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Abstract: Employing non-invasive management techniques for collection animals is a priority throughout the National Zoological Park (NZP). In January of 2001 staff at the NZP Cheetah Conservation Station (CCS) began weighing cheetahs on a weekly basis. Although weighing monthly is sufficient for assessing general health, we believe that monitoring weekly provides more consistent information on the cats in our collection. In addition to the health benefits of weighing cheetahs, keepers have noticed that weekly weights provide information that may be useful in determining if a female that has recently bred is actually pregnant.
Using Weight to Determine Pregnancy in Cheetahs  
(*Acinonyx jubatus*)

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Employing non-invasive management techniques for collection animals is a priority throughout the National Zoological Park (NZP). In January of 2001 staff at the NZP Cheetah Conservation Station (CCS) began weighing cheetahs on a weekly basis. Although weighing monthly is sufficient for assessing general health, we believe that monitoring weekly provides more consistent information on the cats in our collection. In addition to the health benefits of weighing cheetahs, keepers have noticed that weekly weights provide information that may be useful in determining if a female that has recently bred is actually pregnant. We know that analysis of excreted progestin metabolites in fecal samples can indicate if a female has ovulated after copulation. These data, however, cannot determine if that female is indeed pregnant until at least 70 days after the breeding date. The progestin concentrations of a cheetah that has ovulated increase above baseline by 10- to 100- fold. This level will be maintained for about 60 days (give or take several days) and then will fall back to near baseline. If fecal progestins remain at baseline for more than two or three days, then it is almost certain she has gone through a “false pregnancy”. If the cheetah is pregnant, however, the progestins will rise again around Day 65 - 70, and remain elevated until birth. The data shared in this report is not meant to suggest anything definitive. It is intended to initiate discussion about possible management strategies for a difficult species.

NZP has been attempting to breed cheetahs since 1999. As of 1 January 2005 we have had eight breeding introductions that led to successful copulations and one artificial insemination (AI) attempt. While there was confirmed intromission in all of the natural breedings, only one yielded cubs. The AI attempt did not produce cubs. All breeding activity involved some combination of the following animals:

- male studbook # 2659 (Norok) – born 21 December 1991  
- male studbook # 3304 (Amadi) – born 18 October 1994  
- female studbook # 2800 (Wandu) – born 20 March 1992  
- female studbook # 3003 (Jomu) – born 4 June 1993  
- female studbook # 4568 (Tumai) – born 19 April 2000

None of these cheetahs had bred prior to their arrival at NZP. This report will focus on the females involved in each breeding attempt and the information gathered during the suspected gestation period. It is important to note that each female’s diet was increased by 0.2 kg. at each 30-day interval of suspected pregnancy.

**Jomu**

A successful copulation between Jomu and Amadi occurred on 14 February 2000, before initiation of the weekly weighing protocol. Conception did not occur. On 25 March 2002, Jomu was artificially inseminated with freshly collected semen from Amadi after pretreatment with Norplant® to suppress ovarian activity. For the post-AI period fecal progestin data (chart J – 1) and weight information (chart J – 2) are presented. The Progestin Chart shows a clear increase in steroid concentrations, beginning shortly after the AI. The progestins dropped to near baseline just before Day 60 and remained there for over seven days. This indicates that this was a false pregnancy. The Weight Chart shows a gain of 5 kg. from her breeding weight to the weight taken after Day 60. At this point the weight stopped increasing and even dropped slightly.
Chart J - 1
Jomu post AI progestin concentrations 2002

Norplant insertion removal, and
AI -- 25, March

Day 60 -- 25, May

Chart J - 2
Jomu post AI weights 2002

Inseminated 25, March

Day 30 -- 25, April

Day 60 -- 25, May

Day 90 -- 24, June
**Wandu**

Between January 2001 and June 2004 Wandu had six breeding encounters with Norok. Two of these encounters spanned two consecutive days each and during one of the encounters there were two breedings in the same day. The encounter dates were:

17 January 2001:  
The weight information from this post-breeding period (chart W – 1) showed a weight gain of 5 kg. just before Day 60. After this peak, the weight dropped slightly and then leveled off. Wandu did not give birth, so this period was considered a false pregnancy.

![Chart W - 1](image)

17 and 18 April 2001:  
The weight information from this post-breeding period (chart W – 2) showed a small weight gain of 2 kg. at the peak around Day 70. She never showed a steady weight gain during this period and the weight she did gain could be explained by diet increase. Progestin analyses were not conducted, but it is possible she did not even ovulate after this copulation.

26 July 2001:  
The weight information from this post-breeding period (chart W – 3) showed a gain of 5 kg. at the peak just before Day 60. After this peak, the weight dropped and then leveled off. She exhibited a larger increase in weight just before Day 90, but could have been due to a scale malfunction. She did not give birth so this period was considered a false pregnancy.
10 July 2002:
There were two separate breedings between Wandu and Norok on this day. Progestin data were available for this post-breeding period (chart W - 4). An increase in progestin concentrations after breeding indicates that she ovulated. Just after Day 60 the progestin dropped to near baseline and remained there (with the exception of one spike) for over a week. This is a classic false pregnancy profile. The weight information (chart W - 5) from this false pregnancy showed a gain of 6 kg. just before Day 60 and then the weight dropped steadily through Day 90.
2 and 3 June 2003:
The scale used to weigh cheetahs was out of order from early May until early July, so the closest weighing date to breeding was about one month before. The trend shown in the weight chart (chart W – 6) from this post-breeding period still provides valuable information. The weight gain for this period continued until it peaked close to Day 90 (much later than the previous peaks). After that, her weight dropped more rapidly as well. Wandu was closed into a maternity stall on 8 September due to signs of possible parturition exhibited. When no cubs were observed and she was shifted out of that area on 13 September, keepers found three paws from a small mammal in her stall. The paws were taken to the zoo’s pathology department, which identified them as possible squirrel paws (although not with 100% confirmation). This cat has killed squirrels in the past, but in those cases she either did not eat the animal or left only the tail. There is some speculation that the paws may have been those of a cub(s) that was born (possibly a stillbirth) and then eaten, but nothing was confirmed.

18 June 2004:
The weight information from this post-breeding period (chart W – 7) showed a weight gain of 3 kg from her breeding weight to a peak just after Day 50. After this peak, the weight steadily declined and leveled off by Day 90. Wandu did not give birth so this period was considered a false pregnancy.
Tumai
On 21 August 2004 Tumai was introduced to Amadi for breeding. The weight chart for her during this post-breeding period showed a gain of 4 kg. from the breeding date to Day 60. After Day 60 her weight continued to increase for a total weight gain of 10 kg. before she gave birth on 23 November 2004 to a litter of four cubs.
In conclusion, the ability to analyze progestin concentrations in feces is a valuable tool for helping cheetah managers understand what is happening physiologically to the animals in their care. Fecal analyses can confirm that a female has ovulated after mating. Because progestins during a false pregnancy are elevated for only 1/2 to 2/3 the time of a pregnancy, it is technically possible to diagnose pregnancy based on sustained concentrations after 70 days post-breeding. Unfortunately, it takes weeks to dry fecal samples for progestin analysis. Once dried it then takes several days for the samples to be extracted and the steroids to be analyzed by enzyme immunoassay. By the time fecal progestin data are available, the female is at or very near the end of her gestation period. So while progestin testing is important, the information it provides is primarily useful as a hindsight tool. Ultrasound is another technique that is sometimes used to diagnose pregnancy in recently bred cheetahs. If a facility has a female that is conditioned to and will not be severely stressed by an ultrasound procedure, and the veterinary staff are trained to conduct such an examination, then it is a reliable means of diagnosing pregnancy.

The weight information reported in this paper suggests there are significant weight gains up to Day 60 or so of a false pregnancy, and at that point the weight levels off or begins to drop. There were only two occasions during which the weight gains continued past Day 60. One of those cases was a confirmed pregnancy and the other presented some question about conception. After reviewing the weight charts in this report, it can be suggested that there is merit in further investigating the ability of using weight data to determine if a female cheetah is pregnant. Like fecal progestin testing, weighing is noninvasive and nonstressful, but weighing is simple and yields real time data. Thus, in the long term weekly weighing may be useful for assessing pregnancy status and an important tool for managers involved in cheetah breeding programs.

Cheetah
By Luke Hunter, PhD. and Dave Hamman, Photographer, 2005
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I was excited to receive and review this book as I have traveled to Africa and participated in Cheetah Conservation. When I received this book it looked like the perfect “coffee table” book. Unfortunately, I have no coffee table and do not drink coffee. There is more to this book then just looks, although one could definitely just sit and page through the incredible photography of Dave Hamman and others. I thoroughly enjoyed the creative layout of the book. The book combines photography, art, interesting facts and field notes. Boxed in questions and interesting facts draw you into wanting to read more.

The book has seven chapters. The first two chapters cover the cheetah in history and the evolution of the cheetah. Cheetahs were popular and easily trained and their connection to humans is quite interesting. Their distribution changed drastically throughout their history, thus leading to their decline. Did you realize that the cheetah may have lived in North America? After doing a little bit of research in Namibia, I remember thinking that this was quite interesting. Can you imagine seeing cheetah running around the grasslands of North America?

In chapters three, four and five the author discusses social and ranging behavior, reproduction and parenting, and hunting. Once thought to be solitary, males actually form coalitions where male siblings will stay together throughout their life. He also discusses cannibalism in cheetah, and how reproduction in captivity contrasts to wild cheetah. And finally how do cheetah hunt, what do they hunt, and do they cooperate when they hunt? Throughout these three chapters the author brings you into the field with segments from his field notes which I enjoyed reading.

What threats face the Cheetah? Genetic diversity, predators and competitors, and humans all pose threats. The authors’ final chapter discusses the future and survival of the cheetah. The author also lists the top spots to see cheetah, tourism being an important means in protecting wildlife.

I would highly recommend this book to both the lay person and the professional. For those that do not know much about the cheetah, it gives thorough information creatively laid out that does not bog you down into reading just plain text. As a professional I believe it is a great resource. If you do not like to read much, the book is worth getting for the fantastic photography alone.