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Abstract: Five North American zoos, each having produced at least six litters at the time the survey was made, were examined and compared. A husbandry questionnaire was used which included questions concerning enclosure types, exposure to other animal species, diet, social groupings, oestrus behaviour, parturition and maternal care.

ENVIRONMENTAL FACTORS INFLUENCING  
CAPTIVE REPRODUCTION OF CHEETAHS

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Supplement to the AAZPA Cheetah SSP Husbandry Protocol

The propagation of captive cheetahs has been a challenging endeavor since man began keeping these cats thousands of years ago. Despite the desire to maintain self-perpetuating colonies of cheetahs, few facilities have achieved more than limited success.

In the wild, where encroachment and habitat destruction are the cheetah's primary enemies, infertility is not a significant factor in their population decline. It follows, then, that there must be deficiencies in captive environmental conditions and/or husbandry techniques which have resulted in a population of non-breeding animals.

Some of the common problems that cheetah breeders have dealt with over the years include the following:

- 1) Difficulty identifying estrus. A cycling female may show no behavioral signs of estrus.
- 2) Unpredictable cycles. There is no seasonal or other detectable pattern to help predict when estrus may occur.
- 3) Mate selection. Both males and females can show strong mate preferences, and even if a female shows estrus behavior, breeding may not occur.
- 4) Limited fertile years. The average female may have less than seven fertile years to produce cubs based on their limited average life span of 9 years in captivity.
- 5) Infant mortality. 42% of all cubs born do not survive beyond 30 days.
- 6) Male infertility. Males have been shown to have a high sperm abnormality rate and low sperm count. This should be considered when evaluating potential fertility of captive populations.

In order to determine which captive environmental conditions are necessary for successful reproduction, data from the 1988 husbandry survey were analyzed to determine which management procedures and environmental conditions were common to successful breeding programs. This information may help provide guidelines for other facilities wishing to enhance their opportunities for cheetah reproduction.

Five North American zoos, each having produced at least six litters at the time the survey was made, were examined and compared. Facilities studied were: Wildlife Safari (22 litters), San Diego (17 litters), Columbus (16 litters), Cincinnati (7 litters) and St. Louis (6 litters).

The cheetah husbandry questionnaire included questions concerning enclosure types, exposure to other animal species, diet, social groupings, estrus behavior, parturition and maternal care. These categories will be examined individually, in this article. For a detailed summary of the survey on husbandry and reproduction of the cheetah, refer to Part I in the Cheetah Husbandry Manual (Pages 1-5).

### Enclosures and Furnishings

Enclosure dimensions were difficult to compare and evaluate because some respondents gave individual dimensions of pens and others gave the size of the total area. In general, all five facilities had a rather large outside area devoted to cheetahs, ranging from approximately  $\frac{1}{2}$  acre in Cincinnati to 12 acres at the San Diego Wild Animal Park.

Utilization of the available space may influence the effectiveness of the facility. For example, a facility with several smaller enclosures in various parts of the zoo with a system to easily introduce and separate the animals could in effect, provide as much usable space as some larger facilities.

The fencing materials listed were chain link, cyclone or woven wire. Substrate in the outdoor enclosures have been either natural vegetation,

planted grasses or leaf litter.

Each of the facilities provided some sort of "cubbing den" with either wooden or concrete floors. All of the animals were allowed into outside yards except for cubs born during the winter at Columbus. All were given straw or hay as nesting materials and with the exception of Winston, provided with artificial heat in the nest boxes. All of the facilities, except Winston, have one-way glass or video observation but these helpful features may not have been available throughout the entire period of successful reproduction. Another unique feature about Winston is that the public is allowed to drive through the enclosures in cars.

#### Exposure to other Species

Three of the five facilities housed their cheetahs out of visual and olfactory range of from other African carnivores. Two facilities housed cheetahs in enclosures adjacent to other carnivores. All of the facilities housed some hoofstock in the same general area.

#### Diet

Winston was the only facility which reported feeding their cheetahs exclusively on a carcass diet consisting of venison, beef, and horsemeat. The other facilities provided Nebraska or Wisconsin brand commercial diets as the main provisions. San Diego has been switching to a higher percentage of carcasses including calves, rabbits, fryers and goats. Several other facilities have also been experimenting with improving cheetah diets so those mentioned may not be consistent with those diets fed throughout the facility's reproductive years.

Live food was reported to have been rarely, if ever offered, but several zoos stated that cheetahs would sometimes kill and eat squirrels, rabbits or

birds which they opportunistically caught in their enclosures.

All the facilities except San Diego reported giving a vitamin/mineral supplement. San Diego is now experimenting with nutritional supplements as a precautionary measure.

Cincinnati was the only facility which did not mention the inclusion of bones as part of their diet.

### Social groupings

The answer to "How many animals are kept together in an exhibit?" was interpreted in different ways. The "exhibit" could mean: an enclosure for a mother with cubs, a public viewing area, or an off-exhibit breeding area. In any case, there was no clear cut answer to how many were housed together for breeding purposes. Some of the responses were qualified with answers such as "depends" or "varies".

One cheetah management technique consistent in all the breeding facilities was periodic rotation or introductions of new animals. The introductions were made when either estrus was suspected or when a group or pair became too "habituated" to one another. At Winston, four males were rotated with the females in sets of two.

Behavioral signs of estrus included vocalizing by the male and/or female, rolling or urine marking by the female or active social interaction between a pair.

### Parturition and maternal care

All of the facilities reported doing some type of reproductive research. These procedures ranged from behavioral observation only to more technical procedures such as artificial insemination and monitoring female cycles

through blood, urine or fecal samples. Cycles were also monitored through vaginal.

The main clue to impending labor listed by each facility was loss of appetite. Restless behavior was another sign mentioned. Females were usually separated from the males as soon as mating was confirmed or pregnancy was suspected. Some remained with the male for up to two weeks before parturition. All of the facilities minimized disturbances and limited human contact for the first few days after parturition. Some of the facilities offered more variety or quantity of food to the mother then before the pregnancy.

Based on the data we have accumulated so far, the following factors appear to be important for a successful breeding program.

- 1) "Total available area" is important in the sense that there needs to be sufficient space to separate animals at will, neutral areas for introductions and separate areas for mothers with cubs. There should be a system whereby the cheetahs can easily be rotated.
- 2) All successful facilities agree that novel situations can stimulate breeding interest. This includes the introduction of new animals or movement to new enclosures. Even situations such as noisy machinery or live prey have been reported to stimulate breeding activity.
- 3) It is advantageous to work with several males and females in a program. This provides various pairing combinations and increases the chances of the animals finding suitable mates. Sometimes breeding activity from one pair will stimulate interest from others.
- 4) If breeding is not taking place, pairs or groups should be rotated regularly and new combinations attempted. Cheetahs can become habituated to each other which often results in loss of sexual interest.
- 5) Since cubs are produced throughout the year (with a slight peak in

October) breeding efforts should be continued through each season to maximize reproductive potential.

6) Some facilities believe that male competition for the female plays an important role in the mating process. However, most cheetah caretakers agree that males should be introduced to the females separately to avoid injuries due to aggression and prevent uncertain paternity of cubs.

7) Each successful facility mentioned housing hoofstock or other prey animals close to the cheetahs. Desmond Varaday, a private breeder in South Africa reported that after keeping cheetahs for several years without any reproduction, several litters were born soon after domestic livestock were moved to an adjacent enclosure. Since the livestock were introduced, there have been over 100 cubs born at his facility.

8) Any diet which comes close to a cheetah's natural diet would be optimum for maintenance of a generally healthy state. It has been shown that proper texture is important to dental and oral health.

9) It is necessary to remove the males from a female before she gives birth. Infanticide has also occurred when males in adjacent enclosures have access to cubs through the fence.

10) A next box shelter should be available in a maternity pen with heat provided if necessary. The De Wildt facility in South Africa had an infant mortality rate of 48% in its early years due to poor maternal rearing. After the installation of new huts with heated floors, the maternal care improved dramatically and the mortality rate was reduced to only 11%.

One important additional factor which is common to all the successful



breeding facilities is the continual commitment and interest of the caretakers and managers. Cheetahs require an extensive management program to achieve the goal of self-sustaining captive populations.