REPRODUCTION IN FEMALE AFRICAN ELEPHANT
IN THE WANKIE NATIONAL PARK, RHODESIA

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ABSTRACT. — Data from 614 female elephant were used to assess the reproductive status of this species in Wankie National Park. Elephant in Wankie are seasonal breeders with a peak during the rainy season and a calving interval of approximately 4.3 years. Of the female sample 9.1 percent was under the age of 1 year and 44.1 percent under the age of 11 years. The mean age of first ovulation was approximately 11 years. The m_x value for young adults was high with a late decline in fecundity. All these aspects suggest that the Wankie elephant are close to maximum reproductive potential which is characteristic of a young expanding population.

INTRODUCTION

Wankie National Park is situated against the Botswana border in the dry western region of Rhodesia and is approximately 14 545 km² in extent. The area has only one wet season, from November to March each year, with an average of 550mm of rain annually. Historically this area was not heavily utilized by large animals on a year round basis, but was an important wet season area to which animals dispersed away from permanent water in the Gwaii, Deka and Zambezi river systems. Animals returned to the above areas as the seasonal pans dried up and the dry season progressed. Fencing and settlement outside the park interrupted this pattern and necessitated the provision of artificially maintained waterholes, thus converting the park to year-round habitat for its many species.

The development of permanent water is apparently one of several factors which resulted in an increase in wildlife populations, the most notable being that of elephant (Loxodonta africana) (Weir 1971). The increase in numbers of this species has resulted in serious habitat deterioration in areas of the park in which there is now year-round surface water (Williamson 1970). Despite a reduction programme in 1971 in which 1004 were removed, aerial counts flown triannually showed a continued build up of the elephant population and damage in the shallow soil areas continued (Williamson 1971, 1972). Accordingly, in 1972 a further reduction programme resulted in 972 elephant being killed. This paper deals with the reproductive data obtained from the female segment of this latter sample.

METHODS AND MATERIALS

The 972 elephant killed came from 33 herds which were shot by hunters, aided by a light aircraft and a helicopter, over a period of 33 days. Two herds were not sampled in their entirety and the data obtained from these herds have not been included in this paper. The data described were obtained from 614 female elephant.

The lactational status of the cows was recorded prior to the skinning and removal of the meat. Reference numbers were punched on the tusks and jaws of all animals. The tusks were later weighed, and the jaws retained for estimating the age of each animal using the criteria developed by Laws (1969). All other data were collected in the field after the skins and meat were removed. All foetuses (164) were collected and weighed and their age predicted using the formula of Huggett & Widdas (1951) (See Fig. 2). The growth equation

\[ t \text{ (foetal age)} = W^{\frac{1}{3}}/0.0083 + 66 \text{ days} \]

was derived from Laws (1968). The uteri of non pregnant animals were examined for placental scars. The mean calving interval was calculated using the method described by Laws (1967), and from the method described by Hanks (1972), in which the average duration of anoestrus is calculated from the following formula.

\[ x = \frac{22 \text{ (No. of non pregnant)}}{\text{No. of pregnant}} \]

from which the calving interval (C.I.) = 22 (gestation period) + X months. Animals were classified as immature if their ovaries contained neither corpora lutea nor corpora albicantia, pubertal if the ovaries contained at least one follicle greater than 5 mm in diameter and mature if the ovaries contained at least one corpus luteum or corpus albicans.

RESULTS

Age structure

The population structure of 972 animals (both sexes) killed, is shown in Fig. 1. The sex ratio of the prepubertal animals were exactly 1:1 (260 males : 260 females). Of the 149 foetuses which were sexed 77 were females and 72 were males, which does not depart from equality significantly (Chi - square = 0.17; p > 0.05).

Seasonal breeding

Breeding was seasonal and similar to that reported by Hanks (1972) for the Luangwa valley, with the peak in the conception period occurring during the rains. Of the conceptions, 88 percent were recorded in the 6 months November to April (Fig. 2) which is also the period of annual rains.
**Attainment of sexual maturity**

First ovulation was used to indicate puberty and from overlapping age distributions of immature and mature females (Fig. 3) a mean estimate of 11 years has been made (range 9-15 years).

**Mean calving interval**

Placental scar frequencies for 118 non-pregnant females were plotted against age (Fig. 4). The regression of the number of scars (s) on age (t) is given by $t = 4.30s + 14.77$. The 95% confidence limit is $\pm 0.40$ giving a calving interval with a range of 3.9 to 4.7 years. The ‘r’ value for the regression is 0.63 ($p > .001$).

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Fig. 1. Sex and age class frequencies observed in a sample of 972 male and female elephants from complete groups taken in Wankie National Park.

Fig. 2. Monthly frequency of elephant conceptions (histogram) and rainfall (broken line) for 1970/71 and 1971/72.

The slope of the line is an estimate of the mean calving interval (4.3 years). The length of lactational anoestrus $(x)$ can be estimated as follows:

No. of pregnant $= 139$ 22 where 22 is the duration
No. not pregnant $= 164 \times x$ of pregnancy

Hence $x = 25.9$ months. This gives a calving interval of approximately 47.9 months (4 years) which agrees fairly closely with the figure calculated from the incidence of placental scars.

**Recruitment**

Of the 972 animals shot, 614 were females. Fig. 5 shows the population structure, smoothed as a three year running average, of individuals from complete family groups in Wankie compared with that for the Luangwa valley as reported by Hanks (1972). There are certain similarities up to the age of 17 years; after that no definite peaks in recruitment are indicated.

Fig. 3. Year class frequencies of immature (above line) and mature (below line) females under 25 years of age examined in 1972.
Reproduction and age

Table 1 shows the $m_x$ (age specific fertility) value (Hanks 1972) for 390 pubertal and mature female elephant. There is no significant peak in fertility after the age of 13 years, through to the age of 49 years. There is a drop in percentage pregnancy in the 50 - 60 year old elephant; but of the 17 elephant of 50 years and over, 15 were lactating including 3 which were in the 60 year age group.

TABLE 1. Variations in $m_x$ values with age in 390 female elephant from Wankie National Park.

<table>
<thead>
<tr>
<th>Age Years</th>
<th>Number Classified</th>
<th>Number Pregnant</th>
<th>%</th>
<th>$m_x$</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 - 12</td>
<td>37</td>
<td>7</td>
<td>18.9</td>
<td>0.047</td>
</tr>
<tr>
<td>13 - 14</td>
<td>50</td>
<td>24</td>
<td>48.0</td>
<td>0.120</td>
</tr>
<tr>
<td>15 - 17</td>
<td>51</td>
<td>26</td>
<td>51.0</td>
<td>0.127</td>
</tr>
<tr>
<td>18 - 19</td>
<td>18</td>
<td>9</td>
<td>50.0</td>
<td>0.125</td>
</tr>
<tr>
<td>20 - 29</td>
<td>114</td>
<td>52</td>
<td>45.6</td>
<td>0.114</td>
</tr>
<tr>
<td>30 - 39</td>
<td>75</td>
<td>35</td>
<td>46.7</td>
<td>0.117</td>
</tr>
<tr>
<td>40 - 49</td>
<td>27</td>
<td>13</td>
<td>48.1</td>
<td>0.120</td>
</tr>
<tr>
<td>50 - 60</td>
<td>16</td>
<td>3</td>
<td>16.7</td>
<td>0.042</td>
</tr>
</tbody>
</table>

DISCUSSION

The data obtained indicate that the elephant population of Wankie is essentially a young and vigorous one. Of the female population, 9.1 percent are under the age of 1 year and 44.4 percent under the age of 11 years.

The seasonal breeding peaks are probably a product of an increase in water availability and the consequent dispersions of elephant away from artificial waterholes, resulting in favourable breeding conditions under reduced stress, and to the seasonal availability of high quality food. In the latter aspect the flush of green grass is less significant than that of browse plants, as grass only predominates in January and March, whereas much of the browse flushes in September and October (Williamson 1975b).

Laws (1969) found that, although female elephant may reach sexual maturity at 10 or 11 years of age, follicular maturation and ovulation are inhibited by density-dependent stress factors. As about half the 9 year old females had ovulated and as the majority did so before they were 12 years old, this is good evidence that the Wankie population is not subject to the factors inhibiting maturation as Laws (op. cit.) found in several East African populations.

The regression calculated for mean calving intervals gives an interval for 4.3 years (Fig. 4). Laws (1967) doubts the authenticity of scar counts over an extended period of time. Therefore, if females over the age of 45 years are eliminated the regression then reads

$$t = 4.22s + 12.38. (r = 0.93).$$

This again fits in well with the other results described above.

The 3 years running average of Wankie and of Luangwa age frequencies (Fig. 5) show close approximation up to the age of 30 years. Laws (1969) suggests that these peaks and troughs indicate cycles of recruitment, but Hanks (1972) concludes that they are artefacts of the ageing criteria used. If Hanks is correct, then it can be assumed that these peaks would show up in the Wankie population irrespective of base year as all animals were aged using the same criteria. If the sample of older animals were
Fig. 5. A comparison of the frequency distribution of elephant ages in Wankie (-----) and Luangwa valley (x---x) populations, both sexes included.
eater, then it is likely that the pattern shown by a Wankie elephant would resemble that of the Luangwa populations.

The early age of puberty among female elephant Wankie, coupled with a short calving interval, a high m_x value amongst most mature individuals, combine to suggest that the populations rate of reproduction approaches the maximum potential described by other workers. This is in line with historical and other evidence of a young, vigorous and expanding population.

ACKNOWLEDGEMENTS

The author is grateful to all those members of National Parks staff who assisted in the collection field data, particularly Rangers B. Howells and R. Smith and game scouts Morven Madondo, Patrick Mutsvanwa, Million Shibinda and Devia Siziwa. The author is grateful also to the Director Dr. G. Child and the Chief Research Officer (Wildlife) Mr. R.I.G. Stewell for commenting upon this work.

This paper is published with the approval of the Director of National Parks and Wildlife Management and is part of a continuing study of elephant populations in Rhodesia.

REFERENCES


Received 8 April 1976.