

Using weight to determine pregnancy in cheetahs (*Acinonyx jubatus*)

By

Craig Saffoe, senior cheetah keeper
National Zoological Park
Washington, DC

Employing non-invasive management techniques for collection animals is a priority throughout the National Zoological Park (NZN). In January of 2001 staff at the NZN 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 who has recently bred is actually pregnant. We know that analysis of excreted progesterone 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 progesterone 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 progesterone remain at baseline for more than 2 or 3 days, then it is almost certain she has gone through a "false pregnancy". If the cheetah is pregnant, however, the progesterone 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.

NZN 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 NZN. 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 progesterone data (chart J – 1) and weight information (chart J – 2) are presented. The Progesterone chart shows a clear increase in steroid concentrations, beginning shortly after the AI. The progesterone dropped to near baseline just before day 60 and remained there for over 7 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

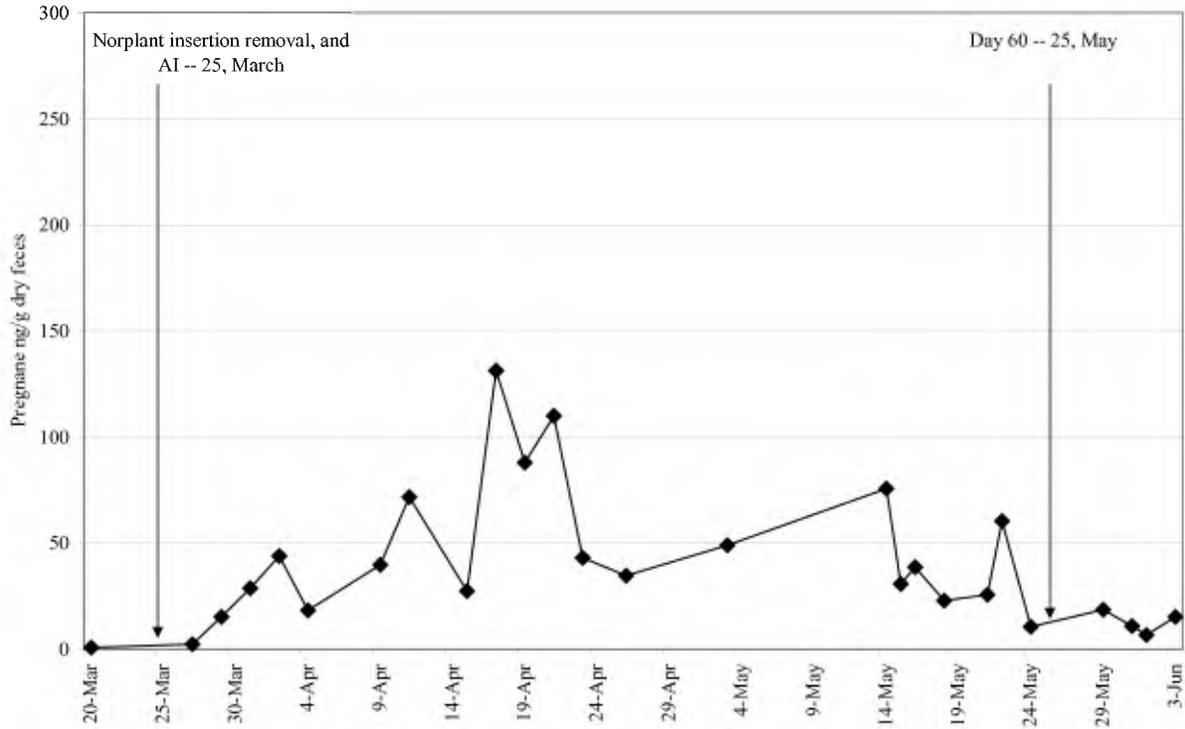
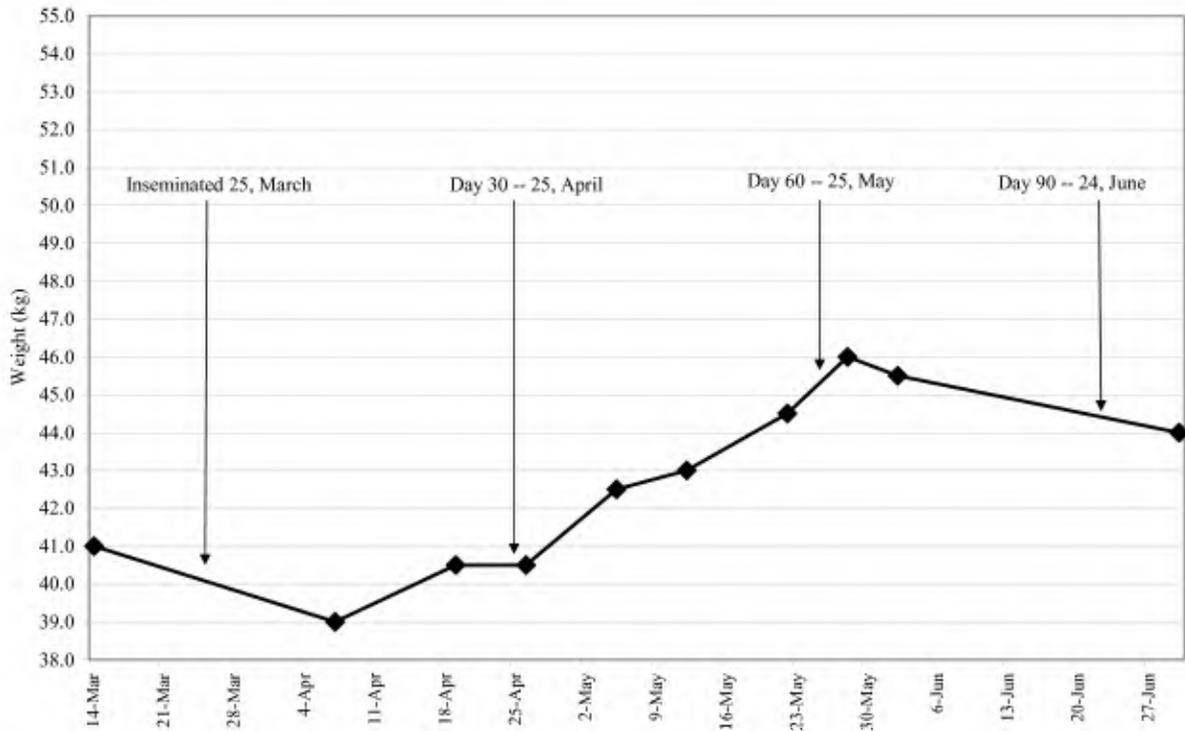


Chart J - 2

Jomu post AI weights 2002



Wandu

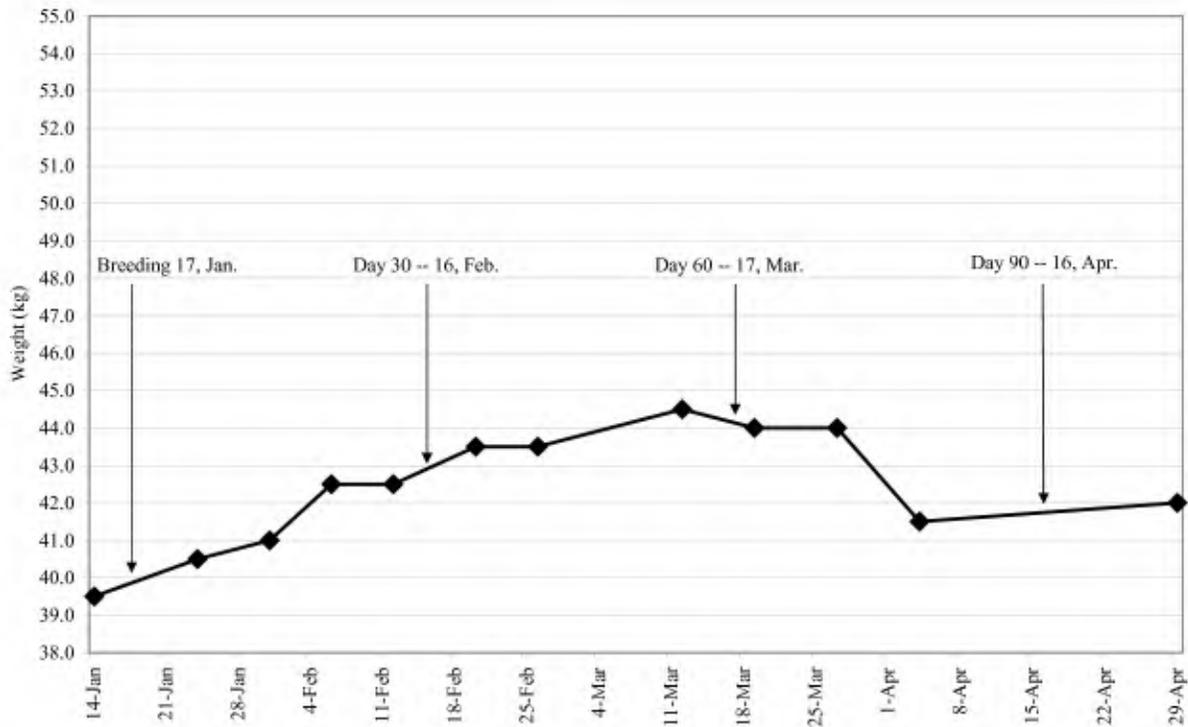
Between January 2001 and June 2004 Wandu had six breeding encounters with Norok. Two of these encounters spanned two consecutive days each and during one of the encounters there were two breedings in the same day. The encounter dates were:

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

Wandu post breeding weights (breeding #1) 2001

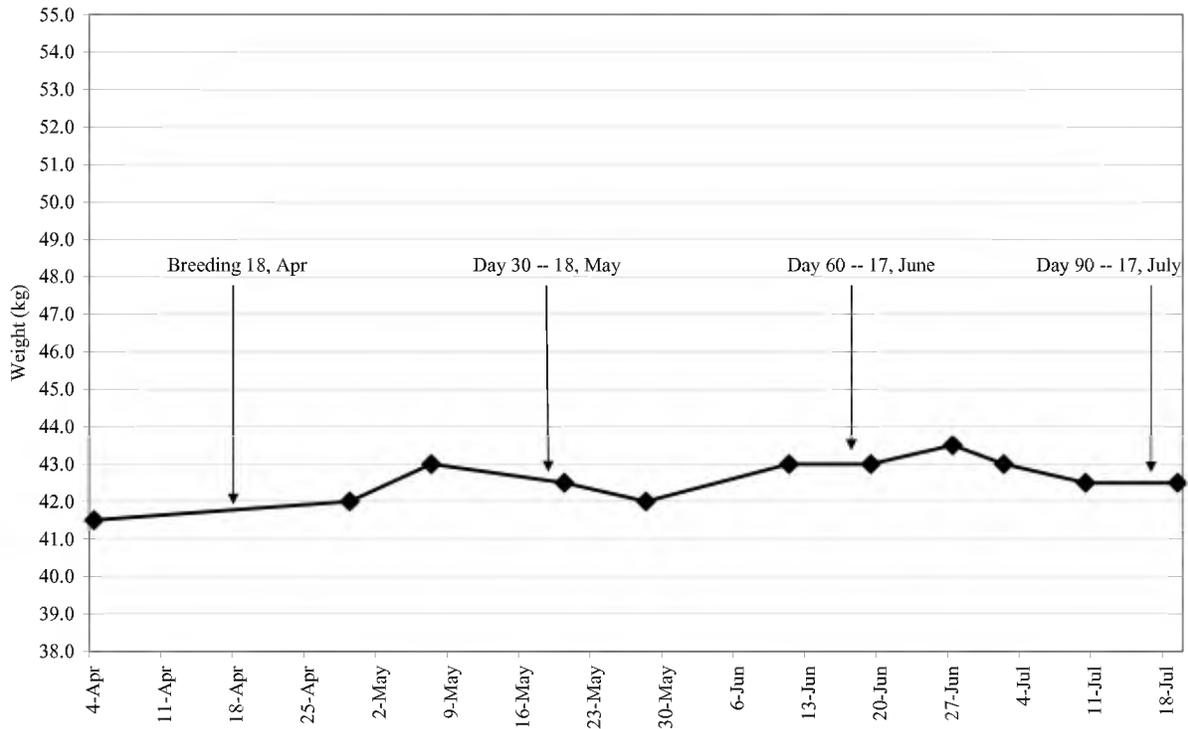


17 and 18 April 2001:

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.

Chart W - 2

Wandu post breeding weights (breeding #2) 2001

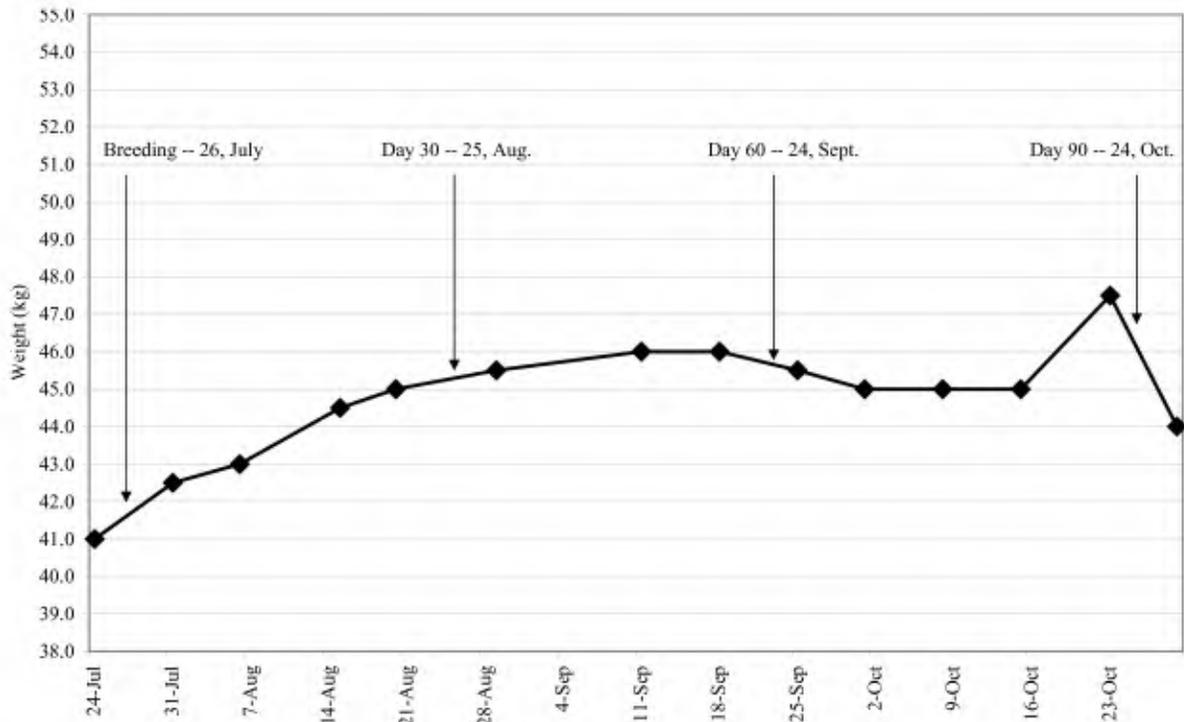


26 July 2001:

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.

Chart W - 3

Wandu post breeding weights (breeding #3) 2001



10 July 2002:

There were two separate breedings between Wandu and Norok on this day. Progesterone data were available for this post-breeding period (chart W - 4). An increase in progesterone concentrations after breeding indicates that she ovulated. Just after day 60 the progesterone 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.

Chart W - 4

Wandu post breeding progestin concentrations 2002

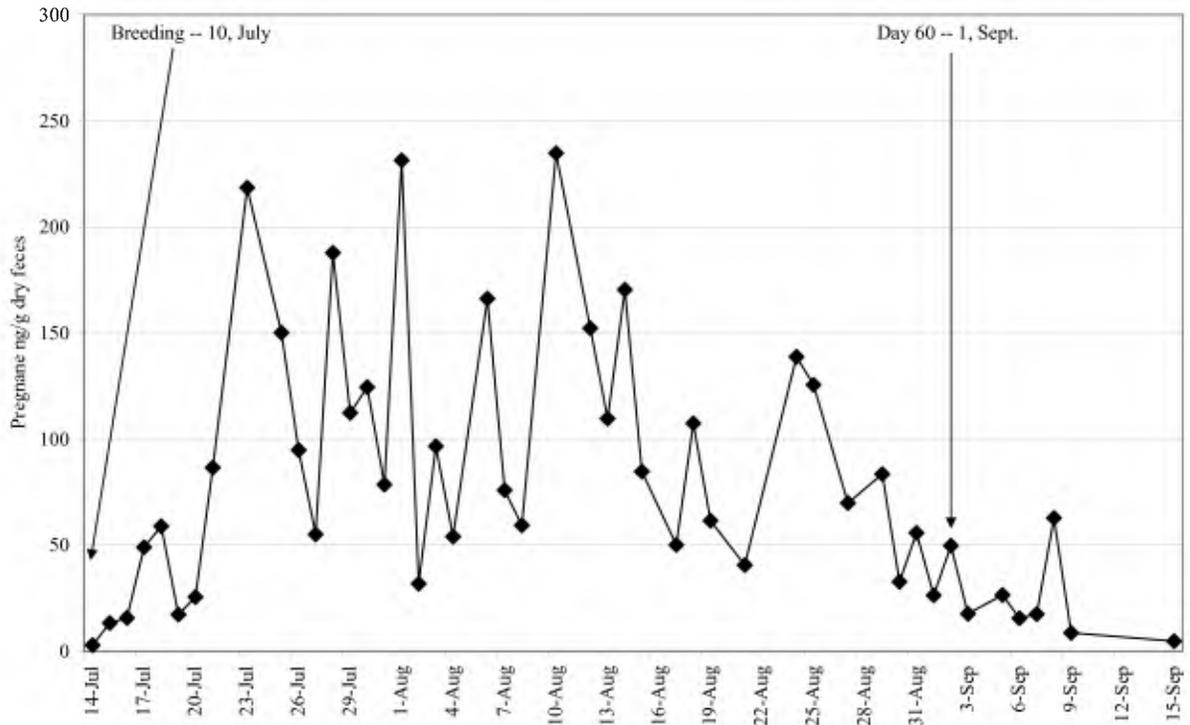
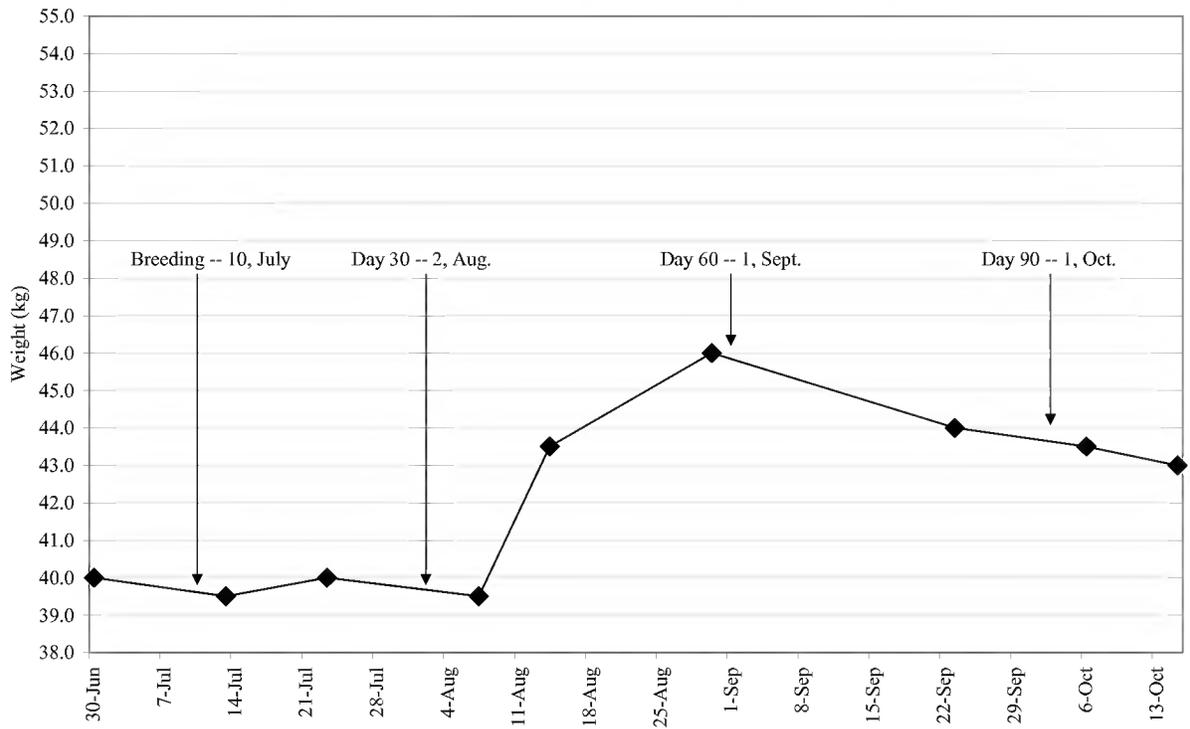


Chart W - 5

Wandu post breeding weights 2002

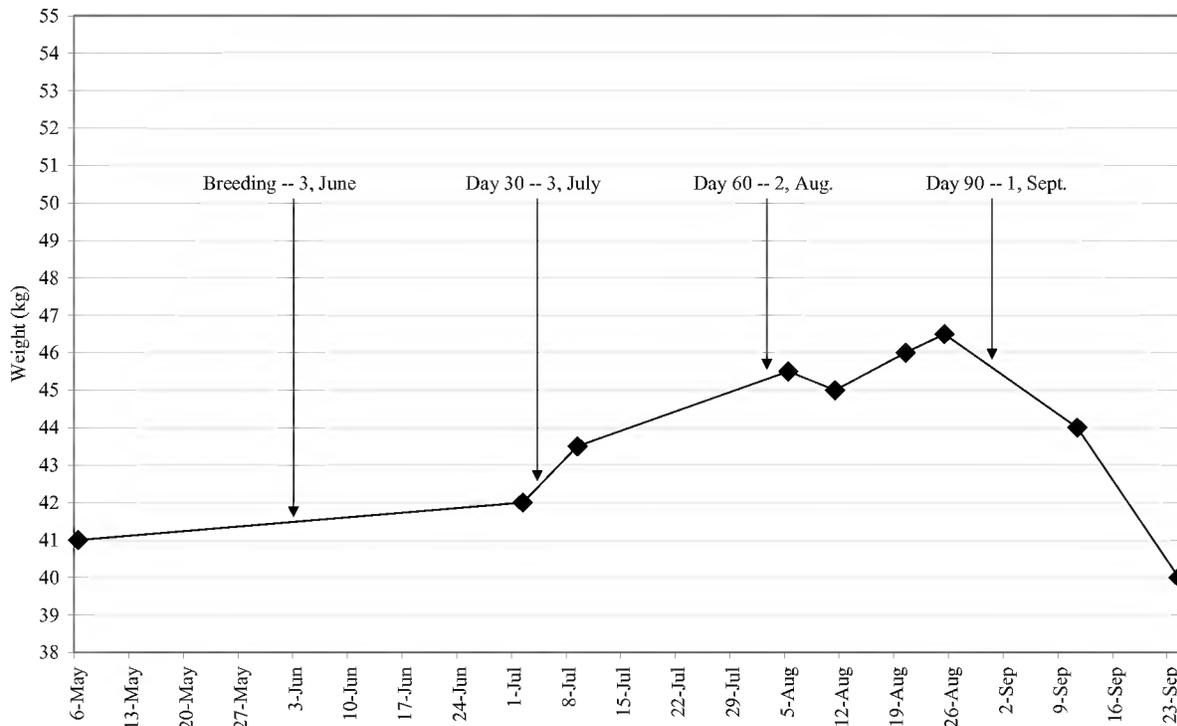


2 and 3 June 2003:

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.

Chart W - 6

Wandu post breeding weights 2003

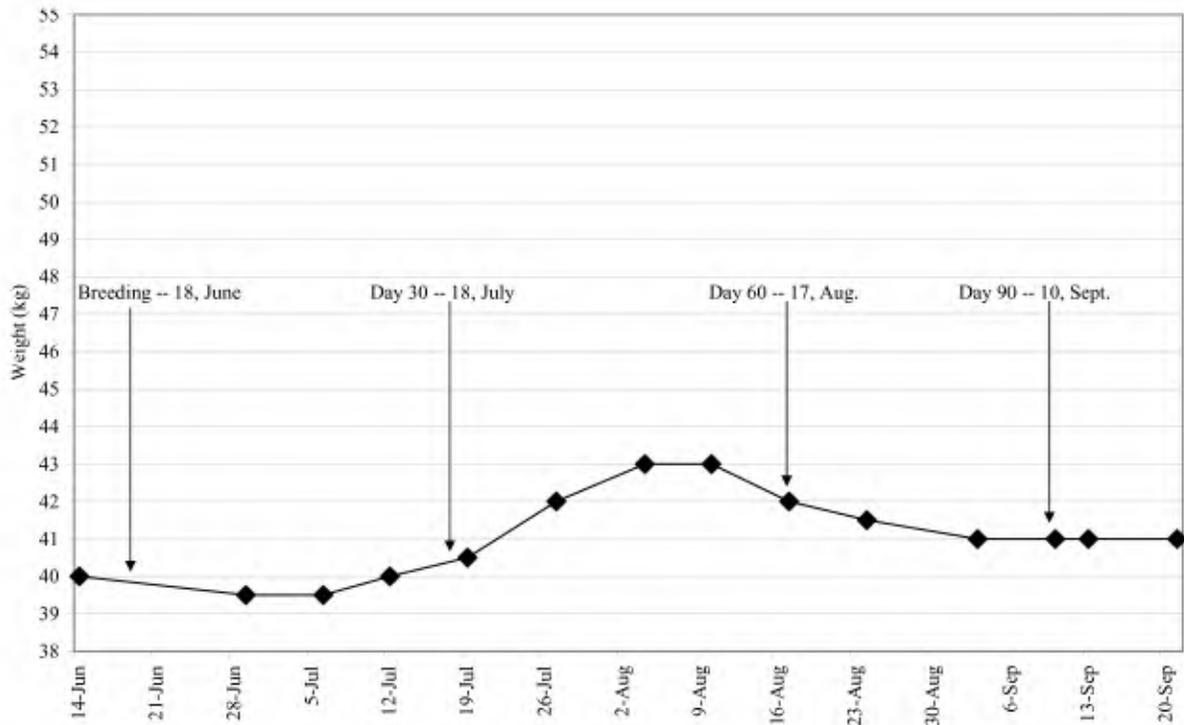


18 June 2004:

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.

Chart W - 7

Wandu post breeding weights 2004

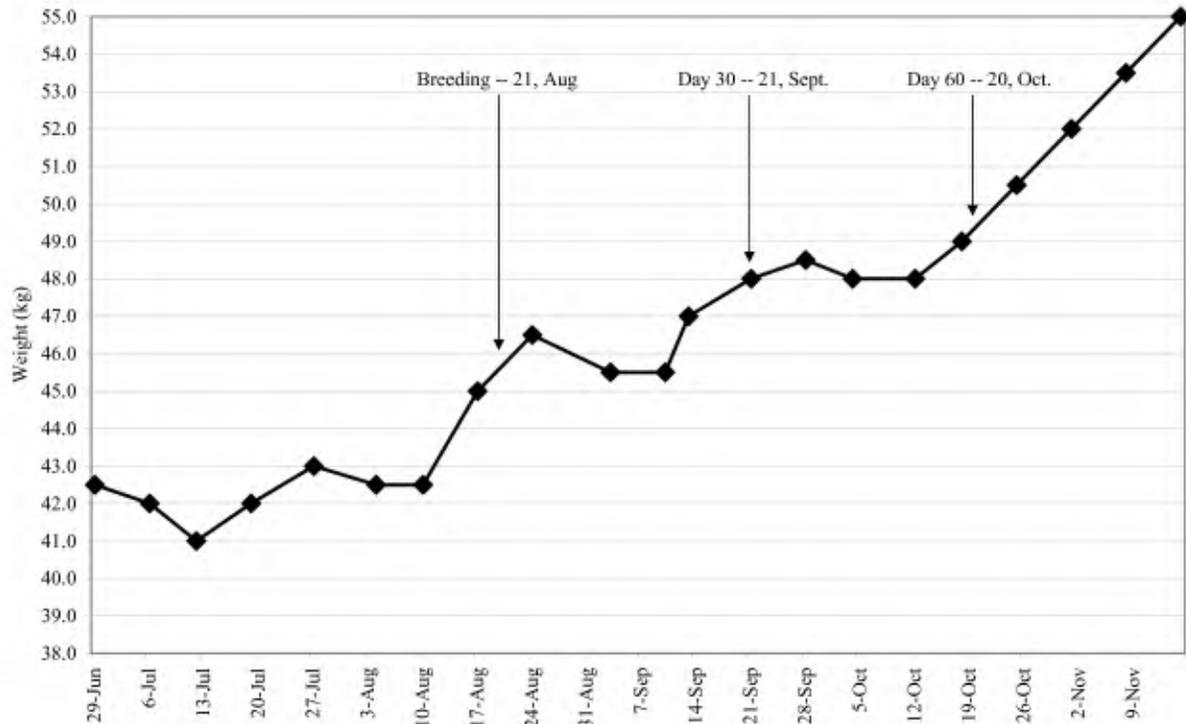


Tumai

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.

Chart T - 1

Tumai pregnancy weights 2004



In conclusion, the ability to analyze progesterin 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 progesterins 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 progesterin analysis. Once dried it then takes several days for the samples to be extracted and the steroids to be analyzed by enzymeimmunoassay. By the time fecal progesterin data are available, the female is at or very near the end of her gestation period. So while progesterin 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 who 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 progesterin 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.