

5.Summary

Reproductive activity in cheetah females, cub survival and health of male and female cheetahs on Namibian farmland

This doctoral thesis presents and discusses several aspects of the reproduction and health of free-ranging and captive Namibian cheetahs.

Chapter 1 gives a general introduction to the issue of low levels of genetic variability in cheetahs and presents an overview on the discussion of whether the low reproductive performance, high juvenile mortality and high susceptibility to infectious diseases found in captive cheetahs is due to the genetic monomorphism or rather to inappropriate husbandry and management conditions. This question is not only relevant for husbandry management but also for conservation activities concerning free-ranging cheetahs. By studying both, the large free-ranging cheetah population on Namibian farmland and captive cheetahs kept on Namibian farmland in their natural habitat, it was possible to test predictions derived from hypotheses on reproductive activity, cub survival, health and sero-prevalence of viral antibodies in cheetahs.

Chapter 2 deals with reproductive success and failure in cheetahs. Firstly, the reproductive status of 15 free-ranging and nine captive female cheetahs was investigated using the minimally invasive technique of ultrasonography. Females were allocated to different reproductive states, i.e. pro-oestrous, oestrous, di-oestrous, a luteal phase or reproductive inactivity. Adult free-ranging females were significantly more often in a reproductively active state than captive ones. This suggests that the genetic monomorphism of the species is unlikely to be responsible for breeding failures in captivity but rather captivity itself. In the second part of Chapter 2 breeding success of free-ranging cheetah females assessed and compared with published results from the Serengeti National Park, Tanzania. While cub survival in Tanzania is very low (5 %), which is mainly due to predation by other large carnivores (Laurenson 1994), it was 4.7 times higher on Namibian farmland, where most other large predators had been eradicated. Also, average litter size at the age of 14 months, i.e. shortly before independence, was 67% higher in Namibia than in Tanzania.

In Chapter 3 three possible mechanisms for the above-described differences in reproductive activity between free-ranging and captive females were investigated. Firstly, it was tested whether the high incidence of reproductive inactivity in captive females was caused by chronic stress due to captivity. For

this, the sizes of the adrenal glands were measured in free-ranging and captive cheetah females using ultrasonography. The size of the adrenal glands is a suitable indicator of “stress” as they respond to the constant production of large amounts of corticosteroids with enlargement. No difference in adrenal gland sizes were detected, suggesting that the reproductive inactivity in captive female cheetahs is unlikely to be caused by the suppression of reproductive activity owing to increased production of glucocorticoids. Secondly, it was tested whether the reproductive inactivity in captive females was triggered by an endogenous circannual rhythm triggered by the onset of the rainy season. However, no relationship between the incidence of reproductive inactivity and climatic conditions were found, making it unlikely that reproductive inactivity is triggered by environmental conditions. Thirdly, in captive females, significantly more genital pathologies were detected than in free-ranging females. The occurrence of these pathologies was mostly found in older, nulliparous captive female. This result is consistent with the model of ‘asymmetric aging’, suggesting an accelerated aging of the reproductive organs in non-breeding captive females compared to breeding free-ranging females due to the continuous maturation of follicles, ovulation and luteal phases of the former. During this asymmetric aging process, the reproductive organs are likely to develop pathologies and at the end of the process ovaries might turn into irreversible acyclicity.

In Chapter 4 sixty-one free-ranging male and female cheetahs on Namibian farmland were investigated for symptoms of acute viral infections. Only one of the cheetahs showed symptoms, i.e. diarrhoea, that might have been related to a viral infection. Most cheetahs were in a good health status, suggesting that the cheetahs’ immunocompetence does not limit their capacity to respond effectively to challenges posed by viral infections. A serosurvey of 67 free-ranging cheetahs for FHV, FCV, FPV, FCoV, CDV, FeLV, FIV and rabies revealed that antibody prevalences were low, ranging between 0 % and 4.5 % to any of these viruses. Samples from free-ranging leopards, caracals and jackals revealed antibodies for one or more of these viruses, suggesting that any or all of these species might act as pathogen transmitters to the free-ranging cheetah population. Sero-prevalences for FHV, FPV and CDV were higher in captive cheetahs than in free-ranging cheetahs, which might be due to the accumulation of antigens inside the enclosures and/or heightened exposure to domestic animals that may act as pathogen transmitters. This suggests that captivity rather than the genetic monomorphism of cheetahs has also an impact on the health of cheetahs. Detailed analyses on the nutritional status and body mass index of free-ranging males and females revealed that adult females were in a worse nutritional status and had a lower body mass index than adult males. Compared to free-ranging cheetah females in Tanzania (Caro et al. 1987), where an analysis of published data revealed no difference in body mass index between the sexes, Namibian

cheetah females might carry higher energetic costs than Tanzanian females because they raise more offspring than the latter. This might result in a worse nutritional status and a lower body mass index of Namibian females than in Namibian males.

References

Caro,T.M., Holt,M.E., Fitzgibbon,C.D., Bush,M., Hawkey,C.M. & Kock,R.A. 1987. Health of adult free-living cheetahs. *Journal of Zoology London* 212, 573-584.

Laurenson,M.K. 1994. High juvenile mortality in cheetahs (*Acinonyx jubatus*) and its consequences for maternal care. *Journal of Zoology London* 234, 387-408.