I. INTRODUCTION

Cheetah population estimates show that there are 7,500 to 10,000 cheetahs left in the wild; For the last 18 years, the species has decreased by 30%, and this trend persists (Lindsey et al., 2009a). This is primarily due to the increasing impact of anthropogenic factors directly affecting the animals - poaching, conflict with the local population and direct concern, and indirectly - the reduction of the range caused by the destruction of the habitat of the species due to population growth, cultivation of land and a decrease in the number species of natural extraction (Woodroffe, 2000).

Of the five currently allocated subspecies of the cheetah (Marker 2003), the rarest is the Asian (Acinonyx jubatus venaticus). The last representatives of the Asian cheetah, once inhabiting the territory of India and the former Soviet republics, live in the territory of Iran, where they remained from 70 to 110 individuals. Perhaps several individuals survived in Pakistan and Afghanistan (Charruau et al., 2011).

At the beginning of the millennium, it was suggested that the Asian genetic line was maintained by African individuals (Breitenmoser 2002), but recent comparative genetic studies of African and Asian cheetahs concluded that it is important to preserve the genetic identity of the endangered cheetahs in Iran (Charruau et al., 2011). Along with the need to take radical measures to protect the remaining livestock, in recent years the issue of the possibility of reviving Asian subspecies populations in the territories of the historical range has been widely debated, from where it disappeared for various reasons. In connection with this, it may be useful to study the experience (regardless of the degree of success) of the previous migrations of the subspecies Acinonyx jubatus jubatus in the territories of various African states.

II. DEFINITION OF TERMS (*reintroduction, translocation, reinforcement/supplementation, conservation/benign introductions*)

The International Union for Conservation of Nature and Natural Resources (IUCN) identifies four types of animal relocations: reintroduction, translocation, reinforcement/supplementation, conservation/benign introduction (introduction). According to the definition of IUCN (1998),

"Re-introduction": an attempt to establish a species(2) in an area which was once part of its historical range, but from which it has been extirpated or become extinct (3) ("Re-establishment" is a synonym, but implies that the re-introduction has been successful).
"Translocation": deliberate and mediated movement of wild individuals or populations from one part of their range to another.
"Re-inforcement/Supplementation": addition of individuals to an existing population of conspecifics.
"Conservation/Benign Introductions": an attempt to establish a species, for the purpose of conservation, outside its recorded distribution but within an appropriate habitat and eco-geographical area. This is a feasible conservation tool only when there is no remaining area left within a species' historic range.

Actually translocation and reinforcement/supplementation serve a common goal - the strengthening of the existing population, however, have one key difference - the source animals: in the first case it is always nature, in the second one - can be both nature and captivity. In describing a particular type of relocation of cheetah authors use different terms, or they combine translocation and replenishment, naming it reintroduction. In some cases authors use the term reintroduction implying relocation of captive born animals into their former range (Beck et al. 1994), and by translocation they use relocation of wild caught animals from one place to another (Kleiman 1989; Griffith et al. 2000). Applying the definitions proposed by IUCN in the context of relocations of cheetahs, described in the literature, we obtain the following specified terms: **reintroduction** - is the relocation of cheetah (regardless of origin) to the territory from which it has been extirpated or become extinct ; **translocation** - the relocation of cheetahs born and reared in the wild, into the existing population; **reinforcement/supplementation** – relocation of captive-bred (regardless of place of birth) cheetah into the existing population (hereinafter **supplementation)**.
Through relocations, the organization may pursue one or more of the following objectives: 1) the preservation of endangered species and attracting tourism; 2) restoration of key ecologically or culturally species in the ecosystem; 3) increase the chance of long-term survival of the species; 4) maintenance / restoration of the natural biodiversity or restoration of ecological integrity by conservation of the local fauna; 5) reduction in the number of hoofed animals as an alternative to shooting them; 6) ensuring long-term economic benefits for the local / national economy; 7) promote wildlife conservation awareness (IUCN 1998; Hayward et al. 2007a).

III.Historical prerequisite of cheetah relocations

From the second half of the twentieth century in various parts of the African continent, there were numerous cheetah relocations, namely, **reintroduction, translocation** and

supplementation. This was largely facilitated by legislative changes in several southern African countries by 1960-70, which secured the rights of landowners to gain financial profit from hunting and sale live specimens of wild animals living on their lands. In Zimbabwe, such changes have taken place in 1960 and 1975, in Namibia - in 1967 and in South Africa - in different years depending on the province.

Massive shifting of traditional cattle farming to breeding of wild ungulates was taking place accross the southern part of the continent, and by 1999, for example, in Zimbabwe, for these purposes was used 27,000 km² of private lands, in Namibia, - 25% of private land. In South Africa 159 000 km² were used for breeding of wild ungulates, i.e. about 5,000 farms and 4,000 more farms combined breeding livestock and wild ungulates. A similar trend is also being developed in Botswana and Zambia (Lindsey et al. 2009c).

It should be noted that Zimbabwe is perhaps the only southern African country where landowners are positive towards predators because of the profits that accrue from eco-tourism and sport hunting for lions, leopards and cheetahs (Lindsey et al. 2005).

In the other African countries an attitude of farmers towards large predators mainly negative, because they see predators as a threat to their property - livestock or wild ungulates. Many of them believe that if they cannot receive financial gain from the capture of a cheetah, setting a trap and its maintenance is not worth the effort, so they prefer to shoot predators, considering it as the fastest and cheapest way to fix the problem and obtaining some degree of moral compensation (Marnewick et al. 2009).

The alternative method is a relocation of "problem" animal from the area with intolerance to the predator to the areas with a tolerant attitude to the predator. At various times, such actions were carried out, for example, in Kenya (Hamilton 1981). However, wild fauna in Kenya is public property, and landowners are prohibited to gain any revenue from the wildlife (Lindsey et al. 2007). As a result of such a country policy, the numbers of wild animals including predators, has been declining, especially in the unprotected areas (Georgiadis et al. 2007).

In the countries where the owners have the opportunity to make a profit from sailing of live predators, like in South Africa (Marnewick et al. 2009), Namibia (Marker 2003) and Botswana, their relocations occur regularly (Klein 2007).

However, the exact number of relocated cheetahs and their place of residence is difficult to track, because in some cases, farmers have decided on their own and continue to decide the fate of the captured animals. Some cheetahs were released on the farms where they have been caught or where the owners were tolerant to the presence of predators, some were transferred to the national parks and reserves within the country and abroad, and some were sold for captivity to local and foreign zoos and safari parks (Marker 2005).

Changing the law in South Africa has allowed to replace the cattle with wild ungulates, which farmers have purchased in large quantities mainly for the purpose of breeding for hunting and live sales. Many farms were fenced and out of all predators, only cheetahs, brown hyenas and leopards have been left in the farms. On the one hand, it opened up

new prospects for the conservation of the most vulnerable and the least competitive species such as African wild dogs and cheetahs that have survived in small numbers in protected areas. Additionally, the owners have got the opportunity to increase the tourist attractiveness of their properties by providing guests with the opportunity to see the most spectacular large predators (Lindsey et al. 2007).

For this purpose, landowners were purchasing cheetahs to be released at their property or to be kept in enclosures. At the same time the owners of some farms, dissatisfied with the major "problem" predators leaving on their land (because of the threat to their livestock or wild ungulates), were able to get rid of them, not only by shooting, but by selling of live animals (Marnewick et al. 2009).

In South Africa, it is De Wildt Cheetah Breeding Centre (hereinafter referred to De Wildt), which is engaged in "problem" predators from the 1970s. It developed a program of conflict mitigation (De Wildt Wild Cheetah program), which involved the owners of the lands, inhabited by cheetahs living outside of protected areas. In the 2000s, also for farmer-cheetah conflict resolution National Cheetah Conservation Forum of South Africa (CCFSA) was created. Employees of CCFSA together with farmers and officials from environmental agencies held mass trapping and relocation of "problem" cheetahs from private properties to the national parks and reserves to attract more tourists. The program also included financial compensation to owners for each captured individual (Marnewick et al. 2009). From 2000 to 2006 within the program "compensation-relocation" there were 137 (84.53) of problem cheetahs caught (Lindsey et al. 2009b), out of which 20 were not releasable due to the young age and injuries - a broken jaw or amputated limbs, and remained in captivity. These animals were transferred to different facilities such as De Wildt and Cango Wildlife Ranch and Hoedspruit Centre for Endangered Species (Marnewick et al. 2009). Injured cheetah received help and 107 were released in the protected areas, and 64 individuals have not only survived, but have adapted well and produced 51 cubs, even though having fastened bones, blindness in one eye or healed lacerations which they had gotten during capturing by snares or dogs (Lindsey et al. 2009b).

For relocating cheetahs, De Wildt Shingwedzi (South Africa) center was specially designed, where animal keepers have experience of carrying for wild cheetahs.

Before 2009, in South African Republic cheetahs have been relocated to the territory of more than 70 parks, including private game reserves (Lindsey et al. 2009b), but these data are not documented.

The South African legislation allowes commercial breeding of predators, including cheetahs and hunting on big and small cats. Some farms specialize in breeding of carnivores for sport hunting or so-called "canned" hunting that brings a weighty income. Many of these farms are also involved in breeding cheetahs, often using illegally caught

cheetahs from natural populations, living in the provinces of North West, Northern Cape and Limpopo, where landlords illegally catch them for sale (Marnewick et al. 2007).
Cheetahs caught in the wild, are not always good breeders, and those who fail, would be equipped with microchips and export as captive-bred individuals. Since until now, South Africa did not legally incorporated a DNA certificate as an indication of the origin of species, microchipping is the only confirmation of the origin of the animals from captivity and, according to the CITES, is the basis of the legal export from the country. Breeding centers are not required to be members of ISIS or any other recognized accounting system, for example, the International Cheetah Studbook. In 2007, in 44 South African breeding centers there were 524 cheetahs. Some of the animals were legally or illegally transferred to these centers from the wild in order to maintain genetic diversity, and captive breeding is often used as a cover of the black market trade in animals (Marnewick et al. 2007). Therefore, to date, it is impossible to determine the exact number of cheetahs in captivity.
From 1996 to 2005, by CITES permit 428 cheetahs has been sold in South Africa, out of which 399 (93%) were registered as captive born. Most of them were sent to zoos and other captive facilities. Over the last decade, cheetah sales have increased and about 50 animals leave the country every year. In addition, adults and young cheetah have been also caught on farms in Namibia and Botswana, where from traders illegally relocate them to South Africa for sale to zoos and safari parks.
Also cheetahs captured in South Africa, trafficked to Namibia for "canned" hunting - every year around 60 individuals are sold (Marnewick et al. 2007).

In Namibia, the largest number of cheetahs inhabits the northern and central regions of the country, traditionally considered important pastoral areas, therefore in these areas conflict between farmers and cheetahs particularly acute (Marker et al. 2003a). As in the past, the farmers mitigate the conflict by the destruction of predators - to the 1950s on these farms most of the large predators including lions and spotted hyenas were wiped out. On the one hand it ensured the protection of cheetahs from dangerous competitors, but at the same time made a human the chief enemy of a cheetah. Cheetahs are persecuted more by the owners of wildlife breeding farms than by the owners of livestock farms. (Marker et al. 2003b).
Indirectly cheetahs survival also depends on cyclical climatic changes: during the dry periods the numbers of wild ungulates decrease, and the confrontation between predators and farmers is exacerbated because during such economically difficult times farmers are especially intolerant of livestock losses. The shift to gamefarming has not changed the attitude of the farmers to predators, because they were not ready to bear the loss of valuable species of wild ungulates. As a result, from 1980 to 1991, 6818 cheetahs were killed or sold to captivity (Marker 2007).
Attempts to capture and kill of problem animals often lead to the appearance of "not-releasable" individuals, including cheetahs, whose age, dental health and overall physical

condition indicate their inability to independently take care of themselves. For example, cubs and young cheetahs under 16 months age whose mothers have died or been killed by farmers, as well as traumatized individuals of any age. Since the beginning of the 1990s, there are two organizations which are engaged in carrying for "problematic" and "not-releasable" predators in Namibia: Cheetah Conservation Fund (CCF) and AfriCat Foundation (AfriCat). Both organizations track the relocations of cheetahs within the country for the last 25 years: from 1991 to 2006 in the ten regions of the country 968 cheetahs were caught, most of which (n=513) were considered a threat to livestock and to wild ungulates (n=428), and 27 cheetahs were captured for tagging and released (Marker 2007). During the period from 1991 to 2005, out of the 600 examined living cheetahs (500 individuals from nature and 100 from captivity), 50% were released in Namibia, 8% - were sent to South Africa and Zambia and released into the wild and 42% - were sent to South Africa and the United States for captivity (Marker 2005).

However, it is impossible to follow all the relocations as well as the exact number of animals kept in captivity. By the end of 2005, according to the International Cheetah Studbook, there were 182 (90.92) cheetah were registered in 21 private organizations in Namibia, but a number of cheetahs in private companies, who did not want publicity, also remains unknown. According to the circular of the Ministry of Environment and Tourism (MET), it is allowed to keep cheetahs in captivity in the country, but reproduction is prohibited. In order to reduce the number of large predators in captivity, in 2005 requirements for keeping cheetahs in captivity were revised, however, to date some cheetahs are kept illegally and in unacceptable conditions: without proper nutrition, movement and light. In 2007, 6 wild adolescent cheetahs were confiscated from a tourist camp after 5 months of keeping them as entertainment for tourists. Later, from the same farm 9 cheetahs were confiscated and 8 of them released into the wild and 1 sub-adult cub brought to the Cheetah Conservation Fund (CCF) (Marker et al. 2007). The CCF by December 31, 2010 there were 63 (27.36) cheetah of different ages, some of which were scheduled for relocation to the private reserves (Marker 2010).

In Botswana, the program of compensation to farmers and cheetahs relocations began in 2004. However, to date the mechanism of control of such relocations and subsequent monitoring of the fate of animals are not set up. As a result, cheetah cubs who lost their mothers, are often hand raised and kept in the cages, where they are used to attract tourists. For example, in Botswana in 2007, 5 problem cheetahs were caught and kept at two farms in the Ghanzi region, and 2 hand raised cheetahs were kept at Mokolodi Nature Reserve. The real number of cheetahs in captivity in Botswana is not known (Klein 2007).

The increasing scientific and public interest in the re-introduction led to the creation in 1988 of the Reeintroduction Specialists Group (RSG; http://www.iucnsscrsg.org/) within the Commission for the Conservation of the International Union for Conservation of Nature and Natural Resources (IUCN / SSC) (hereinafter referred to specialists RSG / IUCN / SSC) (Armstrong, Seddon 2007).

According to the RSG / IUCN / SSC list, in 1998, 5 organizations were engaged in cheetah relocations, 2 of them carried out translocation (CCF and AfriSat) and 3 - reintroduction (Pilanesburg National Park, Division of Nature Conservation Transvaal Provincial Administration and the Mammal Research Institute University of Pretoria) (Soorae, Seddon 1998). Since 2004, CCF has also started the reintroduction projects (Marker 2010).

This review discusses the projects, reflected in reports, articles and other publications, with reference to the time period of the relocation of animals, their numbers and place of release and initiated by the owners of different facilities following one or more of the above objectives.

IV.Criteria of success of relocation projects

Reintroduction of predators considers much more complicated than herbivores (Van Houtan et al. 2009) and omnivores (Wolf et al. 1998). According to Breitenmoser et al. (2001) until 2001, only 9 out of 30 relocations of large predators in Africa were successful. Reintroduction in five South African parks has shown that the cheetah and leopard were the least successful species comparably to the lion, spotted hyena and bat-eared fox (Hayward et al. 2007b). Since 2001, in 7 parks of the Eastern Cape Province in South Africa, 36 adult cheetahs were released. By 2005, 41 individual have been recorded, 23 cubs were born and 14 animals died, which was the highest mortality rate compared to other predator species, which had been reintroduced over the same period.

The degree of success of the released cheetahs was different in various parks. For example, in the presence of lions in Lalibela GR, both released cheetah died within the first year, while in Kwandwe GR cheetah population doubled after reintroduction and in Shamwari GR cheetah population increased by 5 individuals. However, alongside with the reproduction, mortality of individuals of all ages was very high due to the predation by lions (Hayward et al. 2007b). Thus, if consider only the survival rate of individuals against the overall low degree of success of the reintroduction in the region, success in a particular park can be assessed as high.

There are several criteria for assessing the success of relocations (Griffith et al.1989; Breitenmoser et al. 2001; Hayward et al. 2007b; ICN 2010; IUCN Standards 2010):
1. Reproduction of the first generation born in the wild.
2. Reproduction of the wild population for 3 years, wherein the recruitment exceeds the mortality rate of mature individuals. Mature re-introduced individuals are the ones who have produced viable offspring. (IUCN 2001).
3. Population of no less than 500 individuals, which does not require supplementation.

4. Creation a self-sustaining wild population.

The project, which combines all of these criteria can be considered successful.

However, there is a number of limits for application of all mentioned above criteria for evaluating the success of the projects on relocation of large carnivores, including cheetahs. First, a long monitoring of animals is required, necessity of which has been highlighted by RSG / IUCN / SSC (Armstrong, Seddon 2007). By 2011, the longest monitoring of the relocated cheetahs covered the 6-year period (Hunter 1999).

Since most of the projects ended up in a few months after the reintroduction of animals (due to time and financial constraints), their success is difficult to assess, even by the first criterion. Carrying capacity (maximum long-term self-sustained population density in the particular area) and number of initial population founders also have to be taken into consideration. Therefore, some criteria (e.g. 3 and 4) do not apply to small isolated populations of large carnivores, like cheetah populations of 5-10 individuals in fenced parks, especially in the presence of other large predators (Pettifer 1981a). Therefore, most projects are evaluated only on the second criterion, especially in small parks (Hayward 2007b), or on the first two criteria (Griffith et al. 1989).

Some authors suggest evaluation the *long-term success* of the project as establishing the long-term self-sustainable population, and *short-term success*, when cheetahs demonstrate the ability to successfully hunt, socialize with conspecifics and reproduce (Johnson et al. 2010), and the recruitment exceeds the mortality in the breeding population during 3 years after release (Hayward et al. 2007b).
In fact, every project on relocation can have its own qualitative assessment of success depending on the goals of the facility. For example, continuous monitoring, reproductive success of individuals, etc. In addition, depending on the goals, the degree of success can vary, that is, the project could be a highly successful, successful, partially successful and unsuccessful (Soorae 2010).

With the release of a small number of animals, it would be appropriate to assess the success of individual animals: for females – reproduction of the first generation; for males – successful breeding of a male or his coalition, or the male's ability to establish and maintain the territory for one and a half years (Johnson et al. 2010). However, it is extremely difficult to witness the process of mating of cheetahs in the wild, which makes determination the degree of success of males (both individually and as a coalition) not always possible.

Exceptions were the cases when a certain number of adults of known sex have been released in the park where there were no other cheetahs. At the individual level, the success of the males could be assessed by the fact of maintaining by the males the territory for 1.5 years.

V. Factors ensuring successful relocation

The success of the project depends on the combination of such factors as *economic* (the desirability and feasibility of the project), *environmental* (territory characteristics), *biological* (characteristics of animals) and *organizational* (preparation and carrying out of the project, security) and their components.

1. The economic

The high cost of the project can cause its termination (Kleiman 1989). However, in countries where wild animals have an economic value, this value becomes the main driving force behind such projects. For example, in South Africa, both governmental agencies and private companies employ experts in catching and transporting animals, which provides security and a significant reduction in price of such events. In addition, the interest of tourists in exotic species, particularly large predators (Hofmeyr, Van Dyk 1998), facilitates the flow of financing for environmental needs (Hayward 2005).

2. *Environmental*

2**.1 Appropriate habitat** (Grif fi th et al. 1989; Wolf et al. 1996; 1998; Rout et al. 2007), which is able to meet the needs that are important for survival, at the individual and population level. This is not limited to the local vegetation, but includes various aspects of the environment such as:

2.1.1 *Adequate carrying capacity* (Brambell 1977) required to maintain a growing population of reintroduced species; calculated on the basis of ecological and ethological studies (Hayward, 2007c).

2.1.2 *Constant and inexhaustible prey base* (Grif fi th et al. 1989; Wolf et al. 1996; 1998), available for predators all year round and capable to sustain additional relocations during the first few years, thus reducing the potential risk of encountering predators with men (Hunter 1998a).

2.1.3 *The absence of predators or competitors, including conspecifics*. The presence on the territory of cheetah relocation other predators negatively affects the success of the project (Pettifer 1981a; Griffith et al., 1989; Wolf et al. 1998) and on the survival of the

cheetah (Marnewick et al. 2009). In some cases, the presence of the resident population can negatively affect the survival of relocated individuals (Griffith et al. 1989), or vice versa – resident individuals may be affected by the new arrivals. Therefore, it is better if there are no other predators at the place of planned relocation or their numbers are minimal, especially in the case of very rare species (Kleiman 1989).

2.2 *Belonging of the release site to the species historical range* greatly increases the chances of the animals to establish self-sustaining populations (Grif fi th et al. 1989; Wolf et al. 1996; 1998). It is important to assess the extent of environmental change which occurred in the expected region and the place of relocation, as well as the possibility of these changes in the foreseeable future after relocation of the species (IUCN 1998).

3. Biological

3.1 *The source of animals* (wilderness / captivity) (Griffith et al. 1989; Wolf et al. 1996; Fischer, Lindenmayer 2000). Animals caught in the wild are more successful in terms of reintroduction than those born in captivity are. For example, out of 145 projects that used captive born animals, only 16 were successful (Beck et al. 1994). Moreover, this trend can be seen in many animal species and families (Jule et al. 2008). This is due to a number of differences between animals reared by parents in their natural habitat, and individuals born and raised in captivity. Among them are: food dependence on men and the lack of fear of humans, the absence of experience of avoidance of predators and competitors (Jule et al. 2008), lack of experience of protection of the territory. Meetings with conspecifics, especially singletons with groups, which have already established their territories, at best end up in a fight and exiling relocated individuals to the least suitable sites, and at worst – cause injury and death (Kleiman 1989). The lack of such socially acquired skills like hunting, leads either to death of hunger (Jule et al. 2008), or to attempts to hunt inappropriate size game (Pettifer et al., 1982; Ferguson, 1993), refocusing on the more accessible food sources like livestock (Soorae, Stanley Price 1997), making these animals problematic. Analysis of the 45 projects for the reintroduction of 17 species of predators revealed that men caused the death of animals in more than 50% of the cases (Jule et al.2008).

It was noted that a large number of carnivore species in captivity display stereotyped behavior (Clubb & Mason 2003), which may negatively affect their reproduction (Vickery, Mason 2003). Besides, relocated individuals which were born in captivity were more susceptible to diseases (Jule et al. 2008). Adding individuals from captivity into a residential wild population of rare (and especially endangered) species can be justified only if the future of the initial wild population is entirely dependent on the released specimens (Kleiman 1989), which become the source of new genetic material.

3.2 *The genetic characteristics of the animals*. The reintroduction group specialists (RSG / IUCN / SSC) underline the importance of maximizing the genetic proximity relocated individuals to the species inhabit / inhabited the region, while stressing that the introduction of species beyond its historic range may take place only if within its range for it no more suitable habitat (IUCN 1998). This genetic closeness might facilitate the process of adaptation to a new environmental (Brambell 1977). Those individuals, which belong to particularly valuable genealogical branches, may become genetic sources for the captive population in the future (Kleiman 1989).

3.3 *The individual characteristics of animals (temperament).* If planned to use captive born animals for reintroduction, it is important to take into account the particular temper of each individual, because of the difference in the demonstration of anti-predator (protective and defensive), foraging and exploratory behavior and training success (McDougall et al. 2006).
3.4 *Individual experience of the animals to be relocated*. Experience of interactions with other predators and conspecifics before the release, the ability to hunt for the appropriate prey increase the chances of survival of released cheetahs (Hayward et al. 2007a).

3.5 Optimal number and composition of the group of founders. An important part of preparation for the reintroduction of large social carnivores is the formation of l groups from social compatible individuals during their detention in captivity prior to release (Somers, Gusset 2009; Kleiman 1989). Large social carnivores display plasticity in relations with unrelated and unfamiliar conspecifics, with which they are kept in captivity for some time (Gusset et al., 2006), demonstrating the strong links in the group after the release (Hayward et al. 2007a). Full social compatibility of group members before the release increases survival rates of each of its members after the release (Gusset et al. 2006). The lack of compatibility leads to failure in breeding and intensive post-release movements of individuals (Somers, Gusset 2009). Forming coalitions of male cheetahs before release increases their chances of successful existence in a place reintroduction (Hunter 1998b). Number of animals to be released depends on the particular species and carrying capacity and has to be scientifically tested prior to relocation.

3.6 Relationship with men and livestock. Attacks on livestock and lack of fear of men are the reasons for the failure of relocation projects, while avoiding humans and preference of wild ungulates contribute to the successful adaptation of the predators after the release (IUCN 1998).

4. *Organizational*
4.1 *Understand the needs of the relocated animals* on the basis of a detailed study of the species, including demographics, behavior and ecology in the wild as well as of the

behavior in captivity (Kleiman 1989) to ensure their well-being at all stages of preparation for release and after it. Construction of the model of the reintroduced population, which envisages a variety of conditions, helps to determine the optimal number and composition of individuals, which can be released each year, and the number of years needed to establish a viable population (IUCN 1998). Deepening knowledge about the species, as well as analysis of the experience of previous relocation projects (Jule et al. 2008; Beck et al. 1994; Hayward et al. 2007b, and others.) contribute to the revision of the methodology of projects, thus increasing their chances of success.

4.2 Identification and elimination, or reduction of influence of the factors that caused the extinction of species in a given area (Fischer, Lindenmayer 2000), and among them: shooting both the predators and their main prey species, reducing habitat due to intensive agriculture and many others. It is also important to take into account mistakes of previous projects (IUCN 1998).

4.3 The effectively protected conservation area, providing security to the animals and the local population (IUCN 1998; Kleiman 1989). Fencing of the South African parks greatly contributed to the success of reintroduction of carnivores (Gusset et al. 2008), as it minimized the negative interaction between humans and wild animals and at the same time ensured the safety of the animals, considered valued by the park owners.

In fact, to date, the majority of the conservation areas in the world are represented by the "islands" of wilderness in the collapsing surrounding environment (Saunders et al. 1991). If there is no possibility of elimination (or reduction) of the degree of potential risk to the life of relocated animals from the humans, or any threats to human health and property from the relocated animals, the relocation shall not take place and the area of relocation shall be revised. (IUCN 1998).

4.4 *The order of the release of different predator species*. Release competitively subordinate and vulnerable species of predators prior to the dominant species provides the first opportunity to find safe places before appearance of potential competitors (Hayward et al. 2006; 2007a). The reason for the failure of some projects (for example, in the Eastern Cape Province in South Africa) was ат infringement of the order of the reintroduction of predators (Hayward 2007b).

4.5 *Type of release ("soft" - with pre-release keeping or "hard" - without it).* Predators including cheetahs, after the "hard" release, i.e. immediately after the transportation start intensive movements over very long distances and often go beyond the protected territories (Linnell et al. 1997). Heading toward the area of capture, sometimes they cover hundreds of kilometers (Hayward 2007a). Keeping animals for several weeks before

release in the boma (round enclosure with electro fencing and shelters), reduces the probability of such movements and the homing effect (Linnell et al. 1997), reduces post-transportation stress (Texeira et al. 2007), provides an introduction to a new terrain, alleviates adaptation to new environmental conditions, and after the release facilitates the familiarization with the area. Furthermore, pre-releasing period contributes to the establishment of strong social bonds (Kleiman, 1989), even between unrelated and unfamiliar individuals (Hunter 1998a). Therefore, a soft release is the best, especially with the correct location and construction of the boma, where the resident predators will not be able to harm the animals awaiting release. For example, a male cheetah was killed in the boma be a leopard female in the Shamwari reserve (Hayward 2007a).

4.*6 The veterinary control*. Relocated born in captivity individuals are particularly susceptible to diseases (Jule et al 2008). The disease can not only lead the reintroduction project to the untimely termination (Scheepers et al. 1995), but also to reduce the resident population if reintroduced animals originate from captivity and are carriers of infectious agents, to which they are immuno-resistant in contrast to the wild population (Brambell 1977).

If relocated individuals were wild-caught, it is important that they were not carriers of infections or contagious pathogens and non-aboriginal parasites, and at the same time were not exposed to pathogenic agents which were absent at the site of capture, but present in a place of relocation, and from which animals have no immune protection (IUCN 1998).

4.7 Continuous monitoring on the basis of identification of all individuals. Correct identification of individuals provide accurate information about the size, composition and dynamics of the population, about the occupied territories and animal movements. The unique lines of the tear marks, spot patterns on the head and body (Burney 1980; Kelly 2001), spots on the front and hind limbs as well as the number and arrangement of the rings on the last third part of the tail of the cheetah (Chelysheva 2004), are used for the identification of cheetahs.

For direct observation of animals in addition to the individual colour characteristics, also ear tags, colored collars and radio collars are used (Pettifer 1981b; Kleiman 1989). Although direct observation of all (or several) individuals preferable, indirect monitoring via questionnaires can be used (IUCN 1998). In many South African projects of cheetah relocations, the lack of observations of animals complicates the analysis of the causes of failures of the projects (Rowe-Rowe 1992).

4.8 *Duration of the project*. Project on relocation of animals involves long-term involvement of a variety of resources, including intellectual and financial (IUCN 1998; Kleiman 1989; Griffith et al. 1989). The longer the period it covers, the more data is available for analysis and the more likely to assess its success (Hunter 1998a).

4.9 *The involvement of local communities and environmental education*. The study and evaluation of the attitude of the local population towards the project are especially important in areas where anthropogenic factors led to the animal extinction. It is therefore particularly important that the program has been fully understood, accepted and supported by the local community (IUCN 1998). Cooperation with government officials, obtaining all necessary permits (by both supplying and receiving sides) are particularly important in the bordering regions, i.e., in cases where the project involves more than one state or when released animals can settle in the territory of the neighboring country (IUCN 1998).

Involvement of the local population in the project, training and consulting, as well as the creation of visual aids for environmental education reduces the risk of misunderstanding and conflicts (Hunter 1998a; Hayward 2007a), helps to receive financial assistance and comprehensive support to the program (Kleiman 1989) and contributes to long-term protection of relocated species and their habitat (IUCN 1998). For example, providing cheetahs with open spaces in some cases implies the necessity of clearing the area of bushes, thus providing jobs to the local population neighboring the park (Johnson et al. 2010).

Examples of the creation of educational programs and materials in South Africa are De Wild Cheetah and Wildlife Trust and the Cheetah Outreach (SAR) (Marnewick et al. 2007), in Namibia – Cheetah Conservation Fund, and in Botswana – Cheetah Conservation Botswana. In other words, the policy of reintroduction is just as important as the technique of reintroduction (Kleiman, 1989).

VI. The history of Cheetah relocations and assess the success of related projects

6.1 Goals of relocations.

In 97% of parks (n = 63) the goals for cheetahs relocations were species conservation or restoring its population, as well as attracting tourism. In addition to the above goals, 3% parks (n = 2) also used the relocation of predators to control the number of ungulates: in 1975-76gg. Suikerbosrand Nature Reserve, South Africa (Pettifer et al. 1982) and in 2008 – Sir Bani Yas Island, United Arabian Emirates. The uniqueness of the latest project is that it was the first cheetah introduction project in order to preserve endangered species and restore the ecological integrity of the island through the use of predators, including

the cheetah, to regulate the number of gazelles in the park and at the same time attract tourism (Kader 2011).

6.2 Number of projects. According to official data, from 1965 to 2010 in 65 national parks and private reserves (hereinafter referred to as park) in seven countries - South Africa, Namibia, Botswana, Zimbabwe, Zambia, Mozambique, the United Arab Emirates 731 cheetah was released (Table 1). Most of the relocations carried out in South Africa (49 of 65 parks), where within 42 years 84% (n=617) of all relocated cheetahs were released.

6.3 Types of relocations. Majority of parks 81.5% (n = 53) practiced 1 particular type of relocation; 64.6% - reintroduction, 9.2% - translocation, 6.1% - supplementation, and 1.5% - introduction), while 12 parks performed two or three types of relocations successively. For example, in the Hluhluwe-Umfolozi Reserve (SAR) the reintroduction of 28 cheetahs have been followed by a series of translocations of another 66 individuals. (Table 1) Most of the parks – 81.5% (n = 53) implemented reintroduction, in which 56.5% (n = 413) cheetahs participated; 9.2% (n=12) implemented translocation, and 24.2% (n = 177) cheetahs were released; 6.1% (n=15) parks implemented supplementation by releasing 18.9% (n = 138) cheetahs, and 1 park implemented introduction where 0,4% (n = 3) cheetahs were released (Table 2) Also See Table 3 for the details.

Table 1.

# PARKS Types of relocations	# CHEETAHS Types of relocations
42 (R)	315 (R)
6 (T)	77 (T)
4 (S)	21 (S)
1 (R+T)	94 (R+T)
6 (R+S)	62(R+S)
1 (T+S)	6 (T+S)
4(R+T+S)	136(R+T+S)
1 (I)	3 (I)
Total: 65	**Total: 731**

Table 2.

# PARKS Source of animals	# CHEETAHS Source of animals
18(*W*) 2(*C*) 38(*W*+*C*) 7(*W*,*W*+*C*)	371 (*W*) 8 (*C*) 352 (*W*+*C*)
Total: 65	**Total: 731**

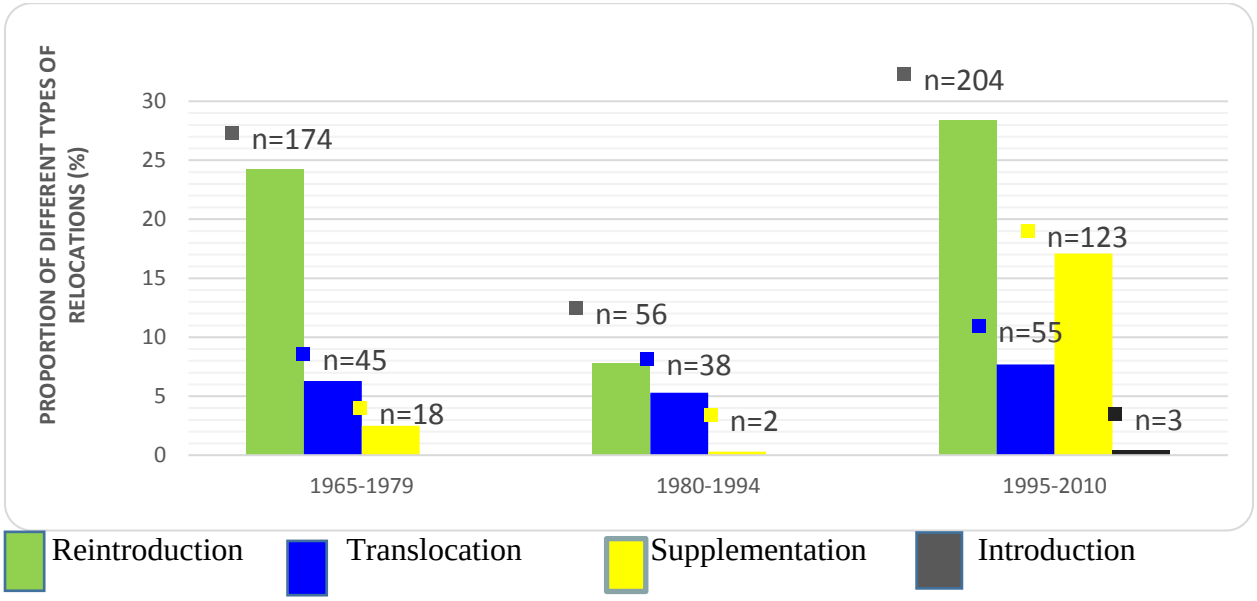
Table 3. Types of relocations and the source of cheetahs, relocated over a 46-year period in 7 countries

Country / Parks & Cheetahs	South Africa	Namibia	Zimbabv	Botswa	Mozambiq	Zambi	UAE	Total
# Parks	**49** (75,4%)	**5** (7,7%)	**4** (6,1)%	**4** (6,1%)	**1** (1,5%)	**1** (1,5%)	**1** (1,5%)	65
# Cheetahs	**617** (84%)	**54** (7,4%)	**33** (4,5%)	**15** (2%)	**6** (0,8%)	**3** (0,4%)	**3** (0,4%)	731
Parks: Type of relocation *	**34** (R) **2** (T) **2** (S) **1**(R+T) **5**(R+S) **1**(T+S) **4**(R+T+S) -	**3** (R) **1** (T) - - **1** (R+S) - - -	- **2** (T) **2** (S) - - - - -	**4** (R) - - - - - - -	**1** (P) - - - - - - -	- **1**(T) - - - - - -	- - - - - - - **1**(I)	42 (R) 6 (T) 4 (S) 1 (R+T) 6 (R+S) 1 (T+S) 4(R+T+S) 1 (I)
Cheetahs: Type of relocation *	**287** (R) **21** (T) **11** (S) **28**(R)+**66**(T) **18**(R)+**44**(S) **4**(T)+**2**(S) **45**(R)+**30**(T)+ **61**(S) -	**7** (R) **30**(T) - - **7**R+**10**S - - -	- **23** (T) **10** (S) - - - - -	**15** (R - - - - - - -	**6** (R) - - - - - - -	- **3**(T) - - - - - -	- - - - - - - **3**(I)	315 (R) 77 (T) 21 (S) 94 (R+T) 62(R+S) 6 (T+S) 136(R+T+S) 3 (I)
Parks: Source of animals **	**9** (*W*)	**2** (*W*)	**2** (*W*)	**3** (*W*)	**1** (*W*)	**1**(*W*)	-	18(*W*)
	1 (*C*)	-	-	-	-	-	**1**(*H*)	2(*C*)
	32(*W*+*C*)	**3**(*W*+*C*)	**2**(*W*+*C*)	**1**(*W*+*C*)	-	-	-	38(*W*+*C*)
	7(*W*,*W*+*C*)	-	-	-	-	-	-	7(*W*,*W*+*C*)
Cheetahs: Source of animals **	**295** (*W*) (47,8%)	**32**(*W*) (59,3%)	**23**(*W*) (69,7%)	**12**(*W*) (80%)	**6**(*W*) (100%)	**3** (*W*) (100%)	-	371 (*W*)
	5 (*H*) (0,8%)	-	-	-	-	-	**3**(*H*) (100%)	8 (*C*)
	317 (51,4%)	**22** (40,7%)	**10** (30,3%)	**3** (20%)	-	-	-	352 (*W*+*C*)

(Legend: Types of relocation*: R-reintroduction, T-translocation, S-supplementation, and I-introduction; Source of animals**: W- Wild (born and raised in the wild), C-captivity (born and raised in captivity), W + C - captivity (born in the wild, but raised by humans, or kept in captivity for more than six months after capture, or were kept in captivity for more than a year after the capture, including the pre-release period).

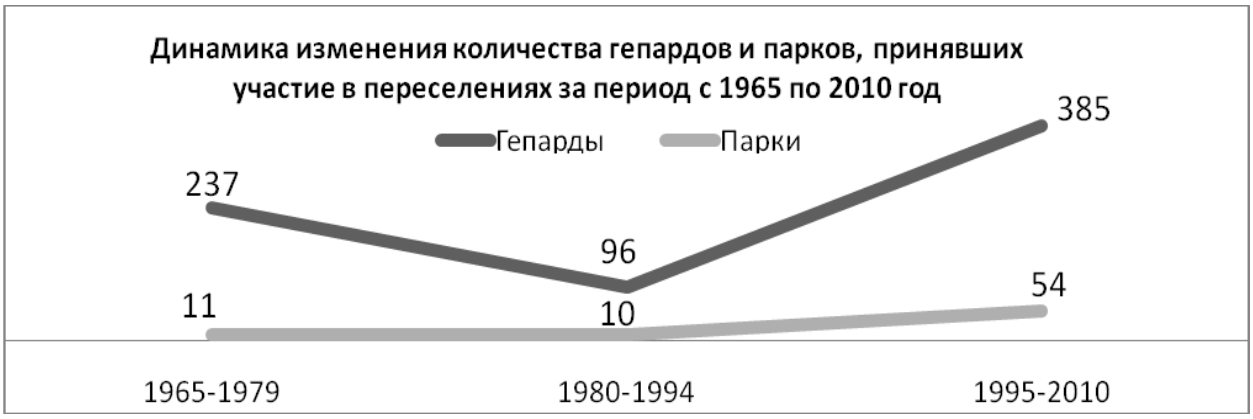
6.4 The number of cheetahs, relocated in different years. Within 46-year history of cheetahs relocations, there is a following trend observed – a large numbers were released in the first and last 15 years (Figure 1).

Figure.1 Cheetah relocations in different years



More often cheetahs were involved in the reintroduction; the number of cheetahs involved in translocation programs were approximately equal within every period; and supplementation have intensified since the mid-90s. The main contribution was made by South African "compensation relocation" program, which began in 2000 (Figure 2).

Fig.2 Dynamics of changing on numbers of cheetahs and parks implemented cheetah relocations from 1965 to 2010 cheetahs parks



The calculations take into account 718 of 731 cheetahs, because for 13 individuals released in the Hluhluwe Umfolozi Park (South Africa) in the period between 1969 and 1994, accurate information on the numbers of released animals for each year are not available, making it impossible for their reckoning to one of the 15-year intervals (Figure 2). However, this does not affect the overall trend: against the background of a relatively small and almost an equal number of parks in the first 30 years (n = 10, n=11), the number of released animals varies significantly. During the first 15 years, 2.5 times more cheetahs were released than in the next 15 years, but is 1.6 times less than in the period of 1995-2010. With that, over the past 15 years, the number of parks has increased by 5 times.

A large total number of relocated cheetahs in the first 15 years was due to the shift of specialization of farms from livestock to wildlife keeping, and also establishing new private reserves, which owners started to fill up their properties with a large numbers of various wild animals. (Figure 2).

In South Africa, 64 cheetahs were released into the Hluhluwe Umfolozi Reserve in 1966-69, and 33 cheetahs were relocated to the Mkuzi Game Reserve in 1966 (Rowe-Rowe 1992). In the first 15 years, reintroduction and translocation were carried out mainly by parks of South Africa (n = 10), where in total 207 cheetahs were released. Other countries have begun to practice such projects much later, except for releases of 30 cheetahs in 1970 in Etosha National Park in Namibia (Du Preez 1970) and 6 cheetahs in 1973 in a park in Mozambique (Purhcase 2007). During that period the number of released individuals per park ranged from 6 to 51 (mean 21.5). Since the beginning of the 90s, except for South Africa (8 parks), the relocation also took place in 1 park in Zimbabwe (1993-94) – 17 cheetahs (Purchase 1998), in 1 park in Zambia (1994) – 3 cheetahs (Phiri 1996). In 1980-1994, each relocation involved from 2 to 18 cheetahs (average 9.6) cheetahs. During that period, the proportion of reintroduction was also more than other types of relocations (Figure 2).
In 1995-2010, 85% (n = 327) cheetahs were released in 41 park of South Africa, and 15% (n = 58) cheetahs were released in 12 parks of four countries conducted: in Namibia 24 cheetahs in 4 parks; in Zimbabwe16 cheetahs in 3 parks; in Botswana 15 cheetahs in 4 parks, and in the United Arab Emirates: 3 cheetahs in 1 park.

Significant contribution to the increasing numbers of parks was made by the "compensation-relocation" program of South Africa, where within several years 281 cheetah was released in 32 private and 5 state parks. (Marnewick et al. 2007). For example, in Mkuze Game Reserve 33 cheetahs were reintroduced in 1965, and in 2000-2006, 5 cheetahs were reintroduced, four were translocated and 2 were released for the population supplementation purposes. In most cases, the cheetah reintroduction took

place in the private parks covering 10-1000 km² on average 221 ± 35 km²), where 1 to 8 individuals were releases (max 42, average 7.2 ± 1.27) (Lindsey, Davies-Mostert 2009c).

6.5 Source of animals. The majority of relocated cheetahs were wild-caught – 50.7%, and 48.5% were caught in the wild, but raised in captivity (Table 1). Reports of early 70s was sometimes indicated that cheetahs originated from captivity, but given the difficulties in breeding this species, most likely these individuals were born in the wild and then kept in captivity for a long time. For example, this category includes 3 cheetahs, which were trapped at the age of 3 months, and after 2 years in captivity released in Kwalata Game Farm in Botswana (Houser 2008).

However, successful breeding programs led to increasing of number of cubs born in captivity. For example, 170 cubs were born in South African De Wildt Breeding Center by 1981 (Pettifer 1981b). It is known that among all relocated cheetahs, 8 individuals were born in captivity, of which 2 born in Kapama Cheetah Centre (Hoedspruit) were released in the Mthethomusha Game Reserve (South Africa) in 1994 (Ferguson 1993); 3 cheetahs born in De Wildt released in Timbavati Private National Reserve (South Africa) in 1980 (Pettifer HL 1981b), and 3 cheetahs born in the Breeding Centre for Endangered Arabian Wildlife in Sharjah, were relocated to the Sir Bani Yas Island (UAE) in 2008 (Kader 2011).

Of the 360 individuals, kept in captivity in 5 facilities and used took part in relocation projects (Table 1), the majority (85.3%) was offered by the De Wildt (South Africa). In 1979 and the 2000s, it has provided 307 cheetahs for releasing in 40 parks of South Africa. Kapama Cheetah Centre in Hoedspruit (South Africa) in 1994 provided 2 cheetahs (0.5%) for one park of South Africa; AfriCat (Namibia) in 1995-1998 provided 26 (7.2%) cheetahs for the release in two South African parks, CCF (Namibia) in 2004-2010 provided 22 (6.1%) individuals for 3 parks and Breeding Centre for Endangered Arabian Wildlife in Sharjah (UAE) in 2008 provided 3 (0.8%) cheetahs to one park UAE.

6.6 Evaluation of the success of projects. The evaluation of the success of projects is complicated by a small number of individuals released in some parks (Lindsey, Davies-Mostert 2009c), absence of monitoring of animals (Rowe-Rowe, 1992), or the lack of time of observation since the release before the publication of the results (see. Hayward et al. 2007b). In the 90-s, the longest monitoring project was in Phinda NRR (South Africa), which covered the period from 1992 to 1999 (Hunter 1999). Publications on those few projects where the monitoring was carried out, began to appear only by 2007 (Hayward et al. 2007a). Therefore, to assess the success of the project the following definitions should be applied:

Long-term success – successful reproduction of the first generation when recruitment exceeds the mortality rate within the first 3 years after relocation;

Short-term – coping with environment of all relocated individuals, ability of cheetahs of both sexes: successfully hunt, socialize with conspecifics and breed.

For released females with sub-adult cubs – successful raising the cubs to independence; *for males* – ability to establish and maintain a territory during 1.5 years after relocation.

Some parks in different years conducted series of relocations of various numbers of cheetahs, but only release of the certain year of a certain number of cheetahs could be counted as successful. For example, in the Madikwe Game Reserve female with 4 cubs which had been released in 1996, separated from the cubs in a year, and these cubs were the only survivors in 2 years after the release. Three other releases of 13 cheetahs in the same park in 1994, 1995 and 1998, were unsuccessful (Hofmeyr, Van Dyk 1998). Therefore, in addition to the park's success it is important to evaluate the success of released animals. For example, a failure can be considered to a project, where after the single release of a group of cheetahs, only one individual survived. For example, in the Lower Zambezi National Park in Zambia after releasing of 3 males, two died within the first year, and the latter has survived for 2 years (Phiri 1996).

Out of 65 parks, 23 can be considered successful. In the *long-term*, only 6 (9.2%) were successful, out of which 5 parks were in South Africa: Suikerbosrand Nature Reserve (Pettifer et al. 1982); Phinda Resource Reserve (Hunter 1998), Pilanesburg National Park (Hofmeyr, Van Dyk 1998); Kwandwe Private Game Reserve (Bissett 2004); Samara Private Game Reserve (Hayward et al. 2007b) and one park in Zimbabwe – Matusadona National Park (Purchase 1998).

In the *short-term*, 17 (26%) parks out if 65 were successful. The percentage of successful projects (parks) in relation to the total number of parks, where cheetahs have been released, the most successful were in Zimbabwe – 75% (3 out of 4) parks were successful; in Namibia – 40% (2 out of 5), and in UAE – 100% (1 park). In South Africa, only 22.4% (11 out of the 49) parks were successful.

The type of relocation did not affect the success of the project. In *long-term,* six parks were successful. Out of them: one park carried out reintroduction (Suikerbosrand NR, 7 cheetahs released), 2 parks carried out translocation (Matusadona NP, 17 cheetahs released, and Kwandwe PGR, 11 cheetahs released); one park carried out supplementation (Pilanesburg NP, 17 cheetahs released) and in 2 parks reintroduction

was followed by translocation (Phinda RR, 9 +6 cheetahs released) or supplementation (Samara PGR, 4 +3 cheetah released).

In the short term, 17 parks were successful. Out of them: 4 parks carried out reintroduction, 4-translocation and 4-supplementation; 4 carried out two types of relocations and 1 park – carried out introduction (see Table 1).

The presence of other predators affected the overall success of the projects: out of 37 parks, inhabited by lions, hyenas and leopards, only 35% (n = 13) parks have been successful in terms of cheetah relocations. Out of these 13 parks, in five parks there were only leopards, and the main cheetahs enemies – lions and hyenas were absent. Perhaps this fact, together with sufficient prey base and an adequate territory of the parks allowed cheetahs to adapt successfully.

Source of animals did not affect success of the park, but cheetah success depended on whether they have been raised in the wild or in captivity. Out of 23 successful parks, 12 (52.2%) used cheetahs caught in the wild; 10 (43.5%) parks used cheetahs caught in the wild, but raised in captivity, and one park (4.3%) released cheetahs born in captivity, that is, half of the successful parks received animals from the wild, and the other half – from captivity.

Out of 210 successfully released cheetahs, 140 (66.6%) animals were born in the wild, and 70 (33.3%) were raised in captivity. As a result, projects in the parks, which released cheetahs from the wild and from captivity, were equally successful, but by the number of animals who successfully adapted after release, individuals that were more successful were born and raised in a natural environment. This confirms the findings of previous studies (Marnewick et al.2009; Hayward et al. 2007b).

The duration of living in the captivity did not affect the survival of cheetahs (Marker et al. 2003a), but only on condition that only behaviorally competent individuals participated in relocations, i.e. equipped with all skills necessary for adaptation and survival. In addition, the absence of other predators in the parks contributes to the successful survival of cheetahs, like in 9 out of 23 successful parks. In cases where the territory was inhabited by other predators, they caused death of cheetah cubs and adult individuals (Hayward et al.2007a). Male coalitions and females who had been born and raised in the parks inhabitant by other predators – had more chances to survive after relocation (Hunter 1998a). For example, a South African park Kwandwe (Bissett, 2004), received several cheetahs from Phinda RR, where they coexisted with lions (Hunter 1998a), and several – from farms of Limpopo Province, where there no other predators. As a result, the death rate of competent-naive cheetahs was higher than that of the cheetah

from Phinda. Therefore, for releasing into a park inhabited by lions and hyenas it is recommended to use cheetahs from the areas, where they had experience of co-existence with these predators (Hayward et al. 2007a).

In each of the parks, where the projects were successful, key factors were taken into account to ensure a successful relocation, including: a large area of the park (in some cases with dense vegetation), available reach prey base, reduction of numbers of lions and hyenas (or their absence), number of released individuals adequate to the size of the area of release, and "soft" release of animals. Some factors facilitate the adaptation process of relocated animals will be discussed in details.

VII. The methodology of release

7.1 Pre-release period. From 1965 until 1992, cheetahs were released mainly straight after transportation, and many projects have failed due to injuries and disorientation of the animals after capture and transportation (Hunter 1999). During that period, out of the 17 parks, only 3 (two of them successful) used pre-release keeping of animals in enclosures located within the release site. Gradually the optimal construction called *boma* was designed for keeping several individuals (Atkinson, Wood 1995; Hunter 1995; Hofmeyr, Van Dyk 1998).

Boma is an enclosure of 200-320 meters in circumference, with no corners, with fencing 3.5-4 m in height, with an upper overhang and the electro fencing alone the inner perimeter: 3 wires with a voltage of 700 Volt stretched at a height of 0.3 m 1.0 m and 2.5 m from the ground. Alternatively, 4 parallel to the ground wires are mounted, 3 of which are in 1m from the ground to stop cheetahs that "fly" into the fence when released from a transport cage (Hofmeyr, Van Dyk 1998). Fencing of the park itself can be 2.2 meters in height, but also electrified (Hunter 1995). The mesh fence dug into the ground at 1 m deep and has a lower peak of half a meter, covered with soil and stone blocks. The enclosure contains natural, diverse and in some places dense vegetation and a source of water. Around the perimeter outside and inside of the enclosure, there is a path cleared of vegetation, which serves as a barrier to the spread of a possible fire, allows keepers to monitor the integrity of the fence, and allows kept animals to escape from predators. In such enclosure, no one individual from a group of 3 or 4 cheetahs was observed with stereotypical behavior (Atkinson, Wood 1995). If creation of a group is planned, 2 additional enclosures built and connected by guillotine doors with each other. Some parts of the fence should be covered with not-transparent materials to minimize the risk of injury to animals when running (Marnewick et al. 2009).

It is important that during the preparatory period, the animals did not associate food with humans, so feeding in the boma performed either remotely from the camouflaged places using throw system (which throws the carcass over the fence) or from the shelter, where people remained invisible for animals (Hayward et al. 2007a). Observation point is also organized outside the enclosure. Boma has to be in the depths of the park, close to the main road, and remain inaccessible to the public review (Atkinson, Wood 1995).

Relocation from familiar environment to a new area is likely to become one of the strongest stress factors, and the period immediately after releasing becomes critical for adaptation in a new place (Purchase 1998). The most critical periods for the adaptation and survival of cheetahs of all age categories were the first 3 months (Hunter 1999) and period between 20 and 40 months after the release (Marnewick et al., 2009) - these periods are characterized by the highest mortality. Keeping in a boma facilitates the adaptation of animals to local environmental conditions. In cheetahs, spent some time in the boma, reduced the degree of displaying of the homing behavior unlike animals, released immediately after arrival (Purchase 1998).

7.2 Preparation for release. Given the limited number of founders of new populations of released animals, to minimize risk of inbreeding it is recommended to use non-related individuals (Moritz 1999). Keeping in the boma solves this problem by forming groups optimal for the release (mainly male coalitions), as it is easier for a group to establish and maintain a territory (Caro 1994). Long-term experience has shown that such groups can be formed from unrelated unfamiliar with each other adult individuals (Van Dyk 1997) caught in different parks and countries (Hunter 1998a). Relations established during the pre-release period are so strong that remain after the release until the death of animals (Hunter 1995). Moreover, experience of socializing with unrelated individuals facilitates in the future the ability of males who had lost their partners to coalesce even with the wild residential males, as it has been observed in different parks (Wilson 2006).

However, if a member of the coalition died shortly after the release, it can lead to death of the remaining male. In the Phinda RR(South Africa), after the death of the male partner in a few days of wandering, the remaining male found himself on the territory of a coalition of two males. He had met them before while he was with his brother. At that time both coalitions were sitting opposite each other watching at a distance of 60m for 9 hours and then moved in different directions. The last current meeting ended up with a death of a single male – he was killed by the coalition. (Hunter, Skinner 1995).

It has been suggested that in the wild males can possibly join coalitions to improve their chances for establishing a territory (Hunter 1995). Therefore, it was suggested that if

individuals, who had lost their partners immediately after relocation observed travelling intensively, they should be caught and placed in the boma with the other male or group of males, hereby giving a new chance to form a coalition (Hunter 1998b). Cheetahs in the group feel more confident and adapt faster (Hofmeyr, Van Dyk, 1998), establish and keep the territory (Caro 1994) therefore the forming of social ties at the pre-release period increases their chances of survival (Hunter 1999).
Since the lack of social stability in the social species of predators leads to increasing of mortality and wandering (Caro, Collins 1987; Stander 1990), releasing of groups may be preferable over single cheetah release (Hunter 1998b).

7.3 Forming of the group. Males were kept in the neighboring enclosures and after they both have started to lay down near each other on both sides of the fence and showed no signs of aggression, the gate would be opened. The union was considered successful if animals did not fight during joint feeding (Marnewick et al. 2009) and often exhibited affiliative behavior: mutual grooming and play.

Interestingly, keeping several individuals of different sexes in a group at the pre-release in one enclosure allowing males to form a coalition and do not exhibit territoriality. For example, in Namibia several males caught in the wild and kept together preferred to stay at different sites of the enclosure and showed no desire to interfere with each other. They were not observed marking the enclosure for many weeks even in presence of females, which led to the suggestion that captive cheetah do not display territoriality.

Feeding procedure also incorporated the process of uniting: once every 3-4 days cheetah group was fed with impala or nyala carcass, and within a few days, joint feeding would lead to the formation of the coalition (Hunter 1995). On average, the process of formation of the coalition took around 2 months (Hunter 1998a). Unrelated and unfamiliar females, however even if displayed affiliative behaviour in the boma (mutual grooming and joint feeding on the same carcass), split soon after release (Hunter 1995). There are several reasons for that. Individual experience of females (as of males) plays an important role in establishing social relationships with conspecifics. Individuals who spent a long time with their mothers or siblings, most likely to be able to co-exist in the group. Most likely, the level of affiliative interactions associated with the tactile contact between these females was not high enough to create a full-fledged coalition (Chelisheva 2010), which is most likely to be created from females littermates. For example, two cheetah sisters released in Mthethomusha (South Africa) spent all time together and if lost visual contact with each other for short time, started loudly calling (Ferguson 1993). Perhaps the desire to be with a partner intensifies in moments of stress, which raising a feeling of insecurity among individuals.

7.4 ***Importance of electro fencing***. Familiarization with electric fence during keeping in the boma is important for the future as it subsequently limits the movement of animals beyond the borders of the park (Linnell et al. 1997; Hunter 1998a; Hofmeyr, van Dyk 1998; Hayward et al. 2007a; Houser, 2008 and others.). For example, cheetahs in Phinda (South Africa) after spending 6-8 weeks in the boma with electric fencing, did not try to leave the park unlike residential hyenas, leopards, wild dogs and warthogs, who used to edge under the fence, and some leopards who climbed over the fence. This behavior is most likely indicates the exceeding carrying capacity of the park (the area of 180 km²) (Hunter 1998b). Cheetahs emerged from that park several times, carefully avoiding electro fence and using holes made by warthogs and opened park gates; with some cheetahs returned into the park (Hunter 1998b).
Some relocated cheetahs in Pilanesberg NP and Madikwe GR, especially male coalitions used a mesh fencing for trapping large and heavy antelopes like kudu, wildebeest and waterbuck, however not as often as one pack of wild dogs in one of these parks (Hofmeyr, Van Dyk 1998).

7.5 Release**.** In case of releasing of several cheetah groups, it is suggested to carry it out successively in different areas of the park, as it:
1) Provides animals with enough time to establish the home territory before any potential negative effects of subsequent releases come out.
2) Reduces the chances of relocated cheetahs to face territorial conspecifics shortly after the release if places for releasing the new individuals are outside of established territories of other cheetahs (Hunter 1999).
An alternative approach is based on the providing animals with equal chances for establishing their territories, as if the number of males in the coalition will exceed the number of single males, the chances of the latter may be lower than that of coalitions.

Studies conducted in different parts of Africa, show a higher survival rate of females compared with males, which is associated with inter-male aggression (Caro 1994). For example, in the Lower Zambezi NP (Zambia), one of the causes of death of cheetahs were conflicts with conspecifics (Phiri 1996).

The presence of residential cheetahs provoked intensive movement of relocated individuals over long distances, especially after fighting with the resident cheetahs, even between two equal coalitions (e.g. two 3 male coalitions in Suikerbosrand NR) (Pettifer et al. 1982). Moreover, first released coalitions may subsequently become a problem for new arrivals because of attacks by conspecifics. For example, a coalition of three males killed several cheetahs in Madikwe GR (Marnewick et al. 2009) and a coalition 2 males at different times killed 2 males in Phinda RR (Skinner & Hunter 1995).

Consecutive release of several groups of cheetahs for 3 years in Kwandwe PGR, starting from a coalition of 4 males, resulted in the death of 3 cheetahs. An adolescent male was killed after he had separation from the mother. An adult female, which had been released 2 years after the coalition, was killed 2 weeks after her release. In addition, the coalition of three males used to took kills from the female with cubs more often than did other predators.

The fact that females choose the places for birth near park borders and most distant from the lions and cheetah coalitions indicating that avoidance of lions and cheetah coalitions have played an equal role in the survival of females (Bissett 2004). The sequential release of cheetahs for 4 years in small groups (n = 2,1,7) in Shamwari (South Africa, the area of 18.746 ha) led to the same cheetah female behavior, and practiced release was considered improper (Hayward et al. 2007a).

Even if the number of residential individuals is small, the population may be stable and adapted to local environmental conditions, and the introduction of new species can lead to a disbalance. Therefore, some authors suggest simultaneous release of cheetahs in different parts of the park in large groups (Hayward et. al. 2007a). wherein the number of released individuals must be adequate to conditions of the park. For example, the successful translocation of 20 individuals to a territory of 1370 km² in Matusadona park in Zimbabwe. (Purchase, Vhurumuku 2005). It is also suggested sequential release of females and then males (Marnewick et al .2009). The absence of settled cheetah coalitions in the park by the time of the release reduces the chance of being during the time of exploring the new area (Hunter 1998b).

VIII. Behavior of released cheetahs

8.1 Home territory.

Two terms describe territoriality of cheetah best, which are home range and home territory. The first can be applied to cheetahs living in South African countries outside the protected areas, where the size of home range can reach hundreds and thousands of square kilometers (Marker 2003). The second term is applicable to the cheetahs who are living in fenced areas, where the fence limits the size of the occupied territory.

According to Burt (1943) home range is the area traversed by the individual in its normal activities of food gathering, mating and caring for young. Prior to establishing the territory, released animals display active travelling in order to get acquainted with local environmental conditions that are important for their survival, including the presence of

conspecifics, locations of food and water sources, safe places for rearing offspring etc. (Purchase 1998).

Using a leopard as a model, Hamilton (1981) describes four phases of post-release movements of predators: 1) post-release phase – orientation, next to the place of release, takes a few days; 2) exploratory movement phase – long, unpredictable zigzag movements, visiting previous places; 3) directional movement phase – optional, a long-term movement in a straight line in any direction, including toward the place of capture; 4) settled phase – reduced movements confined to a limited area, establishing a home territory.

The number of phases in each case is different and depends on the particular animal (Hamilton 1981). For example, movements of a cheetah female in the Klaserie PNR (South Africa, 1979) were second and third phases, while in males displayed the second phase was observed, after which observations were not detailed (Kruger 1988). In Phinda cheetah males displayed homing for 2 months after the release, and then established territories (Hunter 1999).

In general, territories of released and residential cheetahs share some features, though they have significant differences. The common features are: relatively small size of the territory; preference by females places with more dense vegetation (Hunter 1998a; Broomhall et al. 2003). Animals were choosing areas depending on the availability of food and water sources, on presence of other predators, and the sex and age of individuals. In addition to the above, the size and type of the area chosen for the territory by the relocated cheetahs depended on the status of individuals, their previous experiences (in case of translocation) and the number of conspecifics in the park (Bissett, Bernard 2007; Orser 2009; Hunter 1995).

The core difference from the residential cheetahs was the smaller size of the territories of relocated females then those of relocated males. In addition, territories of females successfully raised cubs were smaller than in females who have lost their litters; in adult males territories were smaller than in adolescents. In presence other predators in the park, female cheetah territories were smaller than in their absence. For example, in Mkhuze GR (South Africa) covered area of 400 km^2, where there were no lions, female cheetah territories were 62-66 km^2, and in males varied from 93.9 km^2 in adolescents to 32.7 km^2 in adults (Orser 2009).

In Kwandwe PGR (South Africa) covered area of 240 km^2, which was inhabited by lions and spotted hyenas, the size of the territory for cheetah females with litters was 11 km^2, while for single females – 65.6 km^2 (Bissett, Bernard 2007). The same ratio was observed

in the Matusadona NP (Zimbabwe): young male occupied the largest territory (53.8 km^2), the oldest single male had a territory of 11,3 km^2 and female with a cub had a territory of 23.6 km2 (Purchase 1998).

With relatively small size of the park, females utilized all of its territory, while males used certain parts of different sizes and were fighting and killing each other for the most attractive areas (Hunter, 1998). For example, in Phinda NRR (South Africa) covered 180 km^2, where 15 cheetahs were released, 4 males died in territorial conflicts (Hunter 1999). The reason for that was the lack of the most inhabitable places on the background of the small size of the park and the presence of lions.

8.2 Preferred habitat type.

In different parts of Africa cheetahs prefer different habitats (Bissett & Bernard 2007; Caro 1994; Marker et al. 2008; Kelley et al. 1998), which indicates their adaptability. In the presence of other predators, relocated female cheetahs (especially with cubs) prefered dense vegetation in areas most distant from the hyenas and the prides of lions (Purchase 1998), sometimes on the slopes of the elevated areas, where prey was limited. Relocated males chose open areas near dense vegetation (Bissett, Bernard 2007).

In the absence of lions, relocated cheetah females preferred areas with tall grass bordering open planes (Orser 2009). In some parks core areas of male and female territories could be in the open savanna (Hunter 1998a). It is interesting to note that in open areas cheetahs made more hunting attempts, but with the least successful – 27 successful hunts of 81 attempts, while in dense vegetation they hunted less frequent, but with greater success – 20 successful hunts of 39 attempts (Bissett, Bernard 2007). It is known, that cheetahs inhabit places with dense vegetation, but most efficiently hunt in open spaces (Broomhall et al.2003; Mills et al. 2004).

Studying behavior of released cheetahs expands the boundaries of knowledge about the presence or absence of certain elements, which are not common in individuals born and raised in the wild. For example, in the Kwandwe PGR females did not move their litters (Bissett, Bernard 2007), as is usually do (Laurenson 1994). This was apparently due to living mainly in the dense bush, which provided protection from predators, whose density in these areas was low. The disappearance in the bush helped survival in cases of pursuit by other predators (Hunter 1998a). For example, when a female cheetah with a sub-adult cub was chased by 2 lionesses, the family split up and disappeared into the thick bush, and lions stopped chase (Purchase 1998). It was also noted that in the presence of large predators, relocated female cheetahs remain with their sub-adult cubs longer than in the parks with no predators. For example, in the Suikerbosrand, where there were no

predators, two females used to leave their cubs after reaching the age of 16.5-17 months, and the same females after relocating them to the Eastern Transvaal Loweld park, inhabited by lions and hyenas, were observed staying with their cubs for more than 19.5 months (Pettifer et al. 1982). As females teach cubs by their own examples of behavior in different situations, the longer they stay with their cubs, the more experience they pass, as the extended period of teaching contributes to the survival of the cubs.

8.3 The optimal number of founders.

To create a self-sustaining population it is recommended to use 20-30 successfully reproducing animals, and in the case of less numbers of founders, the after some time supplement population with unrelated individuals (Frankham 2009). As already mentioned, in most parks (48 of 65) small groups of cheetahs (up to 8 individuals) were released, and additional releases were held in 22 of 65 parks. Due to different reasons (e.g. small territory of the park, limited number if founders etc.) total populations rarely exceed 20 individuals.

Twelve of the 22 parks, which conducted supplementary releases, were successful. Coordinated operation of several projects has resulted in exchange of cheetahs between different parks. In 1995, 2 males born in Phinda reserve from the female who was brought in 1992 from Namibia, were sent to Madikwe GR, and Phinda received 2 new males (Hunter 1996). On one hand in small parks the ratio and the number of animals that could be supported by the given ecosystem was observed, and on the other hand the genetic diversity of the population was supported through the introduction of new individuals.

8.4 Carrying capacity and behavior of cheetahs.

Analysis of the behavior of released cheetahs reveals the following indicators of the exceeded carrying capacity as indicator of the overpopulation of the park with predators, including cheetahs:

1) *Constant number of cheetahs* for several years, as in Matusadona NP (Zimbabwe) against the background of 20% annual adult mortality and exiling sub-adult and adolescents from the park to the farmers lands, by adult territorial cheetahs (Purchase 1998).

2) *Pacing along the fence of the park*, especially of male coalitions e.g. Madikwe GR (Hofmeyr, Van Dyk 1998), Phinda GR (Hunter 1998b) and Suikerkop NR (Pettifer 1981b).

3) *Localization in the border areas of the park* (Hofmeyr, Van Dyk 1998) or set up immediately after the release alone the fence bordering the territory of another park. For example, in the Kalahari GL (Namibia), which lions were also reintroduced, cheetahs

were observed in 100m from the fence in 71% of cases, even though they did not attempt to cross the fence and leave the park (Stander 2003).
4) *Fatal territorial conflicts and cannibalism*. It is known that in the wild meeting cheetah coalitions with single males in the territory of the group sometimes end in the death of individuals (Caro 1994), however, cases of cannibalism have not been described in the wild born cheetahs.
Despite the fact that to date such behavior has been observed in a single park, it is noteworthy because it was demonstrated by the males relocated from the wild 15 months prior to the incident. It was in Phinda R.R. (South Africa) where a coalition of 2 males during the chase of impala, caught a cheetah male on their territory and killed him by suffocating and simultaneously gnawing his hindquarters. For 45 minutes after killing, both males methodically and aggressively were attacking the carcass, tearing chunks out of the hindquarter and genitals. One of the males began to lick the blood flowing from the wounds, gradually opened the abdominal cavity and was eating the body for another 25 minutes when his brother joined him. Males ate half of the back part of the torso (Hunter, Skinner 1995).

5) *Leaving the territory of the park*, even in the case of large protected areas (Hunter 1996).
6) *Reduction in numbers of certain types of prey species* (preferred by cheetah). Of the 23 parks where the cheetah relocation has been successful, in four South African parks - Suikerbosrand NR (1975), Itala G.R. (1979), Pilanesberg N.P. (1981) and Phinda R.R. (1992) the number of cheetah preferable prey species of ungulates significantly decreased. In particular, in Suikerbosrand NR, within for 2 years after the releasing of cheetahs in 1975-76, cheetah population has tripled (from 8 to 24 individuals), while the number of springbok and hartebeests decreased (Pettifer 1981s).

Relocated cheetahs in Phinda RR (South Africa) rapidly exceeded the critical number (21 against 14 for the calculated park biomass) and significantly affected some types of ungulates (Hunter 1998a). The problem of overpopulation has been solved by the relocation of some predators. From the Suikerbosrand NR, in 3 years after releasing first 14 individuals were relocated, and in 1980 all cheetahs were removed. Seven cheetahs were withdrawn from Pilanesberg N.P. and one coalition left of three males, who lived to the age of 14 (Pettifer 1981a; Rowe-Rowe 1992; Hofmeyr & man Dyk 1998). From Phinda R.R. several lions and cheetahs were resettled in 1995 (Hunter 1998a).

The proposed solution to the problem of overpopulation of predators ranging widely and include contraception (Oxford & Perrin 1988), sterilization (Hayward et al. 2007a) resettlement of predators (Hunter 1998a) and merging private conservation areas into one

protected area. The merging of territories as in the case of Eastern Cape Province in South Africa, is seen as the best solution, as alone with the continuous individual income from the tourism, the total cost of maintenance of the territory reduces, while dismantling of internal fences of different parks allows continued natural evolutionary process (Hayward et al. 2007b). Therefore, the value of re-introduction in order to preserve rare species in small isolated parks without their union is questionable (Hunter 1998a).

8.5 *Prey selection*.

It is known that cheetahs prey on the species of different sizes – from rodents to large ungulates (Marker 2003) and in certain habitats display preference to one particular type of prey (Mills 1991), even if it is not the most numerous and larger than the middle size antelope. In the southern Kalahari cheetahs hunted blue wildebeest and bat-eared fox (*Otocyon megalotis*), while springbok was the preferred species (Mills 1984). In other areas cheetahs prefer other types of small or medium size herbivores such as impala (Broomhall 2001), Thompson's gazelle (Caro 1994) or Steenbok (Marker 2003). Male coalition can successfully hunt on a big game (including adult kudu and zebra), however females prefer smaller prey (Broomhall 2001; Caro 1994).

Relocated cheetahs of both sexes, regardless to the presence in the park other predators, not only adapted for hunting on the species sometimes 2 times heavier their own weight (kudu, waterbuck, bontebok, nyala, plains zebra, eland), but in some cases preferred large (more than 60-65kg) game. While in Matusadona N.P. (Zimbabwe) cheetahs preferred impala (Purchase, du Toit 2000), in Phinda RR (Hunter 1998a) and Suikerbosrand Nature Reserve (Pettifer 1981b) the main object of hunting were two species – nyala and bontebok and in Kwandwe PGR it was kudu (Bisset 2004).

It was mostly noticeable in a male coalition from the Kwandwe PGR, which in some cases ignored the large herds of grazing impalas while hunting kudu (Bisset 2004). One female in Klaserie PNR also successfully hunted on large ungulates (Kruger 1988). All of these parks implemented successful relocations, where released cheetahs demonstrated successful adaptation.

It should be noted that the choice of the prey after the release is affected by the main type of food in the pre-release period. For example, if in the boma cheetahs had been fed with impala, they preferred impalas after the release (Atkinson, Wood 1995). Perhaps getting used to the certain type of food during staying in captivity, facilitates the formation of preferences and partly explains the ability of cheetahs released in different parks

successfully prey on large ungulates. However, this is only possible if animals have hunting skills.

According to the report of du Preez (1970) on feeding and releasing of 30 cheetahs in 1970 in Etosha NP (Namibia), groups of cheetahs of 8 individuals who knew each other before arriving to the pre-release enclosure) were fed fresh shot oryx, wildebeest, springbok and zebras. Monitoring of the animals after the release was not carried out, so it is impossible to trace the fate of all cheetahs, however, it is mentions that after 4 months after the release one cheetah was spotted in the park in a very bad state, hunt rabbits. Perhaps some cheetahs came from captivity and did not know how to hunt, so they could not catch any large ungulates species, which they had been fed before release or to switch to a medium-sized or smaller antelopes like impala or dik-dik.

There are records of cheetahs killing (Pienaar 1969) and eating small carnivores such as jackals (S.Durant, *personal comment*) and bat-eared foxes (Mills 1984). Fecal samples of male and female cheetahs, relocated to the Kwandwe PGR revealed that they were preying on jackals, which were abundant in the park (Bisset 2004). Perhaps this behavior was due to interspecific competition for food resources or territory.

When the number of the most numerous (or preferred) prey species is reducing, the cheetah can switch to another species thereby giving the chance to the reducing population to recover. In some cases, releasing of cheetahs may even contribute to the conservation of ungulates. For example in Rietvlie Nature Reserve (South Africa), where the numbers of impala from year to year were reducing due to caracals and jackals preying mainly on their fawns, after the release of 2 cheetahs (from De Wildt Cheetah Center) impala population gradually began to increase. Cheetahs hunted adult impalas, but did not completely eat the carcass, leaving opportunity to the other predators to feed with no energy cost for hunting (Herring 2008).

8.6 ***The daily activity and hunting behavior***.

The cheetah is considered diurnal predator with maximum activity in early morning and early evening hours, although local conditions, e.g. temperature regime in the Kalahari (Labuschagne 1981) may stimulate active nightlife of the cheetahs (Novel, Jackson 1996). In some parks regardless to the presence of the other predators, relocated cheetahs remained active at night. For example, in the Lower Zambezi NP (Zambia) three males moved at night for 8-9 km (Phiri 1996). In Kwandwe PGR (South Africa), cheetahs hunted in the dark and of the 19 successful hunts 14 occurred at night and 5 in the early morning (Bisset 2004). The Klaserie PNR (South Africa) cheetahs become active after 5

pm and continued until 9 am (Kruger 1988). The advantage of night hunting could be a limited activity of herbivores in the dark.

Cheetahs raised in captivity are able to learn hunting, which and group living greatly contributes to it. For example, five males raised in a group at CCF and released in NamibRand NR (Namibia) worked out the technique of cooperative hunting for young Oryx and other large ungulates (Marker 2009).

In Timbavati PNR three captive-raised brothers worked out a strategy of cooperative hunting a giraffe calfs with sharing duties. In the first phase, all three were chasing a group of giraffes, and then one brother (always the same) continued chasing, while the other 2 focused on a calf. One brother hitched up the calf's sacrum with the dewclaw and toppled the calf, and the other one leaned heavily on the calf’s shoulder and thus two cheetahs together piled a calf. When the calf was on the ground, one cheetah (always the same) strangulated it, squeezing its neck under the jaw where the trachea is the most accessible. Of the 12 attempts of hunting a baby giraffe, five were successful. That male coalition tried themselves on different species – 21 time they unsuccessfully hunted wildebeest, 13 – on the zebras, and even injuries did not stop them. However, after only a single injury from a buffalo, they lost interest in this species (Pettifer 1981b).

It is known, that in presence of large carnivores (e.g. in East African open landscapes) cheetahs try eating the kill as quickly as possible before kleptoparasites arrive and rarely have a chance to finish the whole carcass (Caro 1994) and typically do not return to the kill. Relocated cheetahs (regardless of gender, social and reproductive status and origin) in many parks in the presence or absence of other predators spent more time at the kills and repeatedly returned to the carcass even the next day. This was observed in Kwandwe PGR (Bisset 2004); Phinda R.R. (Hunter 1998a); Timbavati PNR (Pettifer 1981b) and Klaserie PNR (Kruger 1988). Interestingly, such behavior was not observed in resident wild cheetahs in the same parks.

There could be different reasons for this phenomenon depending on each particular case. In some parks where relocation was successful, thick bush provided protection from the competition so cheetahs felt secure being around their kills. In Kwandwe PGR, such behavior attributed to the fact that the total number of other predators in the park was small, and very cases of kleptoparasitism rarely was recorded (Bisset 2004). The behavior of cheetahs in Timbavati PNR was explained by the fact, that captive-bred cheetahs had no experience of food competition from other predators or scavengers (Pettifer 1981b). Most likely, both of the aspects facilitated returning to the meal and spending long hours at a kill. Captive cheetahs tend to come back to the remains of a meal, even if the only

bone remained. This habit could be developed during the pre-release period in the boma, where group of cheetahs was offered the whole carcass every few days and where no other predators could interfere with feeding and cheetahs had no fear of losing the food.

Similar behavior was observed in cheetahs, who had been raised in captivity from the age of 3 months and later developed hunting skills during keeping in the boma. After the third successful hunt on their own in a 20 x 40m pen they began covering carcass by rowing grass and branches over it, and retained this habit after the release into a 100 hectares enclosure. Returning to the carcasses occurred during the first 1.5 months (Houser 2008).

In the wild, cases of cheetahs returning to their kills are rare. Burney (1980) observed young cheetahs coming back to the kills after more than 5 hours after having left the spot saturated (Burney 1980). Seldom cheetahs have been seen covering the remains of the carcass with soil and grass: Joy Adamson (1972,1976) observed it in adults and Burney (1980) in sub-adults. Obviously, in each case, cheetahs choose an optimal model of behavior that contributed to survival.

8.7 ***Cheetahs personal experience and relationship with humans***.

Unfortunately, a number of projects ended in failure due to the release of untrained animals raised in captivity. Having no hunting skills and fear for men, such individuals rapidly lose their shape because of hunger. Some cheetahs died due to failure in hunting as they were choosing the game of inappropriate size, or killed by farers when hunting livestock beyond the park boundaries. For example, three brothers in Timbavati PNR after unsuccessful attempts to hunt buffalo twice visited local housings and ate chickens (Pettifer 1981b).

Two inexperienced cheetah sisters released in Mthethomusha GR tried hunting impala and nyala in the dense bush, but never learnt the hunting techniques and remained fully dependent on people in terms of food source. They hunted lizards and in search of food approached tour vehicles, but the policy of the project was not to feed the cheetahs in the presence of tourists, although the deplorable condition of the animals was obvious. Females spent in the park just 2 weeks: one was killed and eaten by hyenas and the other one 3 days after was found the park gate next to the rangers post very hungry, dusty, and anxious and calling her sister (Ferguson 1993).

In rare cases, when cheetahs who normally hunted for themselves became temporarily incapable of hunting supplementary feeding was administered. One tame male shortly after the release in Madikwe reserve started limping and as he could not hunt, people started feeding him. The lack of fear of man led him to a tourist camp, where he began to

chase after some employees. In 3 months after the release, he was caught and handed over to the De Wildt Cheetah and Wildlife Center (Hofmeyr & Van Dyk 1998).

In Kwandwe PGR people fed one starving female with 4 cubs (Hayward et al. 2007a). In Bellebenno GC (Namibia) three inexperienced sisters were fed in the hope of their independent hunt. On the 9th day after repeated unsuccessful attempts to catch a duiker or oryx, they made a first successful kill. Since then they were hunting for themselves: for 118 days out of 150 hunting attempts, 63 were successful (Marker 2010).

Human activity was one of the main causes of death of released cheetahs: some died in a snare, others lost their lives in road accidents or in human-carnivore conflicts – shot when attacked the livestock outside of the fenced parks (Hunter 1998a). Individuals raised by man were at a higher risk. Probably, individual characteristics of cheetahs allowed in some cases quick adaptation to new environment and developing hunting techniques suitable to local types of prey, while in other cases made it difficult for cheetahs to adapt.

IX. Cheetah genetics and relocation projects

Recent genetic studies have revealed that cheetahs from north-eastern Africa (*Acinonyx jubatus soemmerringii*), South Africa (*A. j. jubatus*) and Asia (*A. j. venaticus*) are long-term geographically isolated groups with an independent evolutionary history (Charruau et al. 2011). In south-African countries all relocated cheetahs who participated in the described projects, belonged to one subspecies –
A. j. jubatus, and their relocations within neighboring countries were within the subspecies range.
In the case of the proposed reintroduction of cheetahs into its historic range in Asia, in particular India and Uzbekistan, the founders have to belong to the historic subspecies, which is critically endangered Asiatic cheetah (*A. j. venaticus*). However, the only remaining population in Iran consists of around 120 individuals, and therefore is not stable and requires long-term conservation efforts to make it self-sustainable. It will not stand extraction of any number of individuals (Charruau et al. 2011). Restoring environment in the areas where Asiatic cheetah survived alongside with the neighboring areas within its historical range will help cheetah population recover and in the future occupy suitable areas where it now extinct.

X. Conclusion

Reintroduction of a cheetah – is one of the most discussed issues at the moment in terms of conservation of the species. Numerous relocations undertaken in the past decades, and

vast experience described in publications indicate that achievement even a short-term success requires a comprehensive approach, involving diverse intellectual and financial resources. Given the rapid decline of the cheetah in the wild, any project should be primarily focused on the animal welfare. This is especially should be applied to the wild populations. If the animals are to be withdraw from the wild, it is important that extraction would not cause damage to the donor population and impact negatively on the relocated animals. When choosing a source of animals some authors suggest approach based not on taxonomy, but on such criteria as environment, behavior and survival of individuals (Charruau et al. 2011).

An alternative to the wild-caught animals could be using animals born in zoos and conservation centers. However, it has to be taken into account that individuals from populations represented by many generations in captivity have reduced adaptability to environmental conditions in the wild (Frankham 2009). Perhaps the best option would be a program with cheetahs caught in wild after reaching the age of independence, transported to the areas of future release and held in the boma at the pre-release phase. The benefits of such a program are obvious: animals brought up in the natural environment have all the necessary survival skills, including hunting (game as the diet, independence from man in terms of food), avoiding of enemies and socialization.

During the pre-release period, the animals get opportunity to familiarize with local types of prey species, and if necessary – with conspecifics to form groups. It the area is big enough, simultaneous release of the maximum number of cheetahs in several groups facilitates their adaptation to a new environment. In any case, any relocation program should take into account all of the discussed components, such as economic, environmental, biological and organizational.

Bibliography

Adamsom J.1976 The Spotted Sphinx. Galahad Books

Adamson J. 1972 Pippa's Challenge. Collins; 1st Edition edition

Armstrong D.P., Seddon P.J. 2007. Directions in reintroduction biology. Trends in Ecology and Evolution. Vol.23 No.1. pp.20-25.

Atkinson M. W., Wood, P. 1995. Re-introduction of cheetah in Matusadona, Zimbabwe. Cat News 23: 15

Beck B.B., Rapaport L.G., Stanley Price M.R., Wilson A.C., 1994. Reintroduction of captive-born animals. In: Olney, P.J.S., Mace, G.M., Feistner, A.T.C. editors. Creative Conservation: Interactive Management of Wild and Captive Animals. Chapman and Hall, London, pp. 264–386

Bissett C. 2004. The feeding ecology, habitat selection and hunting behaviour of re-introduced cheetah on Kwandwe Private Game Reserve, Eastern Cape Province. MSc. Thesis. Rhodes University.

Bisset C., Bernard R.T.F. 2007. Habitat selection and feeding ecology of the cheetah (Acinonyx jubatus) in thicket vegetation: is the cheetah a savanna specialist? Journal of Zoology. 271, 310-317.

Brambell M. R. 1977. Reintroduction. Int. Zoo Yearb. 17:112-116

Breitenmoser U. 2002. Feasibility study on cheetah re-introduction in Turkmenistan. Cat News:13-15

Breitenmoser U., Breitenmoser-Wursten C., Carbyn L.N., Funk S.M. 2001. Assessment of carnivore reintroductions. In: Carnivore Conservation Edited by J.L. Gittleman, S.M. Funk, D.W. Macdonald, R.K. Wayne. Cambridge University Press and Zoological Society of London, Cambridge, UK.pp.241–280.

Broomhall L. S. 2001. Cheetah Acinonyx jubatus ecology in the Kruger National Park: a comparison with other studies across the grassland-woodland gradient in African savannas. M.Sc. thesis, University of Pretoria

Broomhall L.S., Mills M.G.L., du Toit J.T. 2003. Home range and habitat use by cheetahs (*Acinonyx jubatus*) in the Kruger National Park. Journal Zoology. London, No 261. – P. 119-128.

Burney D.A. 1980. The effects of human activities on cheetah *(Acinonyx jubatus Schr.*) in the Mara region of Kenya: M.Sc. thesis / University of Nairobi. – Nairobi, Kenya. 219 P.

Burt W.H. 1943. Territoriality and home range concepts as applied to mammals. Journal of Mammology: 24, 346-352

Caro T.M. 1994. Cheetah of the Serengeti plains: group living in an asocial species. Chicago: University of Chicago Press

Caro T.M., Collins D.A. 1987. Male cheetah social organization and territoriality. Ethology 74: 52-64

Charruau P., Fernandes C., Orozco-Terwengel P., Peters J., Hunter L., Ziaie H., Jourabchin A., Jowkar H., Schaller G., Ostrowski S., Vercammen P., Grange T., Schlötterer C., Kotze A., Geigl E-M., Walzer C., Burger P.A. 2011. Phylogeography, genetic structure and population divergence time of cheetahs in Africa and Asia: evidence for long-term geographic isolates. Molecular Ecology (2011) 20, 706–724

Chelysheva E. 2004. A New Approach to Cheetah Identification. CAT NEWS, IUCN/CSG. № 41. P.27-29

Clubb R., Mason G., 2003. Captivity effects on wide-ranging carnivores. Nature 425, 473–474.

Du Preez J. S. 1970. Report on the feeding and release of 30 cheetah in Etosha. Namibian Nature Conservation Report N 50/7/3 (unpublished). 9 p.

Ferguson M. 1993. Introduction of cheetah into Mthethomusha Game Reserve, South Africa. In: International Cheetah Studbook

Fischer J., Lindenmayer D.B., 2000. An assessment of the published results of animal relocations. Biol. Conserv. 96, 1–11

Frankham R. 2009. Genetic Considerations in Reintroduction Programmes for Top-Order, Terrestrial Predators In: Reintroduction of Top-Order Predators, 1st edition. Edited by M. Hayward and M. Somers. 2009 Wiley-Blackwell Publishing, Oxford

Georgiadis N., Ihwagi F., Olwero J., Romañach S. 2007. Savanna herbivore dynamics in a livestock-dominated landscape: II. Conservation and management implications of predator restoration. Biological Conservation 137, 473–483

Griffith B., Scott J.M., Carpenter J.W., Reed C. 1989. Translocation as a species conservation tool: status and strategy. Science, 245, 477–480

Griffin A.S., Blumstein D.T., Evans C.S. 2000. Training Captive-Bred or Translocated Animals to Avoid Predators. Conservation Biology, Vol.14, No.5. Pp. 1317-1326

Gusset M., Slotow R., Somers M.J. 2006. Divided we fail: The importance of social integration for the re-introduction of endangered African wild dogs (Lycaon pictus). Journal of Zoology, London 270, 502–511

Gusset M., Ryan S.J., Hofmeyr M., Van Dyk G., Davies-Mostert H.T., Graf J.A., Owen C., Szykman M., Macdonald D.W., Monfort S.L., Wildt D.E., Maddock A.H., Mills M.G.L., Slotow, R., Somers M.J. 2008. Efforts going to the dogs? Evaluating attempts to re-introduce endangered wild dogs in South Africa. Journal of Applied Ecology, 45, 100-108

Hamilton P.H. 1981. The leopard and the cheetah in Kenya: Ecology, status, conservation and management. A report for the U.S. Fish and Wildlife Service, African Leadership Foundation and the Government of Kenya

Hayward M.W. 2005. Lessons from South Africa. Nature 28(6): 80

Hayward M.W., Hofmeyr M., O'Brien J., Kerley G.I.H. 2006. Prey preferences of the cheetah Acinonyx jubatus: Morphological limitations or the need to capture rapidly consumable prey before kleptoparasites arrive? Journal of Zoology, London 270, 615–627

Hayward M. W., Adendorff J., O'Brien J., Sholto-Douglas A., Bissett C., Moolman L. C., Bean P., Fogarty A., Howarth D., Slater R., Kerley G. I. H. 2007a. Practical Considerations for the Reintroduction of Large,

Terrestrial, Mammalian Predators Based on Reintroductions to South Africa`s Eastern Cape Province. The Open Conservation Biology Journal 1: 1-11
Hayward M.W., Adendorff J., O'Brien J., Sholto-Douglas A.,. Bissett C, Moolman L.C., Bean P., Fogarty A., Howarth D., Slater R., Kerley G.I.H. 2007b.The reintroduction of large carnivores to the Eastern Cape, South Africa: an assessment. 2007 FFI, Oryx, 41(2), 205–214
Hayward M.W, O'Brien J., Kerley G.I.H. 2007c.Carrying capacity of large African predators: predictions and tests. Biol.Conserv; 139: 219-229
Herring K.S. 2008. Scatology as non-invasive tool for conservation of cheetah (*Acinonyx jubatus Von Schreber*, 1775) in South Africa. Msc.Thesis University of Pretoria. 84pp.
Hofmeyr M, van Dyk G. 1998. Cheetah introductions to two north-west parks: case studies from Pilanesburg National Park and Madikwe Game Reserve. In: Cheetahs as Game Ranch Animals. Edited by Penzhorn BL. Onderstepoort, South Africa.: Wildlife Group of the South African Veterinary Association; 1998; 60-71
Houser A.M. 2008. Spoor density, movement and rehabilitation of cheetahs in Botswana. Msc Thesis, University of Pretoria. 120pp.
Hunter L.T.B. 1995. The re-introduction of cheetahs into Phinda Resource Reserve, northern Natal, South Africa Pretoria: Mammal Research Institute.7 p.
Hunter L.T.B. 1996. Secondary re-introductions of large cats in South Africa. Cat News:14
Hunter L.T.B. 1998a. The behaviour and ecology of reintroduced lions and cheetahs in the Phinda Resource Reserve, northern KwaZulu-Natal, South Africa. Ph.D. Thesis, Mammal Research Institute, University of Pretoria, 205pp.
Hunter L.T.B. 1998b. Early post-release movements and behaviour of re-introduced cheetahs and lions, and technical considerations in large carnivore restoration. Cheetahs as Game Ranch Animals. (ed. B.L. Penzhorn), Wildlife Group of the South African Veterinary Association, Onderstepoort. pp. 72–82.
Hunter L.T.B. 1999. Large felid restoration: Lessons from the Phinda Resource Reserve, South Africa, 1992-1999. Cat News. pp.20-21
Hunter L.T.B, Skinner J.D. 1995. A case of cannibalism in male cheetahs. African Journal of Ecology. 33: 169-171.
IUCN 2001. IUCN Red List Categories and Criteria: Version 3.1. IUCN, Gland Switzerland and Cambridge, UK[http://www.redlist.org/info/categories_ criteria2001. html, accessed 16 February2007])
IUCN Standards and Petitions Subcommittee. 2010. Guidelines for Using the IUCN Red List Categories and Criteria. Version 8.1. Prepared by the Standards and Petitions Subcommittee in March 2010. Downloadable from http://intranet.iucn.org/webfiles/doc/SSC/RedList/RedListGuidelines.pdf.
IUCN 1998. Guidelines for Re-introductions. Prepared by the IUCN/SSC Re-introduction Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.
Johnson S, Mengersen K, de Waal A, Marnewick K, Cilliers D, Houser AM, Boast LK. 2010. Modelling cheetah relocation success in southern Africa using an Iterative Bayesian Network Development Cycle. Ecological Modeling 221:641-651
Jule K. R., Leaver L. A., Lea S. E. G. 2008. The effects of captive experience in reintroduction survival in carnivores: a review and analysis. Biological Conservation. 141(2): 355-363
Kader, Binsal Abdul. 2011. Rewilding of Cheetahs a big success in Sir Baniyas Island. gulfnews.com. January 1, 2011
Kelly M.J., Laurenson M.K., Fitzgibbon C.D., Collins D.A., Durant S.M., Frame G.W., Bertram B.C.R., Caro T.M. 1998. Demography of the Serengeti cheetah (*Acinonyx jubatus*) population: the first 25 years. J. Zool. London. 244, 473–488
Kleiman D.G. 1989. Reintroduction of captive mammals for conservation. Guidelines for reintroducing endangered species into the wild. *BioScience* Vol. 39. No.3. pp. 152-161
Klein R.2007. Status Report for the Cheetah in Botswana. Cat News Special Issue 3. Pp.14-21
Kruger J.E. 1988. Interrelationships between the larger carnivores of the Klaserie Private Nature Reserve, with special reference to the leopard *Panthera pardus* (Linnaeus, 1758) and the cheetah *Acinonyx jubatus* (Schreber, 1775). MSc thesis, University of Pretoria.

Labuschagne W. 1981. Aspects of Cheetah Ecology in the Kalahari Gemsbok National Park: 36th Annual Conference Int. Assoc. Zoo Directors. – Washington, D.C.
Laurenson M.K. 1994. High juvenile mortality in cheetahs (Acinonyx jubatus) and its consequences for maternal care. Journal of Zoology 234: 387-408
Lindsey P.A., du Toit, J., Mills M.G.L. 2005. Attitudes of ranchers towards African wild dogs Lycaon pictus: Conservation implications for wild dogs on private land. Biological Conservation 125, 113–121
Lindsey P.A., Roulet P., Romañach S. 2007. Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa. Biological Conservation 134, 455–469
Lindsey P.A., Davies-Mostert H.T. (editors). 2009a. South African Action Plan for the Conservation of Cheetahs and African Wild Dogs. Report from a National Conservation Action Planning Workshop, Bela Bela, Limpopo Province, South Africa, 17-19 June 2009
Lindsey P., Marnewick K., Davies-Mostert H., Rehse T., Mills M.G.L., Brummer R., Buk K., Traylor-Holzer K., Morrison K., Mentzel C.,Daly B. (editors). 2009b. Cheetah (Acinonyx jubatus) Population Habitat Viability Assessment Workshop Report. Conservation Breeding Specialist Group (SSC/IUCN/CBSG Southern Africa. Endangered Wildlife Trust
Lindsey P.A., Romañach, S.S. and Davies-Mostert, H.T. 2009c. A Synthesis of Early Indicators of the Drivers of Predator Conservation on Private Lands in South Africa. In: Reintroduction of Top-Order Predators, 1st edition. Edited by M.W. Hayward and M.J. Somers. 2009 Blackwell Publishing. Pp.321-344.
Linnell J.D.C., Aanes R., Swenson J.E., Odden J., Smith M.E. 1997. Translocation of carnivores as a method for managing problem animals: A review. Biodiversity and Conservation 6, 1245–1257
Marnewick K., Beckhelling A., Cilliers D., Lane E., Mills M.G.L., Herring K., Caldwell P., Hall R., Meintjes S. 2007. The status of the Cheetah in South Africa. In: Breitenmoser, C. & Durant, S. (Eds). The Status and Conservation Needs of the Cheetah in Southern Africa. Cat News Special Edition
Marnewick K., Matt W. Hayward Deon Cilliers, Somers M.J. 2009. Survival of cheetahs relocated from ranchland to fenced protected areas in South Africa. In: Reintroduction of Top-Order Predators, 1st edition. Edited by M. Hayward and M. Somers. Wiley-Blackwell Publishing, Oxford. Pp.282-306.
Marker L.L. 2003. Aspects of Cheetah (*Acinonyx jubatus*) Biology, Ecology and Conservation Strategies on Namibian Farmlands: PhD. dissertation, University of Oxford. - UK, Oxford,.- 475p
Marker L. 2005. Conservation of the Cheetah in Namibia. Cheetah Conservation Fund. Annual Progress report. Otjiwarongo, Namibia
Marker L. 2007. Conservation strategy for the long-term survival of the cheetah. Cheetah Conservation Fund. Year End Report 2007. Otjiwarongo, Namibia
Marker L. 2009. Conservation strategy for the long-term survival of the cheetah. Cheetah Conservation Fund. Year End Report 2009. Otjiwarongo, Namibia
Marker L. 2010. Cheetah Conservation Fund 2010 Progress report. Namibia
Marker, L.L., Dickman, A.J., Jeo, R.M., Mills, M.G.L. & Macdonald, D.W. 2003a. Demography of the Namibian cheetah, *Acinonyx jubatus jubatus*. Biological Conservation 114, 413–425
Marker L., Mills M.G.L., Macdonald D. 2003b. Factors influencing perceptions of conflict and tolerance toward cheetahs on Namibian farmlands. Conservation Biology 17:1290–1298
Marker L., Dickman A., Wilkinson C., Schumann B., Fabiano E. 2007. The Namibian Cheetah: Status Report. Cat News Special Issue 3. Pp.4-13
Marker L.L., Dickman A.J., Mills M.G.L., Jeo R.M., Macdonald D.W. 2008. Spatial ecology of cheetahs on north-central Namibian farmlands. Journal of Zoology, 274, 226-238
McDougall P. T., D.R´eale, Sol D., Reader S.M. 2006. Wildlife conservation and animal temperament: causes and consequences of evolutionary change for captive, reintroduced, and wild populations. The Zoological Society of London. Animal Conservation 9:39–48
McVittie R. 1979. Changes in the social behaviour of the South West African cheetah. Madoqua.11: 171-184
Mills M.G.L. 1984. Prey selection and feeding habits of the large carnivores in the southern Kalahari. Supplement to Koedoe 1984: 281-294
Mills M.G.L. 1991. Conservation management of large carnivores in Africa. Koedoe 34(1): 81-90

Mills M.G.L., Broomhall L.S., du Toit J.T. 2004. Cheetah (*Acinonyx jubatus*) feeding ecology in Kruger National Park and a comparison across African savanna habitats: is the cheetah only a successful hunter on open grassland plains? Wildife Biology 10 (3): 177 - 186

Moritz C. 1999. Conservation units and translocations: Strategies for conserving evolutionary processes. Hereditas 130, 217–228

Orford H.J.L, Perrin MR. 1988. Contraception, reproduction and demography of free-ranging Etosha lions (*Panthera leo*). J. Zool. 216: 717-733

Orser R. 2009. Habitat Preference and Home Range of Reintroduced Cheetahs (*Acinonyx jubatus*) in Mkhuze Game Reserve, South Africa. Mount Allison University, Canada. 43 pp.

Pienaar U. De V. 1969. Predator-prey relationships amongst the larger mammals of the Kruger National Park. Koedoe 12: 108-176

Pettifer H.L. 1981a. Aspects of the ecology of cheetah (Acinonyx jubatus) on the Suikerbosrand Nature Reserve. In: Chapman, J.A. & Pursley, P. (eds) Worldwide Furbearers Conference Proceedings 2:1121-1142

Pettifer H.L. 1981b. The experimental release of captive-bred cheetah into the natural environment. Worldwide Furbearer Conference. Pp. 1001-1024.

Pettifer H.L.1981c. The ecology of the cheetah on the Suikerboard Nature Reserve. Transvaal Provincial Administration. Nature Conservation Division. Second progress report. July 1980. 27 p.

Pettifer H.L., Muller J.I.J., De Kock J.P.S., Zambatis N. 1982. The experimental relocation of cheetahs from the Suikerbosrand Nature Reserve to the Eastern Transvaal Loweld. Transvaal Provincial Division of Nature Conservation. Hans Hoheisen Wildlife Research Station. Second progress report. December 1982. 7pp.

Phiri C.M. 1996. Cheetah Translocation Project in Lower Zambezi National Park, Zambia. National Parks and Wildlife Service. Zambia. 4pp.

Purchase G.K. 1998. An assessment of the success of a cheetah re-introduction project in Matusadona National Park [dissertation]. Department of Biological Sciences, University of Zimbabwe, Harare, Zimbabwe. 127 p

Purhcase G. K. 2007. Preliminary assessment of the status and distribution of cheetahs in Mozambique. Cat News Special Issue 3, 36-38

Purchase G.K., Du Toit J.T. 2000. The use of space and prey by cheetahs in Matusadona National Park. Zimbabwe. South African Journal Wildlife Research 30: 1-6

Purchase GK, Vhurumuku G. 2005. Evaluation of a wild-wild translocation of cheetah (*Acinonyx jubatus*) from private land to Matusadona National Park, Zimbabwe (1994-2005) Harare, Zimbabwe: Zambesi Society. 32 pp.

Rout T.M., Hauser C.E., Possingham H.P. 2007. Minimise long-term loss or maximise short-term gain? Optimal translocation strategies for threatened species. ecological modeling 201 (2007) 67–74

Rowe-Rowe D.T. 1992. The Carnivores of Natal. Natal Parks Board, Pietermaritzburg, 31pp.

Saunders D.A, Hobbs R.J, Margules C.R. 1991. Biological consequences of ecosystem fragmentation: a review. Conserv Biol; 5(1): 18-32

Scheepers J.L, Venzke K.A.E. 1995. Attempts to reintroduce African wild dogs Lycaon pictus into Etosha National Park, Namibia. SA J Wildl Res; 25(4): 138-140

Somers M.J., Gusset, M. 2009. The role of social behaviour in carnivore reintroductions. In: Reintroduction of Top-Order Predators, 1st edition. Edited by M. Hayward and M. Somers. 2009 Wiley-Blackwell Publishing, Oxford. pp.270-281.

Soorae P. S. (ed.) 2010. Global re-introduction perspectives: Additional case-studies from around the globe. IUCN/SSC Re-introduction Specialist Group, Abu Dhabi, UAE, xii + 352 pp

Soorae P.S., Stanley Price, M.R., 1997. Successful re-introductions of large carnivores-what are the secrets? Paper presented at the 11th International Conference on Bear Research and Management, Graz, Austria

Soorae P. S., Seddon P. J. (Eds). 1998. Re-introduction Practitioners Directory. Published jointly by the IUCN Species Survival Commission's Re-introduction Specialist Group, Nairobi, Kenya, and the National Commission for Wildlife Conservation and Development, Riyadh, Saudi Arabia. 116 pp.

Stander P.E. 1990. A suggested management strategy for stock-raiding lions in Namibia. South African Journal of Wildlife Research. 20: 37-43

Stander P.E. 2003. The Ecology of Lions and Cheetahs Re-introduced to the Kalahari Game Lodge, Namibia. PCT Research Paper No.2 December 2003. Predator Conservation Trust. Windhoek, Namibia. 12 pp.

Teixeira C.P., De Azevedo C.S., Mendl M., Cipreste C.F.,Young R.J.2007. Revisiting translocation and reintroduction programmes: The importance of considering stress. Animal Behaviour 73, 1–13

Temple H.J. Cuttelod A. (Compilers). 2009. The Status and Distribution of Mediterranean Mammals. Gland, Switzerland and Cambridge, UK:IUCN. 33pp.

Van Dyk G. 1997. Reintroduction techniques for lion (Panthera leo). In: Lions and Leopards as Game Ranch Animals. Edited by Penzhorn BL. Onderstepoort, South Africa: SAWVA. 82-91

Van Houtan K.S., Halley J.M., van Aarde R., Pimm S.L. 2009. Achieving success with small, translocated mammal populations. Conservation Letters 2:254–262

Vickery S.S., Mason G.J., 2003. Behavioural persistence and its implication for reintroduction success. Ursus 14, 35–46

Wilson V. J. 2006. Capture and translocation of problem Cheetahs, Leopards and Brown hyaenas found killing domestic livestock and the monitoring of their movements after release back into the wild. In: Up-date of all Research Projects. Carnivore Research Institute (CRI). Chipangali Wildlife Trust. December 2006. P.4

Wolf C.M., Griffith B., Reed C., Temple S.A., 1996. Avian and mammalian translocations: update and reanalysis of 1987 survey data. Conserv. Biol. 10, 1142–1154

Wolf C.M., Garland J.T., Griffith J.B., 1998. Predictors of avian and mammalian translocation success: reanalysis with phylogenetically independent contrasts. Biological Conservation 86: 243-255

Woodroffe D. 2000. Predators and people: using human densities to interpret declines of large carnivores // Animal Conservation. No 3. – P. 165-173.