APPENDIX 1: A DEVICE TO DETERMINE ELEPHANT (AND OTHER MAMMAL) FOETAL CONCEPTION AND BIRTH DATES

This part of the thesis was compiled from a paper which describes this device (Whyte 1986). It was devised before hand-held computers were available for use in the field, and proved useful in determining elephant foetal conception and birth dates.

The calculation of foetal age is a simple matter even on a hand-held electronic calculator but in the field, the determination of conception and birth dates can be a laborious process if there is no access to a suitably programmed computer. To determine the conception date of a near full-term foetus of a species with a long gestation time (e.g. elephant) involves a lengthy process of counting backward through a calendar for the relevant number of days until the conception date is determined. A similar problem arises when determining the birth date of a young foetus. The process is laborious, time-consuming and prone to error. The device described here eliminates these problems. It is simple, easy to use and accurate, and has been calibrated for elephant, buffalo, hippopotamus and impala.

Huggett & Widdas (1951) found that the equation $W^{1/3} = a(t-t_o)$, where W is foetal mass, a is the specific growth velocity and t_o is the intercept of the linear growth line with the time (x) axis, gave an adequate estimation of mammalian foetal age (age of foetus since conception). The authors stated however, that as t_o was an arbitrary estimate, errors of up to 10% could be expected when growth velocities and foetal ages are calculated. Attention to this limitation was again drawn by Guy (1983), but in spite of this limitation, the Huggett & Widdas equation is still widely used to determine foetal age and thus also conception and birth dates.

To assemble the device, cut out its three elements as shown in Figure 27. Glue or staple the calendar disc (a) onto a piece of soft-board or robust cardboard. For best results a photocopy of Figure 1 made on overhead transparency film should be used as it is robust and transparent. Through the centre points of the two discs and the indicated point on the "collection-date pointer" (b), pin the three elements together with the foetal-age disc (c) on top, and the collection-date pointer between the two discs.

Set the collection-date pointer to the date on which the foetus was sampled. From the foetal

weight and using the Huggett & Widdas formula, estimate the foetal age in days. Turn the foetal-age disc until the foetal age is directly opposite the arrow on the collection-date pointer. Read the conception and birth dates off the calendar-disc as indicated by the relevant arrows on the foetal-age disc.

When reading off these dates, care must be taken to ensure that the correct year is ascribed. This is particularly important in the case of elephant where the 660 day gestation time makes it possible that there can be a two year difference between the year of collection and the year of conception or birth.

Gestation times and average birth weights for the four species are given in Table 18. The variables for the Huggett & Widdas equations for these species are also given for convenience. The variables given for elephant are those of Craig (1984) who revised the Huggett & Widdas equation for elephant.

Although it may seem pedantic to try to determine these dates to the exact day when Huggett & Widdas themselves concede errors of up to 10% in their method, this is how the formula is applied in practice. Whether by back and forward counting on a calendar, or whether these dates are calculated by computer, specific conception and birth dates are ascribed, and as long as the method used is standardised, comparisons can be made between or within populations either spatially and/or temporally.

Table 18. Birth weights, gestation times and specific variables of the Huggett & Widdas formula for the four species of herbivores.

Species	Birth Weight (g)	Gestation time (days)	t_o *	a *	References
Elephant	120 000	660	138	0.0945	Kenneth & Ritchie (1953); Perry (1953); Craig (1984)
Buffalo	45 000	340	68	0.131	Sinclair (1977)
Hippopotamus	42 000	240	48	0.181	Smuts & Whyte (1981)
Impala	5 370	196	39	0.112	Fairall (1969)

* Variables from the Huggett & Widdas (1951) formula.

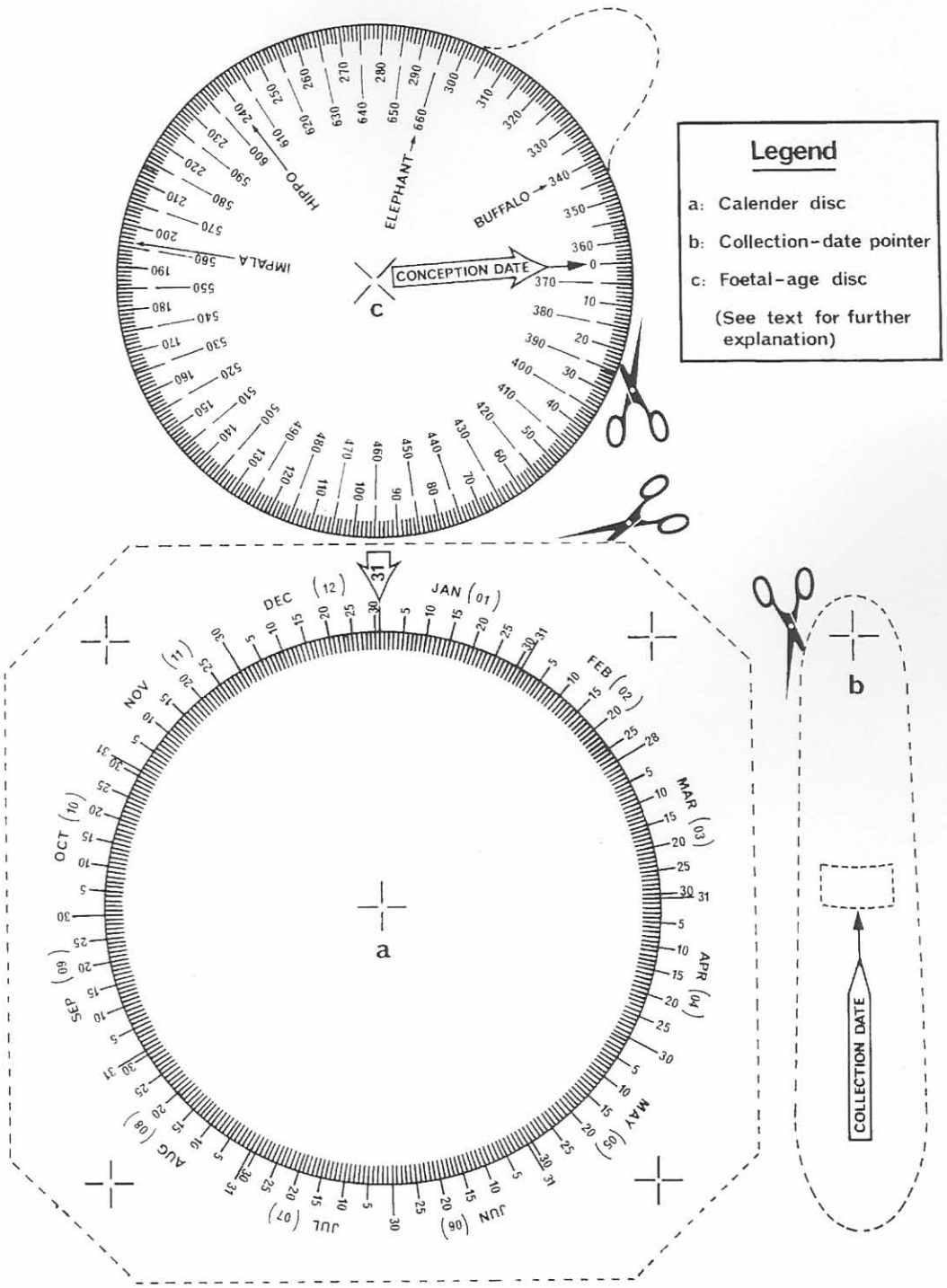

Figure 27: The three components of the device for the determination of foetal conception and birth dates from its conception age as determined by the Huggett and Widdas (1951) formula.