	~/01/'91	UNK	Transfer			~/04/'91
						~/04/'91	UNK	Release			
						~/05/'91	UNK	Capture			~/05/'91
					HOEDSPRUI	~/05/'91	UNK	Transfer			~/02/'95
					JOHANSBRG	~/02/'95	UNK	Transfer			
3019	M	20/04/'88	2021	2022	JOHANSBRG	20/04/'88	UNK	Birth	Captive		01/08/'89
					RIETVLEI	01/08/'89	UNK	Transfer			~/01/'91
					KLASERIE	~/01/'91	UNK	Transfer			~/04/'91
						~/04/'91	UNK	Release			
						~/05/'91	UNK	Capture			~/05/'91
					HOEDSPRUI	~/05/'91	UNK	Transfer			~/02/'95
T539	F	20/04/'88	2021	2022	JOHANSBRG	20/04/'88	UNK	Birth	Captive		08/05/'90
					AGS	08/05/'90	UNK	Transfer		UNK	
T540	M	29/04/'88	2021	3008	JOHANSBRG	29/04/'88	UNK	Birth	Captive		~/04/'88
						~/04/'88		Death		~/04/'88	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T541	M	29/04/'88	2021	3008	JOHANSBRG	29/04/'88	UNK	Birth	Captive		~/04/'88
						~/04/'88		Death		~/04/'88	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T542	F	29/04/'88	2021	3008	JOHANSBRG	29/04/'88	UNK	Birth	Captive		~/04/'88
						~/04/'88		Death		~/04/'88	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T543	F	29/04/'88	2021	3008	JOHANSBRG	29/04/'88	UNK	Birth	Captive		~/04/'88
						~/04/'88		Death		~/04/'88	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T544	?	29/04/'88	2021	3008	JOHANSBRG	29/04/'88	UNK	Birth	Captive		~/04/'88
						~/04/'88		Death		~/04/'88	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T545	?	29/04/'88	2021	3008	JOHANSBRG	29/04/'88	UNK	Birth	Captive		~/04/'88
						~/04/'88		Death		~/04/'88	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T546	?	29/04/'88	2021	3008	JOHANSBRG	29/04/'88	UNK	Birth	Captive		~/04/'88
						~/04/'88		Death		~/04/'88	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
3020	M	29/04/'88	2021	3008	JOHANSBRG	29/04/'88	UNK	Birth	Captive		01/08/'89
					RIETVLEI	01/08/'89	UNK	Transfer			~/01/'91
					KLASERIE	~/01/'91	UNK	Transfer			~/04/'91
						~/04/'91	UNK	Release			
						~/05/'91	UNK	Capture			~/05/'91
					HOEDSPRUI	~/05/'91	UNK	Transfer			~/02/'95
					JOHANSBRG	~/02/'95	UNK	Transfer			

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
3007	F	29/04/'88	2021	3008	JOHANSBRG	29/04/'88	UNK	Birth	Captive		01/08/'89
					RIETVLEI	01/08/'89	UNK	Transfer			~/01/'91
					KLASERIE	~/01/'91	UNK	Transfer			~/04/'91
						~/04/'91	UNK	Release			
						~/05/'91	UNK	Capture			~/05/'91
					HOEDSPRUI	~/05/'91	UNK	Transfer			~/06/'93
						~/06/'93		Death		~/06/'93	
(Death by: Anesth./Restraint Assoc., Mounted or Preserved: HOEDSPRUI, No Autopsy Planned)											
3021	F	29/04/'88	2021	3008	JOHANSBRG	29/04/'88	UNK	Birth	Captive		01/08/'89
					RIETVLEI	01/08/'89	UNK	Transfer			~/01/'91
					KLASERIE	~/01/'91	UNK	Transfer			~/04/'91
						~/04/'91	UNK	Release			
						~/05/'91	UNK	Capture			~/05/'91
					HOEDSPRUI	~/05/'91	UNK	Transfer			~/02/'95
					JOHANSBRG	~/02/'95	UNK	Transfer			
T550	M	~/06/'86	UNK	UNK	JOHANSBRG	09/02/'87	UNK	Transfer	UNK		02/08/'88
						02/08/'88		Death		02/08/'88	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
T551	?	~/05/'89	2021	2022	JOHANSBRG	~/05/'89	UNK	Birth	Captive		06/05/'89
						06/05/'89		Death		06/05/'89	
(Death by: Unknown means)											
T552	?	~/05/'89	2021	2022	JOHANSBRG	~/05/'89	UNK	Birth	Captive		06/05/'89
						06/05/'89		Death		06/05/'89	
(Death by: Unknown means)											
T553	?	~/05/'89	2021	2022	JOHANSBRG	~/05/'89	UNK	Birth	Captive		06/05/'89
						06/05/'89		Death		06/05/'89	
(Death by: Unknown means)											
T554	?	~/05/'89	2021	2022	JOHANSBRG	~/05/'89	UNK	Birth	Captive		06/05/'89
						06/05/'89		Death		06/05/'89	
(Death by: Unknown means)											
T555	M	~/05/'89	2021	2022	JOHANSBRG	~/05/'89	UNK	Birth	Captive		11/05/'89
						11/05/'89		Death		11/05/'89	
(Death by: Unknown means)											
T556?	?	22/05/'89	3005	3007	JOHANSBRG	22/05/'89	UNK	Birth	Captive		22/05/'89
						22/05/'89		Death		22/05/'89	
(Death by: Unknown means)											
T557?	?	22/05/'89	3005	3007	JOHANSBRG	22/05/'89	UNK	Birth	Captive		22/05/'89
						22/05/'89		Death		22/05/'89	
(Death by: Unknown means)											
T558?	?	22/05/'89	3005	3007	JOHANSBRG	22/05/'89	UNK	Birth	Captive		22/05/'89
						22/05/'89		Death		22/05/'89	
(Death by: Unknown means)											
T559?	?	22/05/'89	3005	3007	JOHANSBRG	22/05/'89	UNK	Birth	Captive		22/05/'89
						22/05/'89		Death		22/05/'89	
(Death by: Unknown means)											
T560?	?	22/05/'89	3005	3007	JOHANSBRG	22/05/'89	UNK	Birth	Captive		22/05/'89
						22/05/'89		Death		22/05/'89	
(Death by: Unknown means)											
T561?	?	22/05/'89	3005	3007	JOHANSBRG	22/05/'89	UNK	Birth	Captive		22/05/'89
						22/05/'89		Death		22/05/'89	
(Death by: Unknown means)											
T562?	?	22/05/'89	3005	3007	JOHANSBRG	22/05/'89	UNK	Birth	Captive		22/05/'89
						22/05/'89		Death		22/05/'89	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T563	M	05/11/'89	2021	2022	JOHANSBRG	05/11/'89	UNK	Birth	Captive		19/05/'92
					RIETVLEI	19/05/'92	UNK	Transfer			~/06/'92
					THABA YA	~/06/'92	UNK	Transfer			~/06/'92
						~/06/'92		Death		~/06/'92	
(Death by: Infection Associated, Unknown, No Autopsy Planned)											
2030	M	05/11/'89	2021	2022	JOHANSBRG	05/11/'89	UNK	Birth	Captive		
					HOEDSPRUI	08/01/1996		UNK	Transfer		
T565	M	05/11/'89	2021	2022	JOHANSBRG	05/11/'89	UNK	Birth	Captive		19/05/'92
					RIETVLEI	19/05/'92	UNK	Transfer			~/06/'92
					THABA YA	~/06/'92	UNK	Transfer			~/06/'92
						~/06/'92		Death		~/06/'92	
(Death by: Infection Associated, Unknown, No Autopsy Planned)											
T566	M	05/11/'89	2021	2022	JOHANSBRG	05/11/'89	UNK	Birth	Captive		19/05/'92
					RIETVLEI	19/05/'92	UNK	Transfer			~/06/'92
					THABA YA	~/06/'92	UNK	Transfer			~/06/'92
						~/06/'92		Death		~/06/'92	
(Death by: Infection Associated, Unknown, No Autopsy Planned)											
T567	M	05/11/'89	2021	2022	JOHANSBRG	05/11/'89	UNK	Birth	Captive		06/02/'90
						06/02/'90		Death		06/02/'90	
(Death by: Infection Associated, Unknown, Hemic and Lymph, Protozoan)											
T568	M	18/06/'90	3005	3007	RIETVLEI	18/06/'90	UNK	Birth	Captive		~/06/'90
						~/06/'90		Death		~/06/'90	
(Death by: Unknown means)											
T569	F	18/06/'90	3005	3007	RIETVLEI	18/06/'90	UNK	Birth	Captive		~/06/'90
						~/06/'90		Death		~/06/'90	
(Death by: Unknown means)											
T570?	?	18/06/'90	3005	3021	RIETVLEI	18/06/'90	UNK	Birth	Captive		~/06/'90
						~/06/'90		Death		~/06/'90	
(Death by: Unknown means)											
T571?	?	18/06/'90	3005	3021	RIETVLEI	18/06/'90	UNK	Birth	Captive		~/06/'90
						~/06/'90		Death		~/06/'90	
(Death by: Unknown means)											
T572?	?	18/06/'90	3005	3021	RIETVLEI	18/06/'90	UNK	Birth	Captive		~/06/'90
						~/06/'90		Death		~/06/'90	
(Death by: Unknown means)											
T573?	?	18/06/'90	3005	3021	RIETVLEI	18/06/'90	UNK	Birth	Captive		~/06/'90
						~/06/'90		Death		~/06/'90	
(Death by: Unknown means)											
T574?	?	18/06/'90	3005	3021	RIETVLEI	18/06/'90	UNK	Birth	Captive		~/06/'90
						~/06/'90		Death		~/06/'90	
(Death by: Unknown means)											
T575?	?	18/06/'90	3005	3021	RIETVLEI	18/06/'90	UNK	Birth	Captive		~/06/'90
						~/06/'90		Death		~/06/'90	
(Death by: Unknown means)											
T576?	?	18/06/'90	3005	3021	RIETVLEI	18/06/'90	UNK	Birth	Captive		~/06/'90
						~/06/'90		Death		~/06/'90	
(Death by: Unknown means)											
T577	M	20/07/'90	2021	2022	JOHANSBRG	20/07/'90	UNK	Birth	Captive		20/07/'90
						20/07/'90		Death		20/07/'90	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											
T578	M	20/07/'90	2021	2022	JOHANSBRG	20/07/'90	UNK	Birth	Captive		20/07/'90
						20/07/'90		Death		20/07/'90	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											
T579	M	20/07/'90	2021	2022	JOHANSBRG	20/07/'90	UNK	Birth	Captive		20/07/'90
						20/07/'90		Death		20/07/'90	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T580	M	20/07/'90	2021	2022	JOHANSBRG	20/07/'90	UNK	Birth	Captive		20/07/'90
						20/07/'90		Death		20/07/'90	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											
T581	M	20/07/'90	2021	2022	JOHANSBRG	20/07/'90	UNK	Birth	Captive		~/07/'90
						~/07/'90		Death		~/07/'90	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T582	F	20/07/'90	2021	2022	JOHANSBRG	20/07/'90	UNK	Birth	Captive		20/07/'90
						20/07/'90		Death		20/07/'90	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											
T583	F	20/07/'90	2021	2022	JOHANSBRG	20/07/'90	UNK	Birth	Captive		20/07/'90
						20/07/'90		Death		20/07/'90	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											
T584	F	20/07/'90	2021	2022	JOHANSBRG	20/07/'90	UNK	Birth	Captive		20/07/'90
						20/07/'90		Death		20/07/'90	
(Death by: Stillbirth, Unknown, No Autopsy Planned)											
T585	F	20/07/'90	2021	2022	JOHANSBRG	20/07/'90	UNK	Birth	Captive		~/08/'90
						~/08/'90		Death		~/08/'90	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T586	F	20/07/'90	2021	2022	JOHANSBRG	20/07/'90	UNK	Birth	Captive		~/08/'90
						~/08/'90		Death		~/08/'90	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T587	F	20/07/'90	2021	2022	JOHANSBRG	20/07/'90	UNK	Birth	Captive		~/07/'90
						~/07/'90		Death		~/07/'90	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T588	F	20/07/'90	2021	2022	JOHANSBRG	20/07/'90	UNK	Birth	Captive		~/07/'90
						~/07/'90		Death		~/07/'90	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
T589	F	20/07/'90	2021	2022	JOHANSBRG	20/07/'90	UNK	Birth	Captive		~/07/'90
						~/07/'90		Death		~/07/'90	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
2033	F	~/'83	3000	3003	HARTBEESP	~/'83	UNK	Birth	Captive		06/08/'90
					JOHANSBRG	06/08/'90	UNK	Transfer			
					KRAAIFONT	25/01/1996	UNK	Transfer			
T591?	?	~/05/'91	2021	2033	JOHANSBRG	~/05/'91	UNK	Birth	Captive		~/05/'91
						~/05/'91		Death		~/05/'91	
(Death by: Unknown means)											
T592?	?	~/05/'91	2021	2033	JOHANSBRG	~/05/'91	UNK	Birth	Captive		~/05/'91
						~/05/'91		Death		~/05/'91	
(Death by: Unknown means)											
T593?	?	~/05/'91	2021	2033	JOHANSBRG	~/05/'91	UNK	Birth	Captive		~/05/'91
						~/05/'91		Death		~/05/'91	
(Death by: Unknown means)											
T594?	?	~/05/'91	2021	2033	JOHANSBRG	~/05/'91	UNK	Birth	Captive		~/05/'91
						~/05/'91		Death		~/05/'91	
(Death by: Unknown means)											
T595?	?	~/05/'91	2021	2033	JOHANSBRG	~/05/'91	UNK	Birth	Captive		~/05/'91
						~/05/'91		Death		~/05/'91	
(Death by: Unknown means)											
T596?	?	~/05/'91	2021	2033	JOHANSBRG	~/05/'91	UNK	Birth	Captive		~/05/'91
						~/05/'91		Death		~/05/'91	
(Death by: Unknown means)											
T597?	?	~/05/'91	2021	2033	JOHANSBRG	~/05/'91	UNK	Birth	Captive		~/05/'91
						~/05/'91		Death		~/05/'91	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T598?	?	~/05/'92	2030	2033	JOHANSBRG	~/05/'92	UNK	Birth	Captive		~/05/'92
						~/05/'92		Death		~/05/'92	
(Death by: Unknown means)											
T599?	?	~/05/'92	2030	2033	JOHANSBRG	~/05/'92	UNK	Birth	Captive		~/05/'92
						~/05/'92		Death		~/05/'92	
(Death by: Unknown means)											
T600?	?	~/05/'92	2030	2033	JOHANSBRG	~/05/'92	UNK	Birth	Captive		~/05/'92
						~/05/'92		Death		~/05/'92	
(Death by: Unknown means)											
T601?	?	~/05/'92	2030	2033	JOHANSBRG	~/05/'92	UNK	Birth	Captive		~/05/'92
						~/05/'92		Death		~/05/'92	
(Death by: Unknown means)											
T602?	?	~/05/'92	2030	2033	JOHANSBRG	~/05/'92	UNK	Birth	Captive		~/05/'92
						~/05/'92		Death		~/05/'92	
(Death by: Unknown means)											
T603	F	~/05/'92	2030	2033	JOHANSBRG	~/05/'92	UNK	Birth	Captive		~/05/'92
						~/05/'92		Death		~/05/'92	
(Death by: Env. or Beh. Conditions, Unknown, Digestive, Trauma)											
T604	F	~/05/'92	2030	2033	JOHANSBRG	~/05/'92	UNK	Birth	Captive		~/05/'92
						~/05/'92		Death		~/05/'92	
(Death by: Env. or Beh. Conditions, Unknown, Digestive, Trauma)											
T605?	?	07/05/'93	2030	2033	JOHANSBRG	07/05/'93	UNK	Birth	Captive		10/05/'93
						10/05/'93		Death		10/05/'93	
(Death by: Unknown means)											
T606?	?	07/05/'93	2030	2033	JOHANSBRG	07/05/'93	UNK	Birth	Captive		10/05/'93
						10/05/'93		Death		10/05/'93	
(Death by: Unknown means)											
T607?	?	07/05/'93	2030	2033	JOHANSBRG	07/05/'93	UNK	Birth	Captive		10/05/'93
						10/05/'93		Death		10/05/'93	
(Death by: Unknown means)											
T608?	?	07/05/'93	2030	2033	JOHANSBRG	07/05/'93	UNK	Birth	Captive		10/05/'93
						10/05/'93		Death		10/05/'93	
(Death by: Unknown means)											
T609?	?	07/05/'93	2030	2033	JOHANSBRG	07/05/'93	UNK	Birth	Captive		10/05/'93
						10/05/'93		Death		10/05/'93	
(Death by: Unknown means)											
T610	?	07/05/'93	2030	2033	JOHANSBRG	07/05/'93	UNK	Birth	Captive		10/05/'93
						10/05/'93		Death		10/05/'93	
(Death by: Unknown means)											
T611	?	07/05/'93	2030	2033	JOHANSBRG	07/05/'93	UNK	Birth	Captive		10/05/'93
						10/05/'93		Death		10/05/'93	
(Death by: Unknown means)											
T612?	?	~/05/'94	2030	2033	JOHANSBRG	~/05/'94	UNK	Birth	Captive		~/05/'94
						~/05/'94		Death		~/05/'94	
(Death by: Unknown means)											
T613?	?	~/05/'94	2030	2033	JOHANSBRG	~/05/'94	UNK	Birth	Captive		~/05/'94
						~/05/'94		Death		~/05/'94	
(Death by: Unknown means)											
T614?	?	~/05/'94	2030	2033	JOHANSBRG	~/05/'94	UNK	Birth	Captive		~/05/'94
						~/05/'94		Death		~/05/'94	
(Death by: Unknown means)											
T615?	?	~/05/'94	2030	2033	JOHANSBRG	~/05/'94	UNK	Birth	Captive		~/05/'94
						~/05/'94		Death		~/05/'94	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T616?	?	~/05/'94	2030	2033	JOHANSBRG	~/05/'94	UNK	Birth	Captive		~/05/'94
						~/05/'94		Death		~/05/'94	
(Death by: Unknown means)											
T617?	?	~/05/'94	2030	2033	JOHANSBRG	~/05/'94	UNK	Birth	Captive		~/05/'94
						~/05/'94		Death		~/05/'94	
(Death by: Unknown means)											
T618?	?	~/05/'94	2030	2033	JOHANSBRG	~/05/'94	UNK	Birth	Captive		~/05/'94
						~/05/'94		Death		~/05/'94	
(Death by: Unknown means)											
T619?	?	~/06/'91	3005	3007	HOEDSPRUI	~/06/'91	UNK	Birth	Captive		~/06/'91
						~/06/'91		Death		~/06/'91	
(Death by: Unknown means)											
T620?	?	~/06/'91	3005	3007	HOEDSPRUI	~/06/'91	UNK	Birth	Captive		~/06/'91
						~/06/'91		Death		~/06/'91	
(Death by: Unknown means)											
T621?	?	~/06/'91	3005	3007	HOEDSPRUI	~/06/'91	UNK	Birth	Captive		~/06/'91
						~/06/'91		Death		~/06/'91	
(Death by: Unknown means)											
T622?	?	~/06/'91	3005	3007	HOEDSPRUI	~/06/'91	UNK	Birth	Captive		~/06/'91
						~/06/'91		Death		~/06/'91	
(Death by: Unknown means)											
T623?	?	~/06/'91	3005	3007	HOEDSPRUI	~/06/'91	UNK	Birth	Captive		~/06/'91
						~/06/'91		Death		~/06/'91	
(Death by: Unknown means)											
T624?	?	~/06/'91	3005	3007	HOEDSPRUI	~/06/'91	UNK	Birth	Captive		~/06/'91
						~/06/'91		Death		~/06/'91	
(Death by: Unknown means)											
T625?	?	~/06/'91	3005	3007	HOEDSPRUI	~/06/'91	UNK	Birth	Captive		~/06/'91
						~/06/'91		Death		~/06/'91	
(Death by: Unknown means)											
3023	M	~/06/'91	3019	3021	HOEDSPRUI	~/06/'91	UNK	Birth	Captive		~/09/'94
					OUDTSHORN	~/09/'94	UNK	Transfer			
3022	M	~/06/'91	3019	3021	HOEDSPRUI	~/06/'91	UNK	Birth	Captive		~/09/'94
					OUDTSHORN	~/09/'94	UNK	Transfer			
3024	M	~/06/'91	3019	3021	HOEDSPRUI	~/06/'91	UNK	Birth	Captive		~/09/'94
					OUDTSHORN	~/09/'94	UNK	Transfer			
3025	F	~/06/'91	3019	3021	HOEDSPRUI	~/06/'91	UNK	Birth	Captive		06/10/'94
					MCADAM	06/10/'94	UNK	Transfer			
3026	F	~/06/'91	3019	3021	HOEDSPRUI	~/06/'91	UNK	Birth	Captive		06/10/'94
					MCADAM	06/10/'94	UNK	Transfer			
T631?	?	~/06/'92	3019	3021	HOEDSPRUI	~/06/'92	UNK	Birth	Captive		~/06/'92
						~/06/'92		Death		~/06/'92	
(Death by: Unknown means)											
T632?	?	~/06/'92	3019	3021	HOEDSPRUI	~/06/'92	UNK	Birth	Captive		~/06/'92
						~/06/'92		Death		~/06/'92	
(Death by: Unknown means)											
T633?	?	~/06/'92	3019	3021	HOEDSPRUI	~/06/'92	UNK	Birth	Captive		~/06/'92
						~/06/'92		Death		~/06/'92	
(Death by: Unknown means)											
T634?	?	~/06/'92	3019	3021	HOEDSPRUI	~/06/'92	UNK	Birth	Captive		~/06/'92
						~/06/'92		Death		~/06/'92	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T635?	?	~/06/'92	3019	3021	HOEDSPRUI	~/06/'92	UNK	Birth	Captive		~/06/'92
						~/06/'92		Death		~/06/'92	
(Death by: Unknown means)											
T636?	?	~/06/'92	3019	3021	HOEDSPRUI	~/06/'92	UNK	Birth	Captive		~/06/'92
						~/06/'92		Death		~/06/'92	
(Death by: Unknown means)											
T637?	?	~/06/'92	3019	3021	HOEDSPRUI	~/06/'92	UNK	Birth	Captive		~/06/'92
						~/06/'92		Death		~/06/'92	
(Death by: Unknown means)											
T638	M	~/06/'92	3005	3007	HOEDSPRUI	~/06/'92	UNK	Birth	Captive		~/03/'95
						~/03/'95		Death		~/03/'95	
(Death by: Injury from Predator, Unknown, No Autopsy Planned)											
T639	M	~/06/'92	3005	3007	HOEDSPRUI	~/06/'92	UNK	Birth	Captive		~/03/'95
						~/03/'95		Death		~/03/'95	
(Death by: Env. or Beh. Conditions, Unknown, No Autopsy Planned)											
3027	F	~/06/'92	3005	3007	HOEDSPRUI	~/06/'92	UNK	Birth	Captive		
3030	F	~/06/'92	3005	3007	HOEDSPRUI	~/06/'92	UNK	Birth	Captive		
2062	F	~/06/'92	3005	3007	HOEDSPRUI	~/06/'92	UNK	Birth	Captive		~/02/'95
					PRETORIA	~/02/'95	UNK	Transfer			
3028	F	~/06/'92	3005	3007	HOEDSPRUI	~/06/'92	UNK	Birth	Captive		
3029	F	~/06/'92	3005	3007	HOEDSPRUI	~/06/'92	UNK	Birth	Captive		
T645	?	~/06/'93	3005	3007	HOEDSPRUI	~/06/'93	UNK	Birth	Captive		~/06/'93
						~/06/'93		Death		~/06/'93	
(Death by: Env. or Beh. Conditions, Mounted or Preserved: HOEDSPRUI, No Autopsy Planned)											
T646	?	~/06/'93	3005	3007	HOEDSPRUI	~/06/'93	UNK	Birth	Captive		~/06/'93
						~/06/'93		Death		~/06/'93	
(Death by: Env. or Beh. Conditions, Mounted or Preserved: HOEDSPRUI, No Autopsy Planned)											
T647	?	~/06/'93	3005	3007	HOEDSPRUI	~/06/'93	UNK	Birth	Captive		~/06/'93
						~/06/'93		Death		~/06/'93	
(Death by: Env. or Beh. Conditions, Mounted or Preserved: HOEDSPRUI, No Autopsy Planned)											
T648	?	~/06/'93	3005	3007	HOEDSPRUI	~/06/'93	UNK	Birth	Captive		~/06/'93
						~/06/'93		Death		~/06/'93	
(Death by: Env. or Beh. Conditions, Mounted or Preserved: HOEDSPRUI, No Autopsy Planned)											
T649	?	~/06/'93	3005	3007	HOEDSPRUI	~/06/'93	UNK	Birth	Captive		~/06/'93
						~/06/'93		Death		~/06/'93	
(Death by: Env. or Beh. Conditions, Mounted or Preserved: HOEDSPRUI, No Autopsy Planned)											
T650	?	~/06/'93	3005	3007	HOEDSPRUI	~/06/'93	UNK	Birth	Captive		~/06/'93
						~/06/'93		Death		~/06/'93	
(Death by: Env. or Beh. Conditions, Mounted or Preserved: HOEDSPRUI, No Autopsy Planned)											
T651	?	~/06/'93	3005	3007	HOEDSPRUI	~/06/'93	UNK	Birth	Captive		~/06/'93
						~/06/'93		Death		~/06/'93	
(Death by: Env. or Beh. Conditions, Mounted or Preserved: HOEDSPRUI, No Autopsy Planned)											
T652	?	~/06/'93	3005	3007	HOEDSPRUI	~/06/'93	UNK	Birth	Captive		~/06/'93
						~/06/'93		Death		~/06/'93	
(Death by: Env. or Beh. Conditions, Mounted or Preserved: HOEDSPRUI, No Autopsy Planned)											
T653	?	~/06/'93	3005	3007	HOEDSPRUI	~/06/'93	UNK	Birth	Captive		~/06/'93
						~/06/'93		Death		~/06/'93	
(Death by: Env. or Beh. Conditions, Mounted or Preserved: HOEDSPRUI, No Autopsy Planned)											
T654	?	~/06/'93	3005	3007	HOEDSPRUI	~/06/'93	UNK	Birth	Captive		~/06/'93
						~/06/'93		Death		~/06/'93	
(Death by: Env. or Beh. Conditions, Mounted or Preserved: HOEDSPRUI, No Autopsy Planned)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T655	?	~/06/'93	3005	3007	HOEDSPRUI	~/06/'93	UNK	Birth	Captive		~/06/'93
						~/06/'93		Death		~/06/'93	
(Death by: Env. or Beh. Conditions, Mounted or Preserved: HOEDSPRUI, No Autopsy Planned)											
T656	?	~/06/'93	3005	3007	HOEDSPRUI	~/06/'93	UNK	Birth	Captive		~/06/'93
						~/06/'93		Death		~/06/'93	
(Death by: Env. or Beh. Conditions, Mounted or Preserved: HOEDSPRUI, No Autopsy Planned)											
T657?	?	~/06/'94	3005	3021	HOEDSPRUI	~/06/'94	UNK	Birth	Captive		~/06/'94
						~/06/'94		Death		~/06/'94	
(Death by: Unknown means)											
T658?	?	~/06/'94	3005	3021	HOEDSPRUI	~/06/'94	UNK	Birth	Captive		~/06/'94
						~/06/'94		Death		~/06/'94	
(Death by: Unknown means)											
T659?	?	~/06/'94	3005	3021	HOEDSPRUI	~/06/'94	UNK	Birth	Captive		~/06/'94
						~/06/'94		Death		~/06/'94	
(Death by: Unknown means)											
T660?	?	~/06/'94	3005	3021	HOEDSPRUI	~/06/'94	UNK	Birth	Captive		~/06/'94
						~/06/'94		Death		~/06/'94	
(Death by: Unknown means)											
T661?	?	~/06/'94	3005	3021	HOEDSPRUI	~/06/'94	UNK	Birth	Captive		~/06/'94
						~/06/'94		Death		~/06/'94	
(Death by: Unknown means)											
T662?	?	~/06/'94	3005	3021	HOEDSPRUI	~/06/'94	UNK	Birth	Captive		~/06/'94
						~/06/'94		Death		~/06/'94	
(Death by: Unknown means)											
T663?	?	~/06/'94	3005	3021	HOEDSPRUI	~/06/'94	UNK	Birth	Captive		~/06/'94
						~/06/'94		Death		~/06/'94	
(Death by: Unknown means)											
T664	F	~/'86	UNK	UNK	KRUGER	~/'86	DF1	Birth	Wild		
T665	M	~/'87	UNK	UNK	KRUGER	~/'87	SM3	Birth	Wild		
T666	F	~/'87	UNK	UNK	KRUGER	~/'87	SF1	Birth	Wild		
T667	M	~/06/'89	T665	T666	KRUGER	~/06/'89	SM10	Birth	Wild		
T668	M	~/06/'92	T667	T664	KRUGER	~/06/'92	DM19	Birth	Wild		19/12/'94
					MODIKWE	21/12/'94	UNK	Transfer			
T669	M	~/06/'93	T667	T664	KRUGER	~/06/'93	DM21	Birth	Wild		21/12/'94
					MODIKWE	21/12/'94	UNK	Transfer			
T670	M	~/06/'93	T667	T664	KRUGER	~/06/'93	DM?	Birth	Wild		21/12/'94
					MODIKWE	21/12/'94	UNK	Transfer			
T671?	?	20/06/'83	3067	3068	PRET DW	20/06/'83	UNK	Birth	Captive		20/06/'83
						20/06/'83		Death		20/06/'83	
(Death by: Unknown means)											
T672?	?	20/06/'83	3067	3068	PRET DW	20/06/'83	UNK	Birth	Captive		20/06/'83
						20/06/'83		Death		20/06/'83	
(Death by: Unknown means)											
T673?	?	20/06/'83	3067	3068	PRET DW	20/06/'83	UNK	Birth	Captive		20/06/'83
						20/06/'83		Death		20/06/'83	
(Death by: Unknown means)											
T674?	?	20/06/'83	3067	3068	PRET DW	20/06/'83	UNK	Birth	Captive		20/06/'83
						20/06/'83		Death		20/06/'83	
(Death by: Unknown means)											
T675?	?	20/06/'83	3067	3068	PRET DW	20/06/'83	UNK	Birth	Captive		20/06/'83
						20/06/'83		Death		20/06/'83	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T676?	?	20/06/'83	3067	3068	PRET DW	20/06/'83	UNK	Birth	Captive		20/06/'83
						20/06/'83		Death		20/06/'83	
(Death by: Unknown means)											
T677?	?	20/06/'83	3067	3068	PRET DW	20/06/'83	UNK	Birth	Captive		20/06/'83
						20/06/'83		Death		20/06/'83	
(Death by: Unknown means)											
T678	M	~/'88	UNK	UNK	UNKNOWN	~/'88	UNK	Birth	UNK		~/'89
					PRET DW	~/'89	UNK	Transfer			27/06/'91
					PRETORIA	27/06/'91	UNK	Transfer			~/07/'91
					BUENOSAIR	01/07/'91	UNK	Transfer		UNK	
T679	?	~/05/'95	1982	1985	PRET DW	~/05/'95	UNK	Birth	Captive		~/05/'95
						~/05/'95		Death		~/05/'95	
(Death by: Unknown means)											
T680	?	~/05/'95	1982	1985	PRET DW	~/05/'95	UNK	Birth	Captive		~/05/'95
						~/05/'95		Death		~/05/'95	
(Death by: Unknown means)											
T681	?	~/05/'95	1982	1985	PRET DW	~/05/'95	UNK	Birth	Captive		~/05/'95
						~/05/'95		Death		~/05/'95	
(Death by: Unknown means)											
T682	?	~/05/'95	1982	1985	PRET DW	~/05/'95	UNK	Birth	Captive		~/05/'95
						~/05/'95		Death		~/05/'95	
(Death by: Unknown means)											
3031	F	~/05/'95	1982	1985	PRET DW	~/05/'95	UNK	Birth	Captive		
					MODIKWE	15/12/'97	UNK	Transfer			
3032	F	~/05/'95	1982	1985	PRET DW	~/05/'95	UNK	Birth	Captive		
					MODIKWE	15/12/'97	UNK	Transfer			
3033	F	~/05/'95	1982	1985	PRET DW	~/05/'95	UNK	Birth	Captive		
					MODIKWE	15/12/'97	UNK	Transfer			
3034	?	~/05/'95	1982	1985	PRET DW	~/05/'95	UNK	Birth	Captive		
3035	?	~/05/'95	1982	1985	PRET DW	~/05/'95	UNK	Birth	Captive		
3036	?	~/05/'95	1982	1985	PRET DW	~/05/'95	UNK	Birth	Captive		
3037	?	~/05/'95	1982	1985	PRET DW	~/05/'95	UNK	Birth	Captive		
T690	?	~/05/'95	1982	1985	PRET DW	~/05/'95	UNK	Birth	Captive		
T691	?	~/05/'95	1982	1985	PRET DW	~/05/'95	UNK	Birth	Captive		
T692	?	~/05/'95	1982	1985	PRET DW	~/05/'95	UNK	Birth	Captive		
3041	?	13/05/'95	3024	910	OUDTSHORN	13/05/'95	UNK	Birth	Captive		
3042	?	13/05/'95	3024	910	OUDTSHORN	13/05/'95	UNK	Birth	Captive		
3043	?	13/05/'95	3024	910	OUDTSHORN	13/05/'95	UNK	Birth	Captive		
3044	?	13/05/'95	3024	910	OUDTSHORN	13/05/'95	UNK	Birth	Captive		
3045	?	13/05/'95	3024	910	OUDTSHORN	13/05/'95	UNK	Birth	Captive		
3046	?	13/05/'95	3024	910	OUDTSHORN	13/05/'95	UNK	Birth	Captive		
3047	?	13/05/'95	3024	910	OUDTSHORN	13/05/'95	UNK	Birth	Captive		
3048	?	13/05/'95	3024	910	OUDTSHORN	13/05/'95	UNK	Birth	Captive		
T701	?	~/06/'94	3065	3064	GHIAZZA R	~/06/'94	UNK	Birth	Captive		
3049	M	~/06/'93	T667	T664	KRUGER	~/06/'93	UNK	Birth	Wild		21/12/'94
					HOEDSPRUI	21/12/'94	UNK	Loan to			

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
3050	M	~/06/'93	T667	T664	KRUGER	~/06/'93	UNK	Birth	Wild		21/12/'94
					HOEDSPRUI	21/12/'94	UNK	Loan to			
T704	?	~/05/'95	1982	1986	PRET DW	~/05/'95	UNK	Birth	Captive		~/06/'95
						~/06/'95		Death		~/06/'95	
(Death by: Env. or Beh. Conditions, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T705	?	~/05/'95	1982	1986	PRET DW	~/05/'95	UNK	Birth	Captive		~/06/'95
						~/06/'95		Death		~/06/'95	
(Death by: Env. or Beh. Conditions, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T706	?	~/05/'95	1982	1986	PRET DW	~/05/'95	UNK	Birth	Captive		~/06/'95
						~/06/'95		Death		~/06/'95	
(Death by: Env. or Beh. Conditions, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
3051	?	~/05/'95	1982	1986	PRET DW	~/05/'95	UNK	Birth	Captive		
3052	?	~/05/'95	1982	1986	PRET DW	~/05/'95	UNK	Birth	Captive		
3053	?	~/05/'95	1982	1986	PRET DW	~/05/'95	UNK	Birth	Captive		
3054	?	~/05/'95	1982	1986	PRET DW	~/05/'95	UNK	Birth	Captive		
3055	?	~/05/'95	1982	1986	PRET DW	~/05/'95	UNK	Birth	Captive		
3056	?	~/05/'95	1982	1987	PRET DW	~/05/'95	UNK	Birth	Captive		
3057	?	~/05/'95	1982	1987	PRET DW	~/05/'95	UNK	Birth	Captive		
3058	?	~/05/'95	1982	1987	PRET DW	~/05/'95	UNK	Birth	Captive		
3059	?	~/05/'95	1982	1987	PRET DW	~/05/'95	UNK	Birth	Captive		
3060	?	~/05/'95	1982	1987	PRET DW	~/05/'95	UNK	Birth	Captive		
3061	?	~/05/'95	1982	1987	PRET DW	~/05/'95	UNK	Birth	Captive		
3062	?	~/05/'95	1982	1987	PRET DW	~/05/'95	UNK	Birth	Captive		
3063	?	~/05/'95	1982	1987	PRET DW	~/05/'95	UNK	Birth	Captive		
T720	?	~/06/'94	2048	910	KRAAIFONT	~/06/'94	UNK	Birth	Captive		UNK
T721	?	~/06/'94	2048	910	KRAAIFONT	~/06/'94	UNK	Birth	Captive		UNK
T722	?	~/06/'94	2048	910	KRAAIFONT	~/06/'94	UNK	Birth	Captive		UNK
T723	F	~/06/'95	3065	3064	GHIAZZA R	~/06/'95	UNK	Birth	Captive		~/06/'95
						~/06/'95		Death		~/06/'95	
(Death by: Infection Associated, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T724	F	~/06/'95	3065	3064	GHIAZZA R	~/06/'95	UNK	Birth	Captive		~/06/'95
						~/06/'95		Death		~/06/'95	
(Death by: Infection Associated, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T725	F	~/06/'95	3065	3064	GHIAZZA R	~/06/'95	UNK	Birth	Captive		~/06/'95
						~/06/'95		Death		~/06/'95	
(Death by: Infection Associated, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T726	?	~/06/'94	3065	3064	GHIAZZA R	~/06/'94	UNK	Birth	Captive		
2063	?	~/06/'95	1950	2062	PRETORIA	~/06/'95	UNK	Birth	Captive		~/06/'95
						~/06/'95		Death		~/06/'95	
(Death by: Stillbirth, Unknown, Respiratory, Unknown (after autopsy))											
2064	?	~/06/'95	1950	2062	PRETORIA	~/06/'95	UNK	Birth	Captive		~/06/'95
						~/06/'95		Death		~/06/'95	
(Death by: Stillbirth, Unknown, Respiratory, Unknown (after autopsy))											
2065	?	~/06/'95	1950	2062	PRETORIA	~/06/'95	UNK	Birth	Captive		~/06/'95
						~/06/'95		Death		~/06/'95	
(Death by: Stillbirth, Unknown, Respiratory, Unknown (after autopsy))											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
2066	?	~/06/’95	1950	2062	PRETORIA	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~/06/’95	
(Death by: Stillbirth, Unknown, Respiratory, Unknown (after autopsy))											
T731?	?	~/06/’95	T667	3028	HOEDSPRUI	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~/06/’95	
(Death by: Unknown means)											
T732?	?	~/06/’95	T667	3028	HOEDSPRUI	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~/06/’95	
(Death by: Unknown means)											
T733?	?	~/06/’95	T667	3028	HOEDSPRUI	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~/06/’95	
(Death by: Unknown means)											
T734?	?	~/06/’95	T667	3028	HOEDSPRUI	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~/06/’95	
(Death by: Unknown means)											
T735?	?	~/06/’95	T667	3028	HOEDSPRUI	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~/06/’95	
(Death by: Unknown means)											
T736?	?	~/06/’95	T667	3028	HOEDSPRUI	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~/06/’95	
(Death by: Unknown means)											
T737?	?	~/06/’95	T667	3028	HOEDSPRUI	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~/06/’95	
(Death by: Unknown means)											
T738	?	~/06/’95	3018	3021	JOHANSBRG	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~/06/’95	
(Death by: Infection Associated, Unknown, No Autopsy Planned)											
T739	?	~/06/’95	3018	3021	JOHANSBRG	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~/06/’95	
(Death by: Infection Associated, Unknown, No Autopsy Planned)											
T740	M	~/06/’95	3018	3021	JOHANSBRG	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~/06/’95	
(Death by: Infection Associated, Unknown, No Autopsy Planned)											
T741	M	~/06/’95	3018	3021	JOHANSBRG	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~/06/’95	
(Death by: Infection Associated, Unknown, No Autopsy Planned)											
T742	F	~/06/’95	3018	3021	JOHANSBRG	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~/06/’95	
(Death by: Infection Associated, Unknown, No Autopsy Planned)											
T743	M	~/06/’95	3018	3021	JOHANSBRG	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~06/’95	
(Death by: Env. or Beh. Conditions, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T744	M	~/06/’95	3018	3021	JOHANSBRG	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~06/’95	
(Death by: Env. or Beh. Conditions, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T745	F	~/06/’95	3018	3021	JOHANSBRG	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~06/’95	
(Death by: Env. or Beh. Conditions, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
T746	F	~/06/’95	3018	3021	JOHANSBRG	~/06/’95	UNK	Birth	Captive		~/06/’95
						~/06/’95		Death		~06/’95	
(Death by: Env. or Beh. Conditions, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
3064	F	~/’90	3000	3003	HARTBEESP	~/’90	UNK	Birth	Captive		~/’90
					GHIAZZA R	~/’90	UNK	Transfer			

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T748	M	~/'90	UNK	UNK	UNKNOWN	~/'90	UNK	Birth	UNK		~/01/'92
					GHIAZZA R	~/01/'92		Death		~/01/'92	
(Death by: Injury from Exhibit Mate, Unknown, No Autopsy Planned)											
3065	M	~/'90	UNK	UNK	UNKNOWN	~/'90	UNK	Birth	UNK		
T750?	?	~/06/'92	3065	3064	GHIAZZA R	~/06/'92	UNK	Birth	Captive		~/06/'92
						~/06/'92		Death		~/06/92	
(Death by: Unknown means)											
T751?	?	~/06/'92	3065	3064	GHIAZZA R	~/06/'92	UNK	Birth	Captive		~/06/'92
						~/06/'92		Death		~/06/92	
(Death by: Unknown means)											
T752?	?	~/06/'92	3065	3064	GHIAZZA R	~/06/'92	UNK	Birth	Captive		~/06/'92
						~/06/'92		Death		~/06/92	
(Death by: Unknown means)											
T753?	?	~/06/'92	3065	3064	GHIAZZA R	~/06/'92	UNK	Birth	Captive		~/06/'92
						~/06/'92		Death		~/06/92	
(Death by: Unknown means)											
T754?	?	~/06/'92	3065	3064	GHIAZZA R	~/06/'92	UNK	Birth	Captive		~/06/'92
						~/06/'92		Death		~/06/92	
(Death by: Unknown means)											
T755?	?	~/06/'92	3065	3064	GHIAZZA R	~/06/'92	UNK	Birth	Captive		~/06/'92
						~/06/'92		Death		~/06/92	
(Death by: Unknown means)											
T756?	?	~/06/'92	3065	3064	GHIAZZA R	~/06/'92	UNK	Birth	Captive		~/06/'92
						~/06/'92		Death		~/06/92	
(Death by: Unknown means)											
T757	?	~/06/'94	3065	3064	GHIAZZA R	~/06/'94	UNK	Birth	Captive		~/06/'94
						~/06/'94		Death		~/06/'94	
(Death by: Other/Unknown, Unknown, Unknown (after Autopsy), Unknown (after autopsy))											
3066	F	~/06/'94	3065	3064	GHIAZZA R	~/06/'94	UNK	Birth	Captive		~/07/'94
					HARTBEESP	~/07/'94	UNK	Transfer			
T759	?	~/06/'94	3065	3064	GHIAZZA R	~/06/'94	UNK	Birth	Captive		
T760	M	~/04/'96	3049	3028	HOEDSPRUI	~/04/'96	UNK	Birth	Captive		
T761	M	~/04/'96	3049	3028	HOEDSPRUI	~/04/'96	UNK	Birth	Captive		
T762	M	~/04/'96	3049	3028	HOEDSPRUI	~/04/'96	UNK	Birth	Captive		
T763	M	????	WILD	WILD	ANGOLA	????	UNK	Capture	Wild		????
					UNKNOWN	????	UNK	Transfer			16/03/'94
					JOHANSBRG	16/03/'94	UNK	Transfer			
T764?	?	~/06/'96	1950	3030	PRETORIA	~/06/'96	UNK	Birth	Captive		~/06/'96
						~/06/'96		Death		~/06/'96	
(Death by: Unknown means)											
T765?	?	~/06/'96	1950	3030	PRETORIA	~/06/'96	UNK	Birth	Captive		~/06/'96
						~/06/'96		Death		~/06/'96	
(Death by: Unknown means)											
T766?	?	~/06/'96	1950	3030	PRETORIA	~/06/'96	UNK	Birth	Captive		~/06/'96
						~/06/'96		Death		~/06/'96	
(Death by: Unknown means)											
T767?	?	~/06/'96	1950	3030	PRETORIA	~/06/'96	UNK	Birth	Captive		~/06/'96
						~/06/'96		Death		~/06/'96	
(Death by: Unknown means)											
T768?	?	~/06/'96	1950	3030	PRETORIA	~/06/'96	UNK	Birth	Captive		~/06/'96
						~/06/'96		Death		~/06/'96	
(Death by: Unknown means)											

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Birth-O	Death	Removal
T769?	?	~/06/'96	1950	3030	PRETORIA	~/06/'96 ~/06/'96	UNK	Birth Death	Captive	 ~/06/'96	~/06/'96
(Death by: Unknown means)											
T770?	?	~/06/'96	1950	3030	PRETORIA	~/06/'96 ~/06/'96	UNK	Birth Death	Captive	 ~/06/'96	~/06/'96
(Death by: Unknown means)											
T771	?	~01/07/'96	1982	1985	PRET DW	~01/07/'96	UNK	Birth	Captive		
T772	?	~01/07/'96	1982	1985	PRET DW	~01/07/'96	UNK	Birth	Captive		
T773	?	~01/07/'96	1982	1985	PRET DW	~01/07/'96	UNK	Birth	Captive		
T774	?	~01/07/'96	1982	1985	PRET DW	~01/07/'96	UNK	Birth	Captive		
T775	?	~01/07/'96	1982	1985	PRET DW	~01/07/'96	UNK	Birth	Captive		
T776	?	~01/07/'96	1982	1985	PRET DW	~01/07/'96	UNK	Birth	Captive		
T777	?	~01/07/'96	1982	1985	PRET DW	~01/07/'96	UNK	Birth	Captive		
T778	?	~01/07/'96	1982	1985	PRET DW	~01/07/'96	UNK	Birth	Captive		
T779	?	~01/07/'96	1982	1985	PRET DW	~01/07/'96	UNK	Birth	Captive		
T780	F	~28/05/'96	2030	3014	HOEDSPRUI	~28/05/'96	UNK	Birth	Captive		
T781	F	~28/05/'96	2030	3014	HOEDSPRUI	~28/05/'96	UNK	Birth	Captive		
T782	F	~28/05/'96	2030	3014	HOEDSPRUI	~28/05/'96	UNK	Birth	Captive		
T783	F	~28/05/'96	2030	3014	HOEDSPRUI	~28/05/'96	UNK	Birth	Captive		
T784	M	~28/05/'96	2030	3014	HOEDSPRUI	~28/05/'96	UNK	Birth	Captive		
T785	M	~28/05/'96	2030	3014	HOEDSPRUI	~28/05/'96	UNK	Birth	Captive		
T786	M	~28/05/'96	2030	3014	HOEDSPRUI	~28/05/'96	UNK	Birth	Captive		
T787	?	~28/05/'96	2030	3014	HOEDSPRUI	~28/05/'96	UNK	Birth	Captive		

TOTALS: 145.134.480 (787)

Location Glossary

BLOEMFNTN	Bloemfontein Zoo P.O. Box 3704, Bloemfontein 9300, Orange Free State, South Africa, 27 51 4058498.
CANGO	Cango Crocodile Ranch & Cheetahland P.O. Box 559, Oudtshoorn, E. Cape, South Africa, 2260, 27 443 225593/6.
ETOSHA	Etosha National Park P.O. Okaukejo, Namibia.
GHIAZZA R	African Game Services (Ricardo Ghiazza) P.O. Box 536, Lanseria 1748, Gauteng, South Africa, 27 1207 71070.
HARTBEESP	Hartbeespoort Dam Snake & Animal Park P.O. Box 109, Hartbeespoort 0216, Gauteng, South Africa, 21 1211 30162.
HOEDSPRUI	Hoedspruit Cheetah Project P.O. Box 912031, Silverton 0127, Gauteng, South Africa, 27 12 46 2570.
JOHANSBRG	Johannesburg Zoological Gardens Jan Smuts Ave., Parkview 2193, South Africa, 27 11 646 2000.
KLASERIE	Klaserie Nature Reserve PO Box 150, Hoedspruit, Gauteng, South Africa, 1380, 27 1528 33051.
KRAAIFONT	Tygerberg Zoopark P.O. Box 524, Kraaifontein 7569, South Africa, 27 21 8844494.
MEDUNSA	Medunsa University of South Africa Pretoria, Gauteng, South Africa, (012)529-4111.
NATAL	Natal Zoological Gardens Cato Ridge 3112, Natal, South Africa.
NATAL PB	Natal Park Board P.O. Box 662, Pietermaritzburg 320, Natal, South Africa, 27 331 471 961
OP	Onderstepoort Pretoria, Gauteng, South-Africa.
PRET DW	De Wildt Cheetah Research & Breeding Center P.O. Box 16, De Wildt 0251, South Africa, 27 12 28 6020.
PRETORIA	Pretoria National Zoological Gardens of South Africa P.O. Box 754, Pretoria 0001, South Africa, 27 12 28 3265.
RIETVLEI	Rietvlei (JHB Zoo) Gauteng, South Africa.
S LUCIA	St Lucia (SA) Natal, South Africa.
THABA YA	Thaba Ya Batho Zoological Gardens PO Box 336, Bon Accord, Gauteng, South-Africa, 0009, (012) 572312.
TRANSVAAL	Transvaal Gauteng, South Africa.
UMFOLOZI	Umfolozi National Park Umfolozi, Natal, South Africa.
UNKNOWN	Unknown Location
WILD	Obtained From Wild

A. SUMMARY OF LIVING INDIVIDUALS BY LOCATION 1 JANUARY 1997

stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Name
Cango Crocodile Ranch & Cheetahland, Oudtshoorn 6620, South Africa									
3022	M	~ Jun 1991	3019	3021	HOEDSPRUI	~ Jun 1991	UNK	Birth	Bishop
					OUDTSHORN	~ Sep 1994	UNK	Transfer	
3023	M	~ Jun 1991	3019	3021	HOEDSPRUI	~ Jun 1991	UNK	Birth	Bandaid
					OUDTSHORN	~ Sep 1994	UNK	Transfer	
3024	M	~ Jun 1991	3019	3021	HOEDSPRUI	~ Jun 1991	UNK	Birth	Bandot
					OUDTSHORN	~ Sep 1994	UNK	Transfer	
3041	M	13 May 1995	3024	910	OUDTSHORN	13 May 1995	UNK	Birth	
3042	M	13 May 1995	3024	910	OUDTSHORN	13 May 1995	UNK	Birth	
3043	M	13 May 1995	3024	910	OUDTSHORN	13 May 1995	UNK	Birth	
3044	M	13 May 1995	3024	910	OUDTSHORN	13 May 1995	UNK	Birth	
3045	M	13 May 1995	3024	910	OUDTSHORN	13 May 1995	UNK	Birth	
3046	M	13 May 1995	3024	910	OUDTSHORN	13 May 1995	UNK	Birth	
3047	M	13 May 1995	3024	910	OUDTSHORN	13 May 1995	UNK	Birth	
3048	F	13 May 1995	3024	910	OUDTSHORN	13 May 1995	UNK	Birth	
TOTALS: 10.1.0 (11)									
Hoedspruit Cheetah project, Silverton 0127, Transvaal, South Africa									
2030	M	5 Nov 1989	2021	2022	JOHANSBRG	5 Nov 1989	UNK	Birth	Flashy\Sah
					HOEDSPRUI	8 Jan 1996	UNK	Transfer	
3014	F	~ Dec 1994	1983	913	PRET DW	~ Dec 1994	UNK	Birth	ANNE
					HOEDSPRUI	~ Jan 1996	UNK	Transfer	
3027	F	~ Jun 1992	3005	3007	HOEDSPRUI	~ Jun 1992	UNK	Birth	Chessnut
3028	F	~ Jun 1992	3005	3007	HOEDSPRUI	~ Jun 1992	UNK	Birth	Ninja
3029	F	~ Jun 1992	3005	3007	HOEDSPRUI	~ Jun 1992	UNK	Birth	Tennis
3030	F	~ Jun 1992	3005	3007	HOEDSPRUI	~ Jun 1992	UNK	Birth	Melrose
3049	M	~ 1 Jun 1993	T667	T664	KRUGER	~ 1 Jun 1993	UNK	Birth	
					HOEDSPRUI	21 Dec 1994	UNK	Loan to	
3050	M	~ 1 Jun 1993	T667	T664	KRUGER	~ 1 Jun 1993	UNK	Birth	
					HOEDSPRUI	21 Dec 1994	UNK	Loan to	
T760	M	~ Apr 1996	3049	3028	HOEDSPRUI	~ Apr 1996	UNK	Birth	
T761	M	~ Apr 1996	3049	3028	HOEDSPRUI	~ Apr 1996	UNK	Birth	
T762	M	~ Apr 1996	3049	3028	HOEDSPRUI	~ Apr 1996	UNK	Birth	
T780	F	~28 May 1996	2030	3014	HOEDSPRUI	~28 May 1996	UNK	Birth	
T781	F	~28 May 1996	2030	3014	HOEDSPRUI	~28 May 1996	UNK	Birth	
T782	F	~28 May 1996	2030	3014	HOEDSPRUI	~28 May 1996	UNK	Birth	
T783	F	~28 May 1996	2030	3014	HOEDSPRUI	~28 May 1996	UNK	Birth	
T784	M	~28 May 1996	2030	3014	HOEDSPRUI	~28 May 1996	UNK	Birth	
T785	M	~28 May 1996	2030	3014	HOEDSPRUI	~28 May 1996	UNK	Birth	

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Name
T786	M	~28 May 1996	2030	3014	HOEDSPRUI	~28 May 1996	UNK	Birth	
T787	?	~28 May 1996	2030	3014	HOEDSPRUI	~28 May 1996	UNK	Birth	

TOTALS: 9.9.1 (19)

Johannesburg Zoological Gardens, Parkview 2193, South Africa

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Name
3021	F	29 Apr 1988	2021	3008	JOHANSBRG	29 Apr 1988	UNK	Birth	Madonna
					RIETVLEI	1 Aug 1989	UNK	Transfer	
					KLASERIE	~ Jan 1991	UNK	Transfer	
						~ Apr 1991	UNK	Release	
						~ May 1991	UNK	Capture	
					HOEDSPRUI	~ May 1991	UNK	Transfer	
					JOHANSBRG	~ 1 Feb 1995	UNK	Transfer	
T763	M	????	WILD	WILD	ANGOLA	????	UNK	Capture	Mabeco
					UNKNOWN	????	UNK	Transfer	
					JOHANSBRG	16 Mar 1994	UNK	Transfer	

TOTALS: 1.1.0 (2)

Pretoria National Zoological Gardens, Pretoria 0001, South Africa

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Name
1950	M	2 Jun 1988	903	911	PRET DW	2 Jun 1988	D92479	Birth	'88 MALE/P
					PRETORIA	27 May 1993	903711	Transfer	
2062	F	~ Jun 1992	3005	3007	HOEDSPRUI	~ Jun 1992	UNK	Birth	Miss T
					PRETORIA	~ 1 Feb 1995	UNK	Transfer	

TOTALS: 1.1.0 (2)

Tygerberg Zoopark, Kraaifontein7570, South Africa

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Name
2033	F	~ 1983	3000	3003	HARTBEESP	~ 1983	UNK	Birth	Dracula
					JOHANSBRG	6 Aug 1990	UNK	Transfer	
					KRAAIFONT	25 Jan 1996	UNK	Transfer	
2048	M	1 Oct 1985	3004	3002	PRETORIA	1 Oct 1985	UNK	Birth	
					NATAL	2 Jun 1986	UNK	Transfer	
					PRETORIA	12 Jun 1986	UNK	Transfer	
					PRET DW	19 Jun 1986	UNK	Transfer	
					KRAAIFONT	10 Jul 1986	860003	Transfer	

TOTALS: 1.1.0 (2)

Totals: 22.13.1 (36)
5 APP Institutions

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Name

African Game Srsv (Ricardo Ghiazza), Lanseria 1748, Transvaal, South Africa

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Name
3064	F	~ 1990	3000	3003	HARTBEESP	~ 1990	UNK	Birth	
					GHIAZZA R	~ 1990	UNK	Transfer	

TOTALS: 0.1.0 (1)

Mr Clive Albutt, Kuruman 8460, Cape Province, South Africa

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Name
1991	M	9 Mar 1993	904	912	PRET DW	9 Mar 1993	D92548	Birth	TM1
					MCADAM	4 Oct 1994	UNK	Transfer	
1992	M	9 Mar 1993	904	912	PRET DW	9 Mar 1993	D92549	Birth	TM2
					MCADAM	4 Oct 1994	UNK	Transfer	
3025	F	~ Jun 1991	3019	3021	HOEDSPRUI	~ Jun 1991	UNK	Birth	Wilsin
					MCADAM	6 Oct 1994	UNK	Transfer	
3026	F	~ Jun 1991	3019	3021	HOEDSPRUI	~ Jun 1991	UNK	Birth	Filips
					MCADAM	6 Oct 1994	UNK	Transfer	

TOTALS: 2.2.0 (4)

De Wildt Cheetah Research & Breeding Center, De Wildt 0251, South Africa

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Name
904	M	~ Aug 1987	903	911	PRET DW	~ Aug 1987	D92475	Birth	Quattro
913	F	27 Oct 1990	904	912	PRET DW	27 Oct 1990	D92486	Birth	TRI '91 P/
1982	M	~ 1987	WILD	WILD	ETOSHA	~ May 1993	UNK	Capture	SWM2
					PRET DW	21 May 1993	D92565	Transfer	
1983	M	~ 1989	WILD	WILD	TRANSVAAL	~ Sep 1992	UNK	Capture	Crusoe
					PRET DW	7 Sep 1992	D92564	Transfer	
1984	M	~ 1992	WILD	WILD	ETOSHA	~ May 1993	UNK	Capture	SWM1
					PRET DW	21 May 1993	D92566	Transfer	
1985	F	~ 1992	WILD	WILD	ETOSHA	~ May 1993	UNK	Capture	Collar
					PRET DW	21 May 1993	D92567	Transfer	
1986	F	~ 1992	WILD	WILD	ETOSHA	~ May 1993	UNK	Capture	Band
					PRET DW	21 May 1993	D92568	Transfer	
1987	F	~ 1992	WILD	WILD	ETOSHA	~ May 1993	UNK	Capture	Plain
					PRET DW	21 May 1993	D92569	Transfer	
1993	F	9 Mar 1993	904	912	PRET DW	9 Mar 1993	D92550	Birth	TF1
1995	F	3 May 1993	1983	913	PRET DW	3 May 1993	D92571	Birth	Satellite
2034	F	~ 1990	WILD	WILD	NAMIBIA	~ 1993	UNK	Capture	Domino
					OKAHANDJA	~ 1993	UNK	Transfer	
					PRET DW	21 Dec 1993	D92593	Transfer	
2035	M	~ 1990	WILD	WILD	NAMIBIA	~ 1993	UNK	Capture	Chess
					OKAHANDJA	1 Jan 1993	UNK	Transfer	
					PRET DW	21 Dec 1993	D92594	Transfer	
3010	M	20 Jun 1991	904	912	PRET DW	20 Jun 1991	D92487	Birth	'91 PUP/M3
3015	?	~ Dec 1994	1983	913	PRET DW	~ Dec 1994	UNK	Birth	
3016	?	~ Dec 1994	1983	913	PRET DW	~ Dec 1994	UNK	Birth	
3034	?	~ Dec 1994	1983	913	PRET DW	~ Dec 1994	UNK	Birth	

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Name
3035	?	~ 1 May 1995	1982	1985	PRET DW	~ 1 May 1995	UNK	Birth	
3036	?	~ 1 May 1995	1982	1985	PRET DW	~ 1 May 1995	UNK	Birth	
3037	?	~ 1 May 1995	1982	1985	PRET DW	~ 1 May 1995	UNK	Birth	
3051	?	~ 7 May 1995	1982	1986	PRET DW	~ 7 May 1995	UNK	Birth	
3052	?	~ 7 May 1995	1982	1986	PRET DW	~ 7 May 1995	UNK	Birth	
3053	?	~ 7 May 1995	1982	1986	PRET DW	~ 7 May 1995	UNK	Birth	
3054	?	~ 7 May 1995	1982	1986	PRET DW	~ 7 May 1995	UNK	Birth	
3055	?	~ 7 May 1995	1982	1986	PRET DW	~ 7 May 1995	UNK	Birth	
3056	?	~ 7 May 1995	1982	1987	PRET DW	~ 7 May 1995	UNK	Birth	
3057	?	~ 7 May 1995	1982	1987	PRET DW	~ 7 May 1995	UNK	Birth	
3058	?	~ 7 May 1995	1982	1987	PRET DW	~ 7 May 1995	UNK	Birth	
3059	?	~ 7 May 1995	1982	1987	PRET DW	~ 7 May 1995	UNK	Birth	
3060	?	~ 7 May 1995	1982	1987	PRET DW	~ 7 May 1995	UNK	Birth	
3061	?	~ 7 May 1995	1982	1987	PRET DW	~ 7 May 1995	UNK	Birth	
3062	?	~ 7 May 1995	1982	1987	PRET DW	~ 7 May 1995	UNK	Birth	
3063	?	~ 7 May 1995	1982	1987	PRET DW	~ 7 May 1995	UNK	Birth	
T771	?	~ 1 Jul 1996	1982	1985	PRET DW	~ 1 Jul 1996	UNK	Birth	
T772	?	~ 1 Jul 1996	1982	1985	PRET DW	~ 1 Jul 1996	UNK	Birth	
T773	?	~ 1 Jul 1996	1982	1985	PRET DW	~ 1 Jul 1996	UNK	Birth	
T774	?	~ 1 Jul 1996	1982	1985	PRET DW	~ 1 Jul 1996	UNK	Birth	
T775	?	~ 1 Jul 1996	1982	1985	PRET DW	~ 1 Jul 1996	UNK	Birth	
T776	?	~ 1 Jul 1996	1982	1985	PRET DW	~ 1 Jul 1996	UNK	Birth	
T777	?	~ 1 Jul 1996	1982	1985	PRET DW	~ 1 Jul 1996	UNK	Birth	
T778	?	~ 1 Jul 1996	1982	1985	PRET DW	~ 1 Jul 1996	UNK	Birth	
T779	?	~ 1 Jul 1996	1982	1985	PRET DW	~ 1 Jul 1996	UNK	Birth	

TOTALS: 6.7.28 (41)

Stud #	Sex	Birth	Sire	Dam	Location	Date	Local ID	Event	Name
Hartbeespoort Dam Snake & Animal Park, Hartbeespoort 0216, Transvaal, South Africa									
3009	M	~ 1988	3000	3003	HARTBEESP	~ 1988	UNK	Birth	
3017	M	~ 1983	3000	3003	HARTBEESP	~ 1983	UNK	Birth	
3066	F	~ Jun 1994	3065	3064	GHIAZZA R HARTBEESP	~ Jun 1994 ~ Jul 1994UNK	UNK Transfer	Birth	

TOTALS: 2.1.0 (3)

Totals: 10.11.28 (49)
4 Non-APP Institutions

B. AGE PYRAMID LIVING INDIVIDUALS ONLY

AGE PYRAMID ANALYSIS

Status: Living by 1Jan 1997

```
Age                              Males | Females
                         N = 57                    N = 50
14                                   X | X
13                                     |
12                                   X |
11                                     | X
10                                 XXX | X
 9                                  XX | X
 8                                 XXX |
 7                                  XX | XXX
 6                                XXXX | XX
 5                                  XX | XXXXXXXXX
 4                              XXXXXX | XX
 3                                ???? | ????XX
 2                 XXXXXXX?????????? | ??????????XXXXX
 1                       XXXXXX????? | ?????XXXX
 0                                     |
              ---|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|-|---
              32 28 24 20 16 12 8 4   4 8 12 16 20 24 28 32
                              Number of Animals
```

KEY:

X= Specimens of known sex...
? = Specimens of unknown sex...
1 Male Specimens of unknown age...

The population of 107 living individuals includes 2 (1:1) animals beyond probable reproductive age (>12 years). The majority of the population currently consists of 85 (30:25:30) reproductively mature adults (2-12 years). Immature animals include 20 (6:4:10) sub-adults (1-2 years) and no pups (0-1 years), due to the fact that data are incomplete. The population contains more or less an equal number of males and females.

C. MORTALITY AND FECUNDITY OF ALL SPECIMENS

Fecundity and Mortality Report

Age Class	Fecundity [Mx]... Male	N	Female	N	Mortality [Qx]... Male	N	Female	N
0- 1	0.01	124.1	0.00	113.3	0.66	368.7	0.68	364.0
1- 2	0.06	85.7	0.39	79.7	0.05	92.1	0.06	86.2
2- 3	0.57	66.4	0.83	62.2	0.14	82.2	0.05	65.4
3- 4	1.50	44.4	1.75	43.5	0.02	59.3	0.06	47.1
4- 5	1.57	39.5	1.37	38.0	0.04	44.5	0.02	40.0
5- 6	1.94	33.1	1.28	32.8	0.03	33.1	0.11	35.7
6- 7	1.80	28.1	2.01	21.1	0.13	31.9	0.11	28.0
7- 8	1.02	23.2	1.83	17.1	0.16	24.4	0.12	17.1
8- 9	1.95	15.6	1.48	13.6	0.12	16.2	0.21	14.5
9-10	1.26	10.8	0.89	9.5	0.09	11.7	0.18	10.9
10-11	1.53	5.9	0.89	4.8	0.27	7.4	0.43	7.1
11-12	1.29	3.5	4.35	3.1	0.00	3.5	0.00	3.1
12-13	1.52	2.2	0.00	1.8	0.37	2.7	0.40	2.5
13-14	0.00	1.5	0.00	1.5	0.00	1.5	0.00	1.5
14-15	0.00	1.5	0.00	1.5	0.00	1.7	0.00	1.7
15-16	0.00	0.3	0.00	0.3	1.00	0.3	1.00	0.3
16-17	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
17-18	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0

T = 6.027
Ro = 2.992
lambda=1.20
r = 0.182

T = 5.599
Ro = 2.916
lambda=1.21
r = 0.191

30 day mortality: 63%
(448 deaths out of 715 arriving
within 30 days of birth date)

5 specimens of unknown age ignored...

680 birth events to known age parents tabulated for Mx...plus...
16 births to dams of unknown age...
27 births to UNK or MULT dams...
57 births to sires of unknown age...
27 births to UNK or MULT sires...
[30 parents (includes WILD) not found in data set ignored...]

557 death events of known age tabulated for Qx.

WARNING: Values with small sample sizes (N) warrant less confidence...

Mx: Age-specific fertility rate - the average number of offspring, of the same sex as the parent, born to an individual in age class x.

Qx: Age-specific mortality rate - the proportion of individuals surviving from the beginning of age class x to the next age class, x+1.

T: Generation time - the average age at which an animal produces its offspring.

Ro: Net reproductive rate - the rate of change in population size per generation.

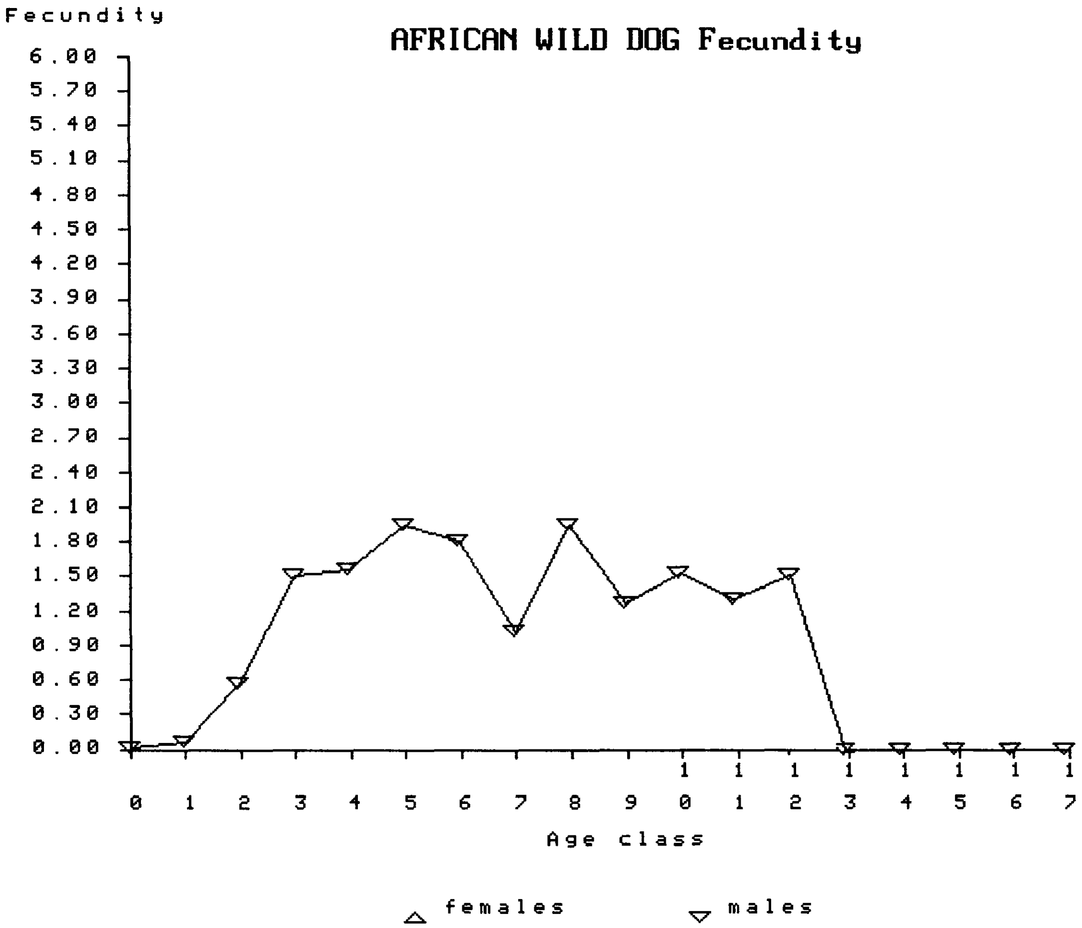
Lambda: Percentage change in population per year.

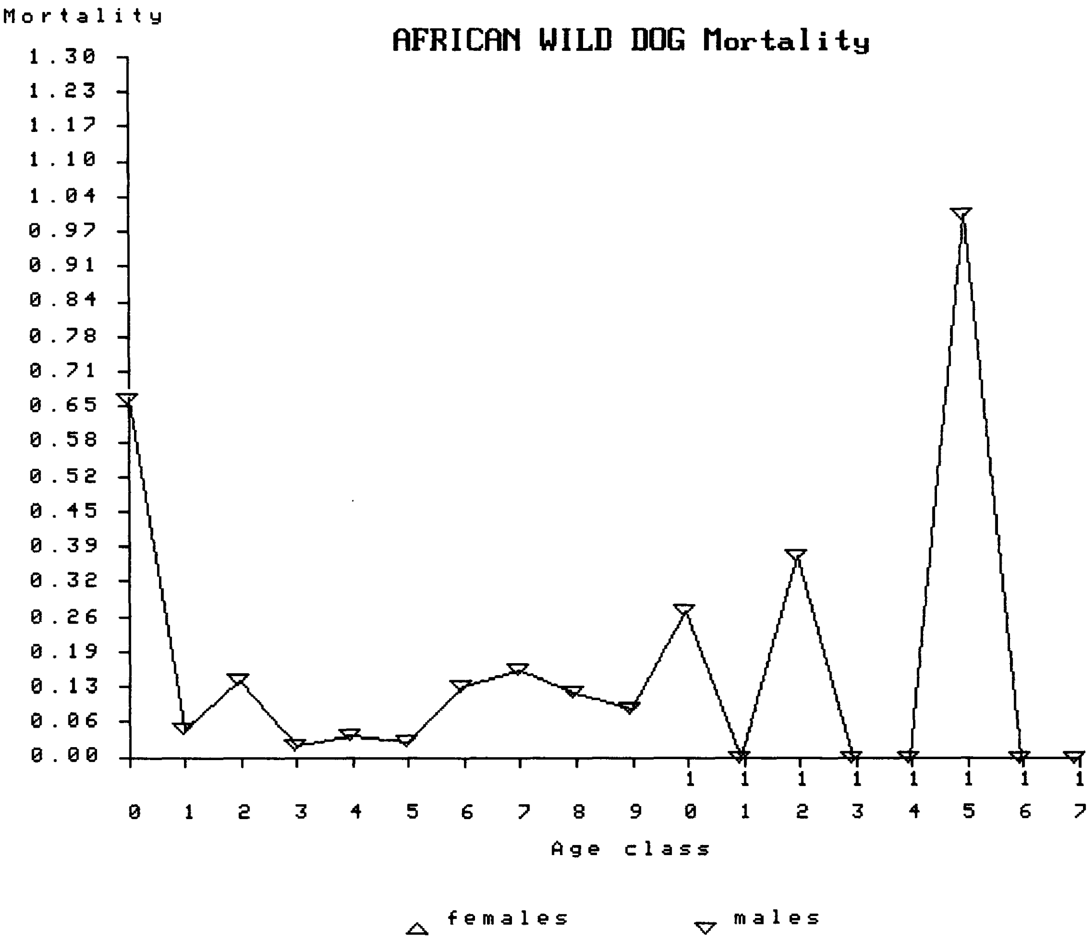
r: Instantaneous rate of change.

SUMMARY

The generation time for males (6 years) tends to be higher than for females (5½ years).

Ro, lambda and r all have values greater than zero, indicating that the captive wild dog population in South Africa has grown between1959 and 1997, despite a 63%, 30 day mortality.




Mortality
AFRICAN WILD DOG Mortality
1.30
1.23
1.17
1.10
1.04
0.97
0.91
0.84
0.78
0.71
0.65
0.58
0.52
0.45
0.39
0.32
0.26
0.19
0.13
0.06
0.00
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
Age class
females
males

D. CRUDE DEMOGRAPHIC PARAMETERS

Crude Demographic Parameters

Dates: During date 01/01/1997

	Crude Demographics					
	CBR	IR	DR	DRn	ER	RC
31 Dec 1996	30%	0%	10%	26%	0%	1.202
31 Dec 1995	93%	0%	60%	48%	0%	1.309
31 Dec 1994	83%	10%	71%	75%	0%	1.079
31 Dec 1993	74%	15%	64%	77%	0%	1.340
31 Dec 1992	93%	2%	93%	69%	0%	1.044
31 Dec 1991	72%	0%	58%	72%	0%	1.125
31 Dec 1990	86%	0%	88%	94%	0%	0.952
31 Dec 1989	84%	3%	55%	59%	0%	1.105
31 Dec 1988	88%	0%	68%	47%	0%	1.118
31 Dec 1987	105%	3%	90%	66%	0%	0.872
31 Dec 1986	77%	0%	54%	30%	0%	1.114
31 Dec 1985	91%	6%	88%	73%	0%	1.061
31 Dec 1984	154%	4%	129%	65%	0%	1.375
31 Dec 1983	236%	0%	155%	54%	0%	1.091
31 Dec 1982	190%	0%	114%	35%	0%	1.048
31 Dec 1981	367%	0%	258%	66%	0%	1.750
31 Dec 1980	185%	8%	146%	75%	0%	0.923
31 Dec 1979	200%	88%	100%	50%	0%	1.625
31 Dec 1978	40%	0%	0%	0%	0%	1.600
31 Dec 1977	0%	600%	0%	0%	0%	5.000
31 Dec 1976	0%	0%	0%	0%	0%	1.000
31 Dec 1975	0%	0%	0%	0%	0%	1.000
31 Dec 1974	0%	0%	0%	0%	0%	1.000
31 Dec 1973	0%	0%	0%	0%	0%	1.000
31 Dec 1972	0%	0%	0%	0%	0%	1.000
31 Dec 1971	0%	0%	50%	0%	0%	0.500
31 Dec 1970	0%	0%	33%	0%	0%	0.667
31 Dec 1969	67%	0%	67%	100%	0%	1.000
31 Dec 1968	333%	0%	300%	70%	0%	1.000
31 Dec 1967	667%	367%	733%	70%	0%	1.000
31 Dec 1966	100%	200%	150%	0%	0%	1.500
31 Dec 1965	0%	33%	0%	0%	0%	0.667
31 Dec 1964	0%	0%	22%	0%	0%	0.333
31 Dec 1963	367%	0%	167%	27%	0%	3.000
31 Dec 1962	0%	50%	0%	0%	0%	0.750
31 Dec 1961	0%	0%	0%	0%	0%	1.000
31 Dec 1960	125%	0%	150%	100%	0%	0.500
31 Dec 1959	300%	0%	0%	0%	0%	4.000
31 Dec 1958	0%	50%	0%	0%	0%	1.000
31 Dec 1957	0%	0%	0%	0%	0%	1.000
31 Dec 1956	0%	0%	0%	0%	0%	2.000
31 Dec 1955	0%	0%	0%	0%	0%	1.000
31 Dec 1954	0%	100%	0%	0%	0%	1.000
31 Dec 1953	0%	0%	0%	0%	0%	1.000

Explanatory Notes: Crude Demographics

CBR - Crude birth rate (births per 100).

CIR - Crude import rate (imports per 100).

CDR - Crude death rate (deaths per 100).

CDRn - Crude death rate of neonates (neonatal deaths per 100 births).

CER - Crude export rate (exports per 100).

CRC - Crude rate of change (actual observed annual growth rate).

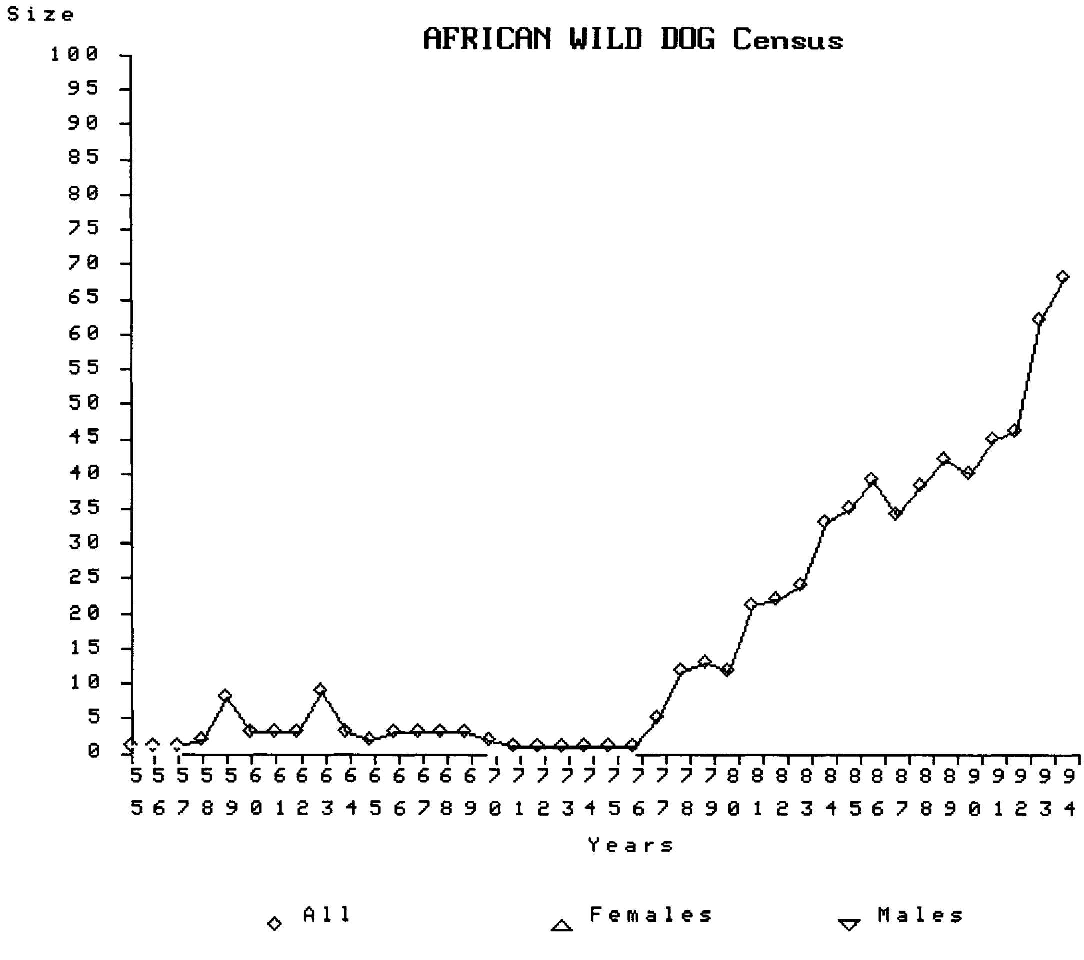
E. CENSUS REPORT

Census Report

Dates: As of End of date 01/01/1997

Year	Specimen	Counts	Observed Lambda Annual	Geometric Mean
1996	38.29.39	(106)	1.20	
1995	34.25.29	(88)	1.29	1.25 (last 2 yrs)
1994	32.28.8	(68)	1.10	1.20 (last 3 yrs)
1993	32.30.0	(62)	1.35	1.23 (last 4 yrs)
1992	23.23.0	(46)	1.02	1.19 (last 5 yrs)
1991	24.21.0	(45)	1.13	1.18 (last 6 yrs)
1990	23.17.0	(40)	0.95	1.14 (last 7 yrs)
1989	25.17.0	(42)	1.11	1.14 (last 8 yrs)
1988	22.16.0	(38)	1.12	1.13 (last 9 yrs)
1987	19.15.0	(34)	0.87	1.11 (last 10 yrs)
1986	17.22.0	(39)	1.11	1.11 (last 11 yrs)
1985	16.19.0	(35)	1.06	1.10 (last 12yrs)
1984	15.18.0	(33)	1.38	1.12 (last 13 yrs)
1983	13.11.0	(24)	1.09	1.12 (last 14 yrs)
1982	14.8.0	(22)	1.05	1.11 (last 15 yrs)
1981	10.8.3	(21)	1.75	1.15 (last 16 yrs)
1980	6.5.1	(12)	0.92	1.13 (last 17 yrs)
1979	7.5.1	(13)	1.08	1.13 (last 18 yrs)
1978	6.5.1	(12)	2.40	1.17 (last 19 yrs)
1977	2.2.1	(5)	5.00	1.26 (last 20 yrs)
1976	0.0.1	(1)	1.00	1.25 (last 21 yrs)
1975	0.0.1	(1)	1.00	1.24 (last 22 yrs)
1974	0.0.1	(1)	1.00	1.22 (last 23 yrs)
1973	0.0.1	(1)	1.00	1.21 (last 24 yrs)
1972	0.0.1	(1)	1.00	1.21 (last 25 yrs)
1971	0.0.1	(1)	0.50	1.16 (last 26 yrs)
1970	1.0.1	(2)	0.67	1.14 (last 27 yrs)
1969	1.1.1	(3)	1.00	1.14 (last 28 yrs)
1968	1.1.1	(3)	1.00	1.13 (last 29 yrs)
1967	1.1.1	(3)	1.00	1.13 (last 30 yrs)
1966	1.1.1	(3)	1.50	1.14 (last 31 yrs)
1965	1.1.0	(2)	0.67	1.12 (last 32 yrs)
1964	1.1.1	(3)	0.33	1.08 (last 33 yrs)
1963	1.2.6	(9)	3.00	1.11 (last 34 yrs)
1962	1.1.1	(3)	1.00	1.11 (last 35 yrs)
1961	1.2.0	(3)	1.00	1.10 (last 36 yrs)
1960	1.2.0	(3)	0.38	1.07 (last 37 yrs)
1959	3.5.0	(8)	4.00	1.11 (last 38 yrs)
1958	1.1.0	(2)	2.00	1.13 (last 39 yrs)
1957	0.1.0	(1)	1.00	1.12 (last 40 yrs)
1956	0.1.0	(1)	1.00	1.12 (last 41 yrs)
1955	0.1.0	(1)	1.00	1.12 (last 42 yrs)
1954	0.1.0	(1)	1.00	1.11 (last 43 yrs)

Note: Lambda values include Imports and Exports...


AFRICAN WILD DOG Census
Size
100
95
90
85
80
75
70
65
60
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30
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20
15
10
5
0
55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94
Years
All
Females
Males

F. INBREEDING COEFFICIENTS AND FOUNDER REPRESENTATION

Inbreeding Coefficient Report

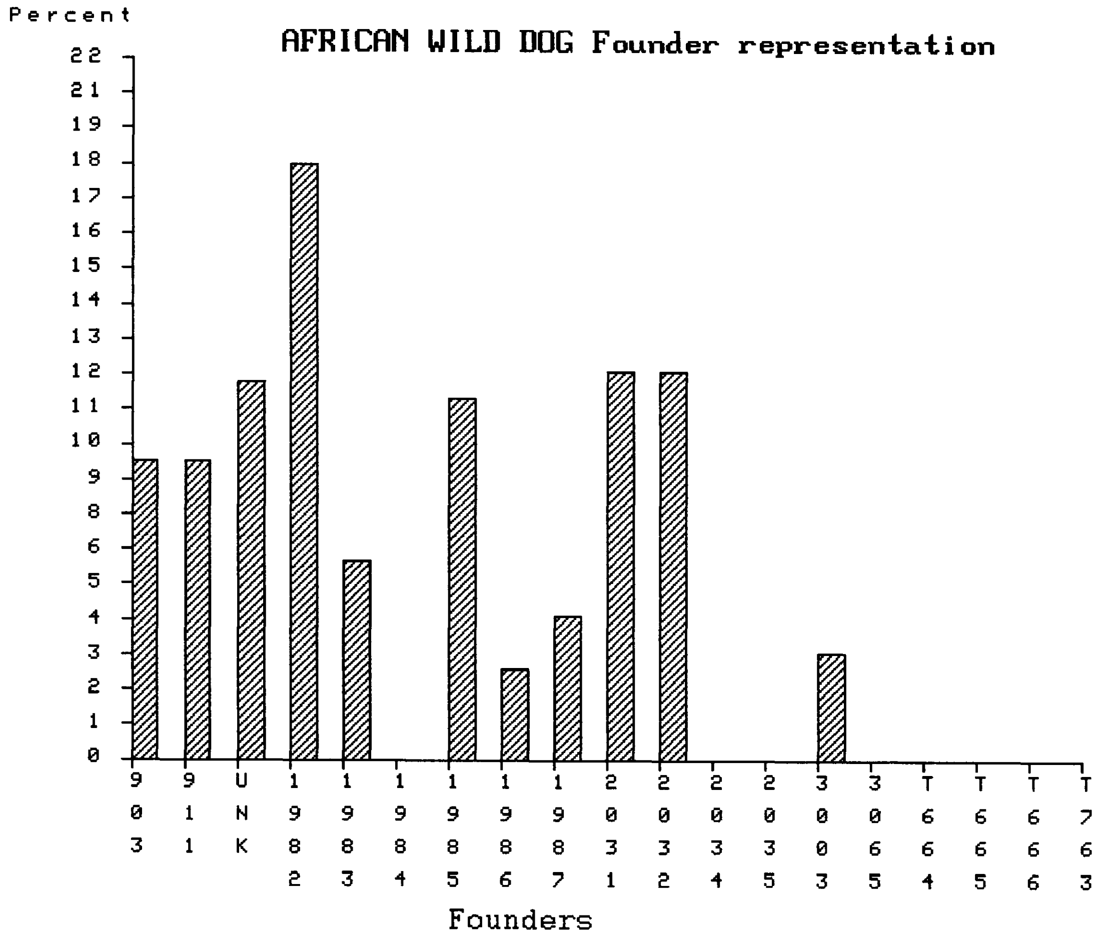
Status: Living by 1 Jan 1997

Stud #	Sex	Age	Sire	Dam	Location	Inbreeding
T763	Male	Unknown	WILD	WILD	JOHANSBRG	0
2033	Female	~14Y	3000	3003	KRAAIFONT	0
3017	Male	~14Y	3000	3003	HARTBEESP	0
2048	Male	12Y,2M,22D	3004	3002	KRAAIFONT	0.2500
T664	Female	~11Y	??	??	KRUGER	0
1982	Male	~10Y	WILD	WILD	PRET DW	0
T665	Male	~10Y	??	??	KRUGER	0
T666	Female	~10Y	??	??	KRUGER	0
904	Male	~10Y,4M	903	911	PRET DW	0
3009	Male	~9Y	3000	3003	HARTBEESP	0
3021	Female	9Y,7M,24D	2021	3008	JOHANSBRG	0.2500
1950	Male	9Y,6M,21D	903	911	PRETORIA	0
1983	Male	~8Y	WILD	WILD	PRET DW	0
T667	Male	~8Y,6M	T665	T666	KRUGER	0
2030	Male	8Y,1M,17D	2021	2022	HOEDSPRUI	0.2500
2034	Female	~7Y	WILD	WILD	PRET DW	0
2035	Male	~7Y	WILD	WILD	PRET DW	0
3065	Male	~7Y	??	??	UNKNOWN	0
3064	Female	~7Y	3000	3003	GHIAZZA R	0
913	Female	7Y,1M,26D	904	912	PRET DW	0.2500
3022	Male	~6Y,6M	3019	3021	OUDTSHORN	0.3125
3023	Male	~6Y,6M	3019	3021	OUDTSHORN	0.3125
3024	Male	~6Y,6M	3019	3021	OUDTSHORN	0.3125
3025	Female	~6Y,6M	3019	3021	MCADAM	0.3125
3026	Female	~6Y,6M	3019	3021	MCADAM	0.3125
3010	Male	6Y,6M,3D	904	912	PRET DW	0.2500
1984	Male	~5Y	WILD	WILD	PRET DW	0
1985	Female	~5Y	WILD	WILD	PRET DW	0
1986	Female	~5Y	WILD	WILD	PRET DW	0
1987	Female	~5Y	WILD	WILD	PRET DW	0
2062	Female	~5Y,6M	3005	3007	PRETORIA	0.2500
3027	Female	~5Y,6M	3005	3007	HOEDSPRUI	0.2500
3028	Female	~5Y,6M	3005	3007	HOEDSPRUI	0.2500
3029	Female	~5Y,6M	3005	3007	HOEDSPRUI	0.2500
3030	Female	~5Y,6M	3005	3007	HOEDSPRUI	0.2500
T668	Male	~5Y,6M	T667	T664	MODIKWE	0
1991	Male	4Y,9M,13D	904	912	MCADAM	0.2500
1992	Male	4Y,9M,13D	904	912	MCADAM	0.2500
1993	Female	4Y,9M,13D	904	912	PRET DW	0.2500
1995	Female	4Y,7M,19D	1983	913	PRET DW	0
3049	Male	~4Y,6M,21D	T667	T664	HOEDSPRUI	0
3050	Male	~4Y,6M,21D	T667	T664	HOEDSPRUI	0
T669	Male	~4Y,6M	T667	T664	MODIKWE	0
T670	Male	~4Y,6M	T667	T664	MODIKWE	0
3066	Female	~3Y,6M	3065	3064	HARTBEESP	0
T701	Unknown	~3Y,6M	3065	3064	GHIAZZA R	0
T726	Unknown	~3Y,6M	3065	3064	GHIAZZA R	0
T759	Unknown	~3Y,6M	3065	3064	GHIAZZA R	0
3014	Female	~3Y,0M	1983	913	HOEDSPRUI	0
3015	Unknown	~3Y,0M	1983	913	PRET DW	0
3016	Unknown	~3Y,0M	1983	913	PRET DW	0
T431	Unknown	~3Y,0M	1983	913	PRET DW	0

Stud #	Sex	Age	Sire	Dam	Location	Inbreeding
T432	Unknown	~3Y,0M	1983	913	PRET DW	0
T433	Unknown	~3Y,0M	1983	913	PRET DW	0
3031	Female	~2Y,7M,21D	1982	1985	MODIKWE	0
3032	Female	~2Y,7M,21D	1982	1985	MODIKWE	0
3033	Female	~2Y,7M,21D	1982	1985	MODIKWE	0
3034	Unknown	~2Y,7M,21D	1982	1985	PRET DW	0
3035	Unknown	~2Y,7M,21D	1982	1985	PRET DW	0
3036	Unknown	~2Y,7M,21D	1982	1985	PRET DW	0
3037	Unknown	~2Y,7M,21D	1982	1985	PRET DW	0
T683	Unknown	~2Y,7M,21D	1982	1985	PRET DW	0
T690	Unknown	~2Y,7M,21D	1982	1985	PRET DW	0
T691	Unknown	~2Y,7M,21D	1982	1985	PRET DW	0
T692	Unknown	~2Y,7M,21D	1982	1985	PRET DW	0
3051	Unknown	~2Y,7M,15D	1982	1986	PRET DW	0
3052	Unknown	~2Y,7M,15D	1982	1986	PRET DW	0
3053	Unknown	~2Y,7M,15D	1982	1986	PRET DW	0
3054	Unknown	~2Y,7M,15D	1982	1986	PRET DW	0
3055	Unknown	~2Y,7M,15D	1982	1986	PRET DW	0
3056	Unknown	~2Y,7M,15D	1982	1987	PRET DW	0
3057	Unknown	~2Y,7M,15D	1982	1987	PRET DW	0
3058	Unknown	~2Y,7M,15D	1982	1987	PRET DW	0
3059	Unknown	~2Y,7M,15D	1982	1987	PRET DW	0
3060	Unknown	~2Y,7M,15D	1982	1987	PRET DW	0
3061	Unknown	~2Y,7M,15D	1982	1987	PRET DW	0
3062	Unknown	~2Y,7M,15D	1982	1987	PRET DW	0
3063	Unknown	~2Y,7M,15D	1982	1987	PRET DW	0
3041	Male	2Y,7M,9D	3024	910	OUDTSHORN	0
3042	Male	2Y,7M,9D	3024	910	OUDTSHORN	0
3043	Male	2Y,7M,9D	3024	910	OUDTSHORN	0
3044	Male	2Y,7M,9D	3024	910	OUDTSHORN	0
3045	Male	2Y,7M,9D	3024	910	OUDTSHORN	0
3046	Male	2Y,7M,9D	3024	910	OUDTSHORN	0
3047	Male	2Y,7M,9D	3024	910	OUDTSHORN	0
3048	Female	2Y,7M,9D	3024	910	OUDTSHORN	0
T760	Male	~1Y,8M	3049	3028	HOEDSPRUI	0
T761	Male	~1Y,8M	3049	3028	HOEDSPRUI	0
T762	Male	~1Y,8M	3049	3028	HOEDSPRUI	0
T780	Female	~1Y,6M,24D	2030	3014	HOEDSPRUI	0
T781	Female	~1Y,6M,24D	2030	3014	HOEDSPRUI	0
T782	Female	~1Y,6M,24D	2030	3014	HOEDSPRUI	0
T783	Female	~1Y,6M,24D	2030	3014	HOEDSPRUI	0
T784	Male	~1Y,6M,24D	2030	3014	HOEDSPRUI	0
T785	Male	~1Y,6M,24D	2030	3014	HOEDSPRUI	0
T786	Male	~1Y,6M,24D	2030	3014	HOEDSPRUI	0
T787	Unknown	~1Y,6M,24D	2030	3014	HOEDSPRUI	0
T771	Unknown	~1Y,5M,20D	1982	1985	PRET DW	0
T772	Unknown	~1Y,5M,20D	1982	1985	PRET DW	0
T773	Unknown	~1Y,5M,20D	1982	1985	PRET DW	0
T774	Unknown	~1Y,5M,20D	1982	1985	PRET DW	0
T775	Unknown	~1Y,5M,20D	1982	1985	PRET DW	0
T776	Unknown	~1Y,5M,20D	1982	1985	PRET DW	0
T777	Unknown	~1Y,5M,20D	1982	1985	PRET DW	0
T778	Unknown	~1Y,5M,20D	1982	1985	PRET DW	0
T779	Unknown	~1Y,5M,20D	1982	1985	PRET DW	0

Specimens listed in birth date order.
68 Unknown parents treated as founders.

Parent IDs shown as ?'s are unknown and therefore treated as founders.



G. GENETIC ANALYSIS

GENE DROP ANALYSIS

Status: Living by 1 Jan 1997

Studbook	Sex	Sire	Dam	Status	Prop. Living desc.	genome unique among all living
904	M	903	911	A	0.0042	0.0042
913	F	904	912	A	0.0000	0.0000
1950	M	903	911	A	0.1294	0.1294
1982	M	WILD	WILD	F		0.0000
1983	M	WILD	WILD	F		0.0071
1984	M	WILD	WILD	F		1.0000
1985	F	WILD	WILD	F		0.0000
1986	F	WILD	WILD	F		0.0336
1987	F	WILD	WILD	F		0.0036
1991	M	904	912	A	0.0036	0.0036
1992	M	904	912	A	0.0044	0.0044
1993	F	904	912	A	0.0039	0.0039
1995	F	1983	913	A	0.0076	0.0000
2030	M	2021	2022	A	0.0003	0.0003
2033	F	3000	3003	A	0.0961	0.0961
2034	F	WILD	WILD	F		1.0000
2035	M	WILD	WILD	F		1.0000
2048	M	3004	3002	A	0.4017	0.4017
2062	F	3005	3007	A	0.0064	0.0064
3009	M	3000	3003	A	0.1018	0.1018
3010	M	904	912	A	0.0034	0.0034
3014	F	1983	913	A	0.0000	0.0000
3015	U	1983	913	A	0.0080	0.0000
3016	U	1983	913	A	0.0089	0.0000
3017	M	3000	3003	A	0.0974	0.0974
3021	F	2021	3008	A	0.0024	0.0024
3022	M	3019	3021	A	0.0013	0.0013
3023	M	3019	3021	A	0.0015	0.0015
3024	M	3019	3021	A	0.0000	0.0000
3025	F	3019	3021	A	0.0021	0.0021
3026	F	3019	3021	A	0.0016	0.0016
3027	F	3005	3007	A	0.0059	0.0059
3028	F	3005	3007	A	0.0008	0.0008
3029	F	3005	3007	A	0.0054	0.0054
3030	F	3005	3007	A	0.0062	0.0062
3031	F	1982	1985	A	0.0000	0.0000
3032	F	1982	1985	A	0.0000	0.0000
3033	F	1982	1985	A	0.0000	0.0000
3034	U	1982	1985	A	0.0000	0.0000
3035	U	1982	1985	A	0.0000	0.0000
3036	U	1982	1985	A	0.0000	0.0000
3037	U	1982	1985	A	0.0000	0.0000
3041	M	3024	910	A	0.0006	0.0006
3042	M	3024	910	A	0.0007	0.0007
3043	M	3024	910	A	0.0004	0.0004
3044	M	3024	910	A	0.0006	0.0006
3045	M	3024	910	A	0.0008	0.0008
3046	M	3024	910	A	0.0005	0.0005
3047	M	3024	910	A	0.0004	0.0004
3048	F	3024	910	A	0.0005	0.0005
3049	M	T667	T664	A	0.0035	0.0000
3050	M	T667	T664	A	0.0287	0.0000
3051	U	1982	1986	A	0.0313	0.0000

Studbook	Sex	Sire	Dam	Status	Prop. Living desc.	genome unique among all living
3052	U	1982	1986	A	0.0294	0.0000
3053	U	1982	1986	A	0.0302	0.0000
3054	U	1982	1986	A	0.0320	0.0000
3055	U	1982	1986	A	0.0309	0.0000
3056	U	1982	1987	A	0.0042	0.0000
3057	U	1982	1987	A	0.0033	0.0000
3058	U	1982	1987	A	0.0042	0.0000
3059	U	1982	1987	A	0.0045	0.0000
3060	U	1982	1987	A	0.0040	0.0000
3061	U	1982	1987	A	0.0037	0.0000
3062	U	1982	1987	A	0.0035	0.0000
3063	U	1982	1987	A	0.0043	0.0000
3064	F	3000	3003	A	0.0032	0.0032
3065	M	UNK	UNK	U		0.0317
3066	F	3065	3064	A	0.0316	0.0000
T431	U	1983	913	A	0.0077	0.0000
T432	U	1983	913	A	0.0072	0.0000
T433	U	1983	913	A	0.0075	0.0000
T516	F	3065	3064	A	0.0312	0.0000
T664	F	UNK	UNK	U	0.0315	
T665	M	UNK	UNK	U	0.5000	
T666	F	UNK	UNK	U	0.5000	
T667	M	T665	T666	A	0.0309	0.0000
T668	M	T667	T664	A	0.0313	0.0000
T669	M	T667	T664	A	0.0311	0.0000
T670	M	T667	T664	A	0.0297	0.0000
T683	U	1982	1985	A	0.0000	0.0000
T690	U	1982	1985	A	0.0000	0.0000
T691	U	1982	1985	A	0.0000	0.0000
T692	U	1982	1985	A	0.0000	0.0000
T701	U	3065	3064	A	0.0323	0.0000
T726	U	3065	3064	A	0.0310	0.0000
T759	U	3065	3064	A	0.0311	0.0000
T760	M	3049	3028	A	0.0000	0.0000
T761	M	3049	3028	A	0.0000	0.0000
T762	M	3049	3028	A	0.0000	0.0000
T763	M	WILD	WILD	F		1.0000
T771	U	1982	1985	A	0.0000	0.0000
T772	U	1982	1985	A	0.0000	0.0000
T773	U	1982	1985	A	0.0000	0.0000
T774	U	1982	1985	A	0.0000	0.0000
T775	U	1982	1985	A	0.0000	0.0000
T776	U	1982	1985	A	0.0000	0.0000
T777	U	1982	1985	A	0.0000	0.0000
T778	U	1982	1985	A	0.0000	0.0000
T779	U	1982	1985	A	0.0000	0.0000
T780	F	2030	3014	A	0.0000	0.0000
T781	F	2030	3014	A	0.0000	0.0000
T782	F	2030	3014	A	0.0000	0.0000
T783	F	2030	3014	A	0.0000	0.0000
T784	M	2030	3014	A	0.0000	0.0000
T785	M	2030	3014	A	0.0000	0.0000
T786	M	2030	3014	A	0.0000	0.0000
T787	U	2030	3014	A	0.0000	0.0000

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20 Founders 94 Living descendants 125 In analysis

EXPLANATORY NOTE: Animals with a high proportion of unique alleles are important to the population from a genetic perspective.

FOUNDER ALLELE REPRESENTATION

Founder	Retention		%Representation		Target		Difference
	With unk	w/o	with unk	w/o	with unk	w/o	
903 M	0.934	8.764	10.330	4.934	6.908	-3.830	-3.423
911 F	0.935	8.783	10.352	4.939	6.914	-3.844	-3.438
T92 MU	0.604	2.000	0.000	3.190	0.000	1.190	0.000
1982 ML	1.000	17.553	20.690	5.282	7.395	-12.271	-13.296
1983 ML	0.993	5.858	6.905	5.282	7.395	-0.576	0.490
1984 ML	0.000	0.000	0.000	5.282	7.395	5.282	7.395
1985 FL	1.000	10.638	12.540	5.282	7.395	-5.356	-5.145
1986 FL	0.966	2.660	3.135	5.282	7.395	2.622	4.260
1987 FL	0.996	4.255	5.016	5.282	7.395	1.027	2.379
2031 M	0.858	11.440	13.485	4.534	6.348	-6.906	-7.137
2032 F	0.858	11.432	13.476	4.533	6.347	-6.899	-7.129
2034 FL	0.000	0.000	0.000	5.282	7.395	5.282	7.395
2035 ML	0.000	0.000	0.000	5.282	7.395	5.282	7.395
3002 FU	0.805	2.525	0.000	4.255	0.000	1.730	0.000
3003 F	0.937	3.454	4.072	4.950	6.930	1.496	2.859
3065 MLU	0.968	2.660	0.000	5.282	0.000	2.622	0.000
T664 FLU	0.969	3.459	0.000	5.282	0.000	1.823	0.000
T665 MLU	0.500	2.254	0.000	5.282	0.000	3.028	0.000
T666 FLU	0.500	2.265	0.000	5.282	0.000	3.017	0.000
T763 ML	0.000	0.000	0.000	5.282	7.395	5.282	7.395

GENETIC SUMMARY LIVING DESCENDANT			POPULATION POTENTIAL	
	with unknowns	w/o	w/ unkn	w/o
Number of founders:	16	10	20	14
Mean retention:	0.864	0.948	0.947	0.966
Founder genomes surviving:	13.825	9.479	18.932	13.523
Founder Genome Equivalents:	7.992	6.090	18.932	13.523
Fraction of wild gene diversity retained:	0.937	0.918	0.974	0.963
Fraction of wild gene diversity lost:	0.063	0.082	0.026	0.037
Mean inbreeding coefficient:	0.051			

EXPLANATORY NOTE: Fraction of the wild gene diversity retained in this population is 0.937 (without unknowns) which is within the ideal limits of 0.9 or higher. The potential for this population is 0.963 (without unknowns), indicating that this ideal is achievable, using an optimum breeding strategy.

INBREEDING COEFFICIENTS AND MEAN KINSHIPS

Status: Living by 1 Jan 1997

Inbreeding and kinship calculations omit genes from UNKNOWN ancestors.

A. MEAN KINSHIP OF LIVING ANIMALS TO LIVING NON-FOUNDERS

STUDBOOK	SIRE	DAM	INBREEDING	MEAN KINSHIP	KINSHIP VALUE	GENOME KNOWN
904 M	903	911	F = 0.0000	mk = 0.0713	kv = 0.0736	1.0000
913 F	904	912	F = 0.2500	mk = 0.0901	kv = 0.0933	1.0000
1950 M	903	911	F = 0.0000	mk = 0.0549	kv = 0.0564	1.0000
1982 M	WILD	WILD	F = 0.0000	mk = 0.1034	kv = 0.1042	1.0000
1983 M	WILD	WILD	F = 0.0000	mk = 0.0345	kv = 0.0363	1.0000
1984 M	WILD	WILD	F = 0.0000	mk = 0.0000	kv = 0.0000	1.0000
1985 F	WILD	WILD	F = 0.0000	mk = 0.0627	kv = 0.0608	1.0000
1986 F	WILD	WILD	F = 0.0000	mk = 0.0157	kv = 0.0167	1.0000
1987 F	WILD	WILD	F = 0.0000	mk = 0.0251	kv = 0.0267	1.0000
1991 M	904	912	F = 0.2500	mk = 0.0729	kv = 0.0764	1.0000
1992 M	904	912	F = 0.2500	mk = 0.0729	kv = 0.0764	1.0000
1993 F	904	912	F = 0.2500	mk = 0.0729	kv = 0.0758	1.0000
1995 F	1983	913	F = 0.0000	mk = 0.0650	kv = 0.0676	1.0000
2030 M	2021	2022	F = 0.2500	mk = 0.1074	kv = 0.1078	1.0000
2033 F	3000	3003	F = 0.0000	mk = 0.0204	kv = 0.0121	0.5000
2034 F	WILD	WILD	F = 0.0000	mk = 0.0000	kv = 0.0000	1.0000
2035 M	WILD	WILD	F = 0.0000	mk = 0.0000	kv = 0.0000	1.0000
2048 M	3004	3002				0.0000
2062 F	3005	3007	F = 0.2500	mk = 0.0968	kv = 0.0963	1.0000
3009 M	3000	3003	F = 0.0000	mk = 0.0204	kv = 0.0121	0.5000
3010 M	904	912	F = 0.2500	mk = 0.0729	kv = 0.0758	1.0000
3014 F	1983	913	F = 0.0000	mk = 0.0760	kv = 0.0792	1.0000
3015 U	1983	913	F = 0.0000	mk = 0.0650	kv = 0.0677	1.0000
3016 U	1983	913	F = 0.0000	mk = 0.0650	kv = 0.0677	1.0000
3017 M	3000	3003	F = 0.0000	mk = 0.0204	kv = 0.0121	0.5000
3021 F	2021	3008	F = 0.2500	mk = 0.1058	kv = 0.1042	1.0000
3022 M	3019	3021	F = 0.3125	mk = 0.1082	kv = 0.1079	1.0000
3023 M	3019	3021	F = 0.3125	mk = 0.1082	kv = 0.1079	1.0000
3024 M	3019	3021	F = 0.3125	mk = 0.1176	kv = 0.1197	1.0000
3025 F	3019	3021	F = 0.3125	mk = 0.1082	kv = 0.1074	1.0000
3026 F	3019	3021	F = 0.3125	mk = 0.1082	kv = 0.1074	1.0000
3027 F	3005	3007	F = 0.2500	mk = 0.0968	kv = 0.0963	1.0000
3028 F	3005	3007	F = 0.2500	mk = 0.1003	kv = 0.1002	1.0000
3029 F	3005	3007	F = 0.2500	mk = 0.0968	kv = 0.0963	1.0000
3030 F	3005	3007	F = 0.2500	mk = 0.0968	kv = 0.0963	1.0000
3031 F	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0858	1.0000
3032 F	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0858	1.0000
3033 F	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0858	1.0000
3034 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0858	1.0000
3035 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0858	1.0000
3036 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0858	1.0000
3037 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0858	1.0000
3041 M	3024	910	F = 0.0000	mk = 0.0936	kv = 0.0983	1.0000
3042 M	3024	910	F = 0.0000	mk = 0.0936	kv = 0.0983	1.0000
3043 M	3024	910	F = 0.0000	mk = 0.0936	kv = 0.0983	1.0000

STUDBOOK	SIRE	DAM	INBREEDING	MEAN KINSHIP	KINSHIP VALUE	GENOME KNOWN
3044 M	3024	910	F = 0.0000	mk = 0.0936	kv = 0.0983	1.0000
3045 M	3024	910	F = 0.0000	mk = 0.0936	kv = 0.0983	1.0000
3046 M	3024	910	F = 0.0000	mk = 0.0936	kv = 0.0983	1.0000
3047 M	3024	910	F = 0.0000	mk = 0.0936	kv = 0.0983	1.0000
3048 F	3024	910	F = 0.0000	mk = 0.0936	kv = 0.0977	1.0000
3049 M	T667	T664				0.0000
3050 M	T667	T664				0.0000
3051 U	1982	1986	F = 0.0000	mk = 0.0627	kv = 0.0638	1.0000
3052 U	1982	1986	F = 0.0000	mk = 0.0627	kv = 0.0638	1.0000
3053 U	1982	1986	F = 0.0000	mk = 0.0627	kv = 0.0638	1.0000
3054 U	1982	1986	F = 0.0000	mk = 0.0627	kv = 0.0638	1.0000
3055 U	1982	1986	F = 0.0000	mk = 0.0627	kv = 0.0638	1.0000
3056 U	1982	1987	F = 0.0000	mk = 0.0674	kv = 0.0688	1.0000
3057 U	1982	1987	F = 0.0000	mk = 0.0674	kv = 0.0688	1.0000
3058 U	1982	1987	F = 0.0000	mk = 0.0674	kv = 0.0688	1.0000
3059 U	1982	1987	F = 0.0000	mk = 0.0674	kv = 0.0688	1.0000
3060 U	1982	1987	F = 0.0000	mk = 0.0674	kv = 0.0688	1.0000
3061 U	1982	1987	F = 0.0000	mk = 0.0674	kv = 0.0688	1.0000
3062 U	1982	1987	F = 0.0000	mk = 0.0674	kv = 0.0688	1.0000
3063 U	1982	1987	F = 0.0000	mk = 0.0674	kv = 0.0688	1.0000
3064 F	3000	3003	F = 0.0000	mk = 0.0204	kv = 0.0121	0.5000
3065 M	UNK	UNK				0.0000
3066 F	3065	3064	F = 0.0000	mk = 0.0204	kv = 0.0121	0.2500
T431 U	1983	913	F = 0.0000	mk = 0.0650	kv = 0.0677	1.0000
T432 U	1983	913	F = 0.0000	mk = 0.0650	kv = 0.0677	1.0000
T433 U	1983	913	F = 0.0000	mk = 0.0650	kv = 0.0677	1.0000
T516 F	3065	3064	F = 0.0000	mk = 0.0204	kv = 0.0121	0.2500
T664 F	UNK	UNK				0.0000
T665 M	UNK	UNK				0.0000
T666 F	UNK	UNK				0.0000
T667 M	T665	T666				0.0000
T668 M	T667	T664				0.0000
T669 M	T667	T664				0.0000
T670 M	T667	T664				0.0000
T683 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0858	1.0000
T690 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0858	1.0000
T691 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0858	1.0000
T692 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0858	1.0000
T701 U	3065	3064	F = 0.0000	mk = 0.0204	kv = 0.0121	0.2500
T726 U	3065	3064	F = 0.0000	mk = 0.0204	kv = 0.0121	0.2500
T759 U	3065	3064	F = 0.0000	mk = 0.0204	kv = 0.0121	0.2500
T760 M	3049	3028	F = 0.0000	mk = 0.0995	kv = 0.0993	0.5000
T761 M	3049	3028	F = 0.0000	mk = 0.0995	kv = 0.0993	0.5000
T762 M	3049	3028	F = 0.0000	mk = 0.0995	kv = 0.0993	0.5000
T763 M	WILD	WILD	F = 0.0000	mk = 0.0000	kv = 0.0000	1.0000
T771 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0852	1.0000
T772 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0852	1.0000
T773 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0852	1.0000
T774 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0852	1.0000
T775 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0852	1.0000
T776 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0852	1.0000
T777 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0852	1.0000
T778 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0852	1.0000
T779 U	1982	1985	F = 0.0000	mk = 0.0862	kv = 0.0852	1.0000
T780 F	2030	3014	F = 0.0000	mk = 0.0944	kv = 0.0962	1.0000
T781 F	2030	3014	F = 0.0000	mk = 0.0944	kv = 0.0962	1.0000
T782 F	2030	3014	F = 0.0000	mk = 0.0944	kv = 0.0962	1.0000

STUDBOOK	SIRE	DAM	INBREEDING	MEAN KINSHIP	KINSHIP VALUE	GENOME KNOWN
T783 F	2030	3014	F = 0.0000	mk = 0.0944	kv = 0.0962	1.0000
T784 M	2030	3014	F = 0.0000	mk = 0.0944	kv = 0.0966	1.0000
T785 M	2030	3014	F = 0.0000	mk = 0.0944	kv = 0.0966	1.0000
T786 M	2030	3014	F = 0.0000	mk = 0.0944	kv = 0.0966	1.0000
T787 U	2030	3014	F = 0.0000	mk = 0.0944	kv = 0.0962	1.0000

ORDERED LISTS OF MEAN KINSHIP BY SEX:

Rank	Male	MK	Age	Known	Female	MK	Age	Known	UNK	MK	Age	Known
1	T763	0.0000	0	1.000	2034	0.00	8	1.000	T701	0.0204	4	0.250
2	2035	0.0000	8	1.000	1986	0.0157	6	1.000	T726	0.0204	4	0.250
3	1984	0.0000	6	1.000	2033	0.0204	15	0.500	T759	0.0204	4	0.250
4	3017	0.0204	15	0.500	3064	0.0204	8	0.500	3051	0.0627	3	1.000
5	3009	0.0204	10	0.500	3066	0.0204	4	0.250	3052	0.0627	3	1.000
6	1983	0.0345	9	1.000	T516	0.0204	3	0.250	3053	0.0627	3	1.000
7	1950	0.0549	10	1.000	1987	0.0251	6	1.000	3054	0.0627	3	1.000
8	904	0.0713	10	1.000	1985	0.0627	6	1.000	3055	0.0627	3	1.000
9	3010	0.0729	7	1.000	1995	0.0650	5	1.000	3015	0.0650	3	1.000
10	1991	0.0729	5	1.000	1993	0.0729	5	1.000	3016	0.0650	3	1.000
11	1992	0.0729	5	1.000	3014	0.0760	3	1.000	T431	0.0650	3	1.000
12	3041	0.0936	3	1.000	3031	0.0862	3	1.000	T432	0.0650	3	1.000
13	3042	0.0936	3	1.000	3032	0.0862	3	1.000	T433	0.0650	3	1.000
14	3043	0.0936	3	1.000	3033	0.0862	3	1.000	3056	0.0674	3	1.000
15	3044	0.0936	3	1.000	913	0.0901	7	1.000	3057	0.0674	3	1.000
16	3045	0.0936	3	1.000	3048	0.0936	3	1.000	3058	0.0674	3	1.000
17	3046	0.0936	3	1.000	T780	0.0944	2	1.000	3059	0.0674	3	1.000
18	3047	0.0936	3	1.000	T781	0.0944	2	1.000	3060	0.0674	3	1.000
19	T784	0.0944	2	1.000	T782	0.0944	2	1.000	3061	0.0674	3	1.000
20	T785	0.0944	2	1.000	T783	0.0944	2	1.000	3062	0.0674	3	1.000
21	T786	0.0944	2	1.000	2062	0.0968	6	1.000	3063	0.0674	3	1.000
22	T760	0.0995	2	0.500	3027	0.0968	6	1.000	3034	0.0862	3	1.000
23	T761	0.0995	2	0.500	3029	0.0968	6	1.000	3035	0.0862	3	1.000
24	T762	0.0995	2	0.500	3030	0.0968	6	1.000	3036	0.0862	3	1.000
25	1982	0.1034	1	1.000	3028	0.1003	6	1.000	3037	0.0862	3	1.000
26	2030	0.1074	8	1.000	3021	0.1058	10	1.000	T683	0.0862	3	1.000
27	3022	0.1082	7	1.000	3025	0.1082	7	1.000	T690	0.0862	3	1.000
28	3023	0.1082	7	1.000	3026	0.1082	7	1.000	T691	0.0862	3	1.000
29	3024	0.1176	7	1.000	T664		12	0.000	T692	0.0862	3	1.000
30	2048		12	0.000	T666		11	0.000	T771	0.0862	1	1.000
31	T665		11	0.000					T772	0.0862	1	1.000
32	T667		9	0.000					T773	0.0862	1	1.000
33	3065		8	0.000					T774	0.0862	1	1.000
34	T668		6	0.000					T775	0.0862	1	1.000
35	3049		5	0.000					T776	0.0862	1	1.000
36	3050		5	0.000					T777	0.0862	1	1.000
37	T669		5	0.000					T778	0.0862	1	1.000
38	T670		5	0.000					T779	0.0862	1	1.000
39									T787	0.0944	2	1.000

EXPLANATORY NOTE: "Mean Kinship" indicates how important an animal is genetically. The ordered list of mean kinship rank animals according to mean kinship, i.e. they show priority animals to breed from.

GENETIC SUMMARY OF POPULATION

Descendant population Mean Kinship:	0.0818
Gene Diversity:	0.9182
Founder Genome Equivalents:	6.1146
Desc. population mean Kinship Value:	0.0839
Gene Value:	0.9161

MATING CHOICES
Inbreeding coefficients for potential offspring.
Males across top, females down side.
Studbook numbers followed by U indicate partially unknown ancestry.

	904	1950	1982	1983	1984	1991	1992	2030	2035	2048U	3009U
913	0.3750	0.2500	0.0000	0.0000	0.0000	0.3750	0.3750	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1993	0.3750	0.2500	0.0000	0.0000	0.0000	0.3750	0.3750	0.0000	0.2500	0.0000	0.0000
1995	0.1875	0.1250	0.0000	0.2500	0.0000	0.1875	0.1875	0.0000	0.0000	0.0000	0.0000
2033U	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5000
2034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2062	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3125	0.0000	0.0000	0.0000
3014	0.1875	0.1250	0.0000	0.2500	0.0000	0.1875	0.1875	0.0000	0.0000	0.0000	0.0000
3021	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3125	0.0000	0.0000	0.0000
3025	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3438	0.0000	0.0000	0.0000
3026	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3438	0.0000	0.0000	0.0000
3027	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3125	0.0000	0.0000	0.0000
3028	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3125	0.0000	0.0000	0.0000
3029	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3125	0.0000	0.0000	0.0000
3030	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3125	0.0000	0.0000	0.0000
3031	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3032	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3033	0.0000	0.0000	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3048	0.1250	0.1250	0.0000	0.0000	0.0000	0.1250	0.1250	0.1719	0.0000	0.0000	0.0000
3064U	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5000
3066U	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5000
T516U	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5000
T664U	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
T666U	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
T780	0.0938	0.0625	0.0000	0.1250	0.0000	0.0938	0.0938	0.3125	0.0000	0.0000	0.1250
T781	0.0938	0.0625	0.0000	0.1250	0.0000	0.0938	0.0938	0.3125	0.0000	0.0000	0.1250
T782	0.0938	0.0625	0.0000	0.1250	0.0000	0.0938	0.0938	0.3125	0.0000	0.0000	0.1250
T783	0.0938	0.0625	0.0000	0.1250	0.0000	0.0938	0.0938	0.3125	0.0000	0.0000	0.1250

	3010	3017U	3022	3023	3024	3041	3042	3043	3044	3045	3046
913	0.3750	0.0000	0.0000	0.0000	0.0000	0.1250	0.1250	0.1250	0.1250	0.1250	0.1250
1985	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1993	0.3750	0.0000	0.0000	0.0000	0.0000	0.1250	0.1250	0.1250	0.1250	0.1250	0.1250
1995	0.1875	0.0000	0.0000	0.0000	0.0000	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625
2033U	0.0000	0.5000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2062	0.0000	0.0000	0.3125	0.3125	0.3125	0.1562	0.1562	0.1562	0.1562	0.1562	0.1562
3014	0.1875	0.0000	0.0000	0.0000	0.0000	0.0625	0.0625	0.0625	0.0625	0.0625	0.0625
3021	0.0000	0.0000	0.4688	0.4688	0.4688	0.2344	0.2344	0.2344	0.2344	0.2344	0.2344
3025	0.0000	0.0000	0.4688	0.4688	0.4688	0.2344	0.2344	0.2344	0.2344	0.2344	0.2344
3026	0.0000	0.0000	0.4688	0.4688	0.4688	0.2344	0.2344	0.2344	0.2344	0.2344	0.2344
3027	0.0000	0.0000	0.3125	0.3125	0.3125	0.1562	0.1562	0.1562	0.1562	0.1562	0.1562
3028	0.0000	0.0000	0.3125	0.3125	0.3125	0.1562	0.1562	0.1562	0.1562	0.1562	0.1562
3029	0.0000	0.0000	0.3125	0.3125	0.3125	0.1562	0.1562	0.1562	0.1562	0.1562	0.1562
3030	0.0000	0.0000	0.3125	0.3125	0.3125	0.1562	0.1562	0.1562	0.1562	0.1562	0.1562
3031	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3032	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3033	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3048	0.1250	0.0000	0.2344	0.2344	0.3281	0.2891	0.2891	0.2891	0.2891	0.2891	0.2891
3064U	0.0000	0.5000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3066U	0.0000	0.5000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
T516U	0.0000	0.5000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
T664U	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
T666U	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
T780	0.0938	0.0000	0.1719	0.1719	0.1719	0.1172	0.1172	0.1172	0.1172	0.1172	0.1172
T781	0.0938	0.0000	0.1719	0.1719	0.1719	0.1172	0.1172	0.1172	0.1172	0.1172	0.1172
T782	0.0938	0.0000	0.1719	0.1719	0.1719	0.1172	0.1172	0.1172	0.1172	0.1172	0.1172
T783	0.0938	0.0000	0.1719	0.1719	0.1719	0.1172	0.1172	0.1172	0.1172	0.1172	0.1172

	3047	3049U	3050U	3065U	T665U	T667U	T668U	T669U	T670U	T760U	T761U
913	0.1250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1993	0.1250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1995	0.0625	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2033U	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2062	0.1562	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4375	0.4375
3014	0.0625	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3021	0.2344	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3125	0.3125
3025	0.2344	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3125	0.3125
3026	0.2344	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3125	0.3125
3027	0.1562	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4375	0.4375
3028	0.1562	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6250	0.6250
3029	0.1562	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4375	0.4375
3030	0.1562	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4375	0.4375
3031	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3032	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3033	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3048	0.2891	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1562	0.1562
3064U	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3066U	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
T516U	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
T664U	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
T666U	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
T780	0.1172	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1562	0.1562
T781	0.1172	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1562	0.1562
T782	0.1172	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1562	0.1562
T783	0.1172	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1562	0.1562

	T762U	T763	T784	T785	T786
913	0.0000	0.0000	0.1562	0.1562	0.1562
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.0000	0.0000	0.0000	0.0000	0.0000
1993	0.0000	0.0000	0.0938	0.0938	0.0938
1995	0.0000	0.0000	0.1406	0.1406	0.1406
2033U	0.0000	0.0000	0.0000	0.0000	0.0000
2034	0.0000	0.0000	0.0000	0.0000	0.0000
2062	0.4375	0.0000	0.1562	0.1562	0.1562
3014	0.0000	0.0000	0.2500	0.2500	0.2500
3021	0.3125	0.0000	0.1562	0.1562	0.1562
3025	0.3125	0.0000	0.1719	0.1719	0.1719
3026	0.3125	0.0000	0.1719	0.1719	0.1719
3027	0.4375	0.0000	0.1562	0.1562	0.1562
3028	0.6250	0.0000	0.1562	0.1562	0.1562
3029	0.4375	0.0000	0.1562	0.1562	0.1562
3030	0.4375	0.0000	0.1562	0.1562	0.1562
3031	0.0000	0.0000	0.0000	0.0000	0.0000
3032	0.0000	0.0000	0.0000	0.0000	0.0000
3033	0.0000	0.0000	0.0000	0.0000	0.0000
3048	0.1562	0.0000	0.1172	0.1172	0.1172
3064U	0.0000	0.0000	0.0000	0.0000	0.0000
3066U	0.0000	0.0000	0.0000	0.0000	0.0000
T516U	0.0000	0.0000	0.0000	0.0000	0.0000
T664U	0.0000	0.0000	0.0000	0.0000	0.0000
T666U	0.0000	0.0000	0.0000	0.0000	0.0000
T780	0.1562	0.0000	0.2812	0.2812	0.2812
T781	0.1562	0.0000	0.2812	0.2812	0.2812
T782	0.1562	0.0000	0.2812	0.2812	0.2812
T783	0.1562	0.0000	0.2812	0.2812	0.2812

FOUNDER ANALYSIS

Status: Living by 1 Jan 1997

Founder calculations omit UNKNOWNs.

Founders	903	911	1982	1983	1984	1985	1986	3050
Founder contributions	8.25	8.25	16.5	5.5	0.0	10.0	2.50	0.0
Founders	1987	2031	2032	2034	2035	3003	T763	3049
Founder contributions	4.0	10.75	10.75	0.0	0.0	3.25	0.0	

Founders	903	911	1982	1983	1984	1985	1986	3050
Fractional contributions	0.09	0.09	0.18	0.06	0.00	0.11	0.03	0.00
Founders	1987	2031	2032	2034	2035	3003	T763	3049
Fractional contributions	0.04	0.11	0.11	0.00	0.00	0.035	0.00	0.016

Founders	903	911	1982	1983	1984	1985	1986	3050
Nr. of living descendants	30	30	33	15	0	20	5	0
Founders	1987	2031	2032	2034	2035	3003	T763	3049
Nr. of living descendants	8	31	31	0	0	9	0	3