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Wildlife Research

Comparison of 2 behavioral sampling methods to establish a time budget in a captive female cheetah (*Acinonyx jubatus*)Cintia Munita^a, Tamara A. Tadich^b, Cristóbal Briceño^{a,*}^a Departamento de Medicina Preventiva Animal, Facultad de Ciencias Veterinarias y Pecuarias, Universidad de Chile, La Pintana, Santiago, Chile^b Departamento de Fomento de la Producción Animal, Facultad de Ciencias Veterinarias y Pecuarias, Universidad de Chile, La Pintana, Santiago, Chile

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ABSTRACT

Behavioral studies of wild animals kept in captivity provide useful information for conservation programs and animal welfare. These studies can also be time and resource consuming. For this reason, the aim of this study was to develop an ethogram for a semi-imprinted cheetah, during lactation and kept in captivity, and to compare 2 behavioral sampling methods to construct a time budget. During the first 34 days of the study, *ad libitum* sampling was used for describing observed behaviors, which allowed development of an ethogram. During the following 30 days, focal sampling with continuous recording and focal sampling with time sampling (instantaneous sampling) every 60 seconds, aided by 3 cameras, was applied to determine the behavioral time budget. An ethogram composed of 8 categories and 22 behaviors was developed. The cheetah allocated most of her time to resting while lying down with her cubs, the most frequent behavioral category assessed by both methods. Pearson's correlation was significant ($P < 0.05$) for 11 of the 22 behaviors, but only 2 presented a moderate correlation according to the r value (pacing and eating chicken). Allocophagia and pacing with cubs were behaviors described for the first time in cheetahs. These behaviors could be indicative of the inability to perform basic, normal behaviors and may represent a welfare concern. For future studies, the use of cameras located in previously detected areas of use with continuous recording could provide the best method for behavioral studies in captive felids.

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Introduction

Behavioral time budgets can provide important information about the welfare of wild animals kept in captivity when compared with time budgets under natural conditions. Such comparisons allow implementation of environmental enrichment programs, provide understanding about which behaviors should be promoted, and alert caregivers to the development of abnormal behaviors such as stereotypies.

The use of an ethogram is necessary for the evaluation of any animal's time budget (McDonnell, 2003). The behavioral sampling method to be used will depend if we are observing one individual, a group of animals, or a specific behavior. Furthermore, behaviors can

be recorded continuously or at intervals (Martin and Bateson, 2007). Video cameras can also aid behavioral studies, since they allow researchers to review images over time and detect short event behaviors. Choosing a behavioral sampling method for the construction of a time budget can be time consuming and costly, but is crucial when designing behavioral studies.

Cheetahs (*Acinonyx jubatus*) have behavioral, energetic, and intraspecific characteristics that contribute to their low population density (Gros, 2002). The current free-ranging population is probably less than 10,000 mature individuals, being classified as vulnerable in the red list of the International Union for Conservation of Nature (Durant et al., 2015). The poor reproductive performance of cheetahs in captivity has been associated with the behavior and management of the species (Wielebnowski et al., 2002). Researchers working with reproduction of endangered species, such as cheetahs, are usually hampered by limited resources, practical difficulties, and challenging environments (Wildt et al., 2003). Such programs could benefit from behavioral studies to improve the conditions in which cheetahs are kept, which results

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in improved fitness and welfare of these animals (see Chadwick et al., 2013; Quirke and O’Riordan, 2011; Quirke et al., 2012; Wielebnowski et al., 2002). To use assets efficiently, methodology must match goals. For this reason, the aim of this study was to develop an ethogram for a semi-imprinted captive cheetah, and then compare 2 behavioral sampling methods, to determine their practical advantages.

Material and methods

The study was conducted at Cheetah Experience, located in Bloemfontein, Republic of South Africa. The subject of study was a female cheetah of 7 years of age, semi-imprinted, and nursing 2 cubs. The female cheetah was kept in an enclosure of 2,273 m², which included a smaller 25 m² area with a 4 m² kennel (Figure). She was provided *ad libitum* water and chicken meat delivered by park personnel 4 times per day. All food and water was provided in the smaller enclosure. Cleaning of the smallest area in the enclosure was performed daily, during which the cheetah was moved into the biggest area.

Behavioral observation

The first 34 days of the study were used to habituate the cheetah to the presence of the observer and to select the locations where cameras would be installed. During this period *ad libitum* behavior sampling was done to develop an ethogram (Table 1).

Focal sampling with 2 recording methods and 2 media were used in parallel:

- (1) Continuous recording: direct observation by one observer (the same that constructed the ethogram) was used. Exact times and duration of behaviors were registered in a notebook. Over a

period of 30 days, 3 daily observations were conducted, according to natural light availability; morning period (07:00–09:00 hours), midday period (11:00–12:00 hours), and afternoon period (15:00–17:00 hours), completing a total registration time of 7,900 minutes. Any time the cheetah was “out of sight” was also recorded.

- (2) Time sampling (instantaneous sampling): instantaneous sampling every 60 seconds was used following Wielebnowski et al. (2002) and Chadwick et al. (2013), who also observed cheetahs in captivity. The 1-minute interval allowed registering the briefest states of interest according to the observations performed during the first 34-day period. For this, 2 Pentax Optio WG-2 cameras (Pentax Corporation, Tokyo, Japan) were installed in the small area of the enclosure, and 1 security camera was installed inside the kennel. The video information was captured and stored using a digital video recorder (DVR, Provision-isr, Israel). A total of 5,636 sampling points (images), corresponding to the same sampling periods used for the continuous method, were obtained. Behaviors were registered as total frequencies of occurrence. The amount of time the cheetah was “out of sight” was also recorded.

Statistical analysis

Behavioral data, obtained using both methods during the 30-day period, was tabulated in an excel spread sheet. For the time budget, the average percentage of time allocated to each behavior and behavioral category, within the 30-day period, was calculated for each recording method.

For the comparison of the 2 recording methods, a Pearson’s correlation was applied to determine how reliable the methods were in detection and quantification of the behaviors. For these analyses, statistical software InfoStat (FCA-UNC, Argentina) was

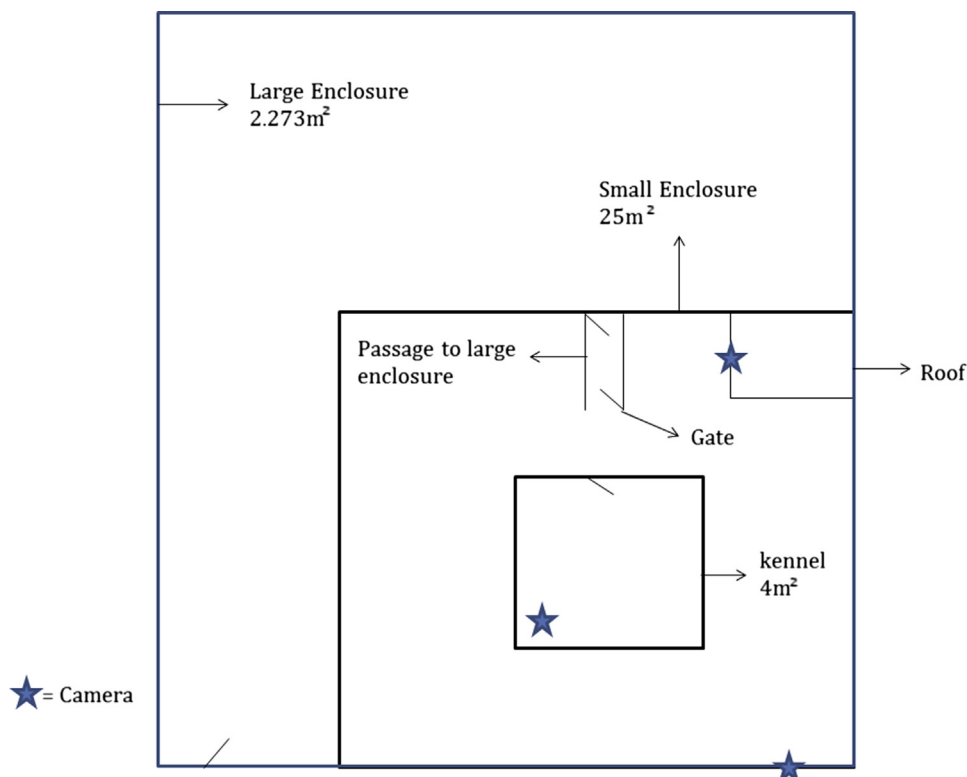


Figure. Reference layout for the cheetah’s enclosure and its dimensions at The Cheetah Experience, located in Bloemfontein, Republic of South Africa (not to scale).

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