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# Elephants in Tarangire

Cynthia Moss

## Tarangire Park

Tarangire National Park, Tanzania, which covers an area of 2,600 sq km, currently contains an estimated 2,319 elephants,<sup>1</sup> and the whole 20,500 sq km ecosystem of which the Park is a part is estimated to contain 6,110 ( $\pm 51\%$ ).<sup>2</sup> Elephants are thought to have moved into the Park and the surrounding Lolikisale Game Controlled Area and Simanjaro Plains as a result of poaching and harassment in other areas. Poaching of the Tarangire population was severe in the 1970s with a carcass ratio of 32% reported for 1977.<sup>3</sup> The 1988 census estimated the overall carcass ratio at 6.7%, which suggests that poaching has decreased in intensity.<sup>4</sup> Before the study reported here, little was known about the age and sex structure of the elephant population using the Tarangire ecosystem and yet it is one of the largest in the Tanzania National Parks system.

## The Survey

In September 1989, a survey was made of the group size, composition and age structure of the Tarangire elephants, using the 17-year-long Amboseli Elephant Research Project as a basis for methodology and comparison. The primary purpose of the survey was to provide information on elephant biomass for incorporation in the Tarangire land-use study being conducted by Robert Davison for the African Wildlife Foundation. Other data collected have made possible an assessment of the overall status of the population. The results indicate a young and growing population which appears to be recovering from a period of intensive poaching in the past.

One week was spent in Tarangire National Park from September 11-18 of which six full days were used for conducting the survey. Observations were made from a vehicle, and mostly from the available road system, in areas suggested by Robert Davison, Director of the Tarangire Land-Use Study, Frank Silkiluwasha, Park Ecologist, and Issac Muro, Park Warden. The northern part of the Park was covered more intensively because elephants are known to concentrate there in September, but three excursions were made to the south-central area.

Whenever a group of elephants was sighted the date, time and location was recorded, the group counted and classified as either cow/calf or bull. In most instances an estimate was made of each animal's age and, if the elephant was considered to be over 10 years old, a note made of its sex. An assessment of the family

structure, detailed drawings and notes of any distinguishing features, the animals' reaction to the vehicle and other relevant ecological and behavioural observations were also recorded.

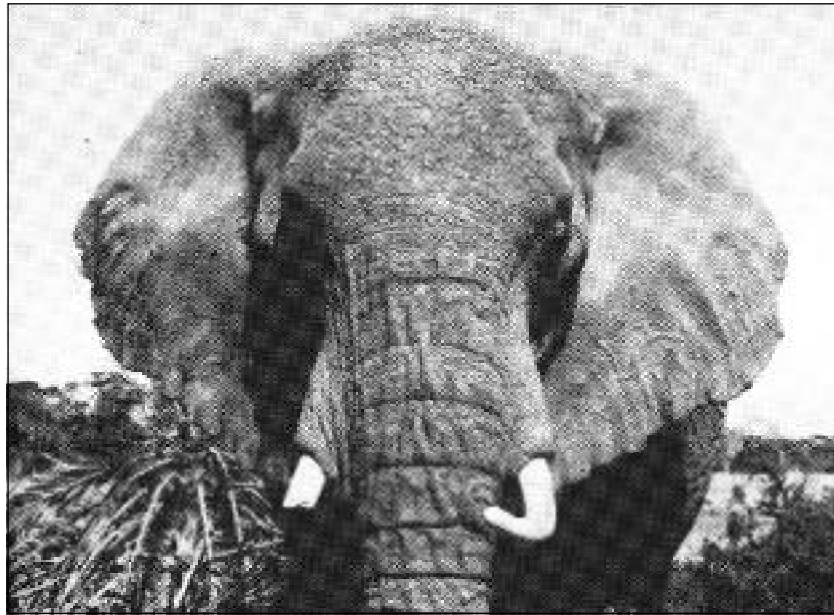
## Estimating Ages

The age estimates were based on 21 year's experience studying animals of known age, first in Lake Manyara National Park from 1968-70 and then in Amboseli National Park from 1972 to the present. The author started the Amboseli

Elephant Research Project in September 1972 and since that time the births of all calves have been recorded to within plus or minus one month; the ages of calves under three years old in 1972 were estimated to within six months by comparison with the Manyara observations. Thus, in Amboseli, year of birth records extend back to the beginning of 1970 and today there are 449 elephants of known age, ranging from newborn calves to animals 20 years old.

The experience gained by observing the growth and development of Amboseli elephants together with knowledge of the age when tusks erupt and the relationship of tusk length and circumference to age make it possible to estimate the ages of elephants up to 10 years old with an accuracy of  $\pm$  one year, and elephants 10-19 years old to within  $\pm$  two years.<sup>5</sup>

The ages of individuals of 20 years and older are more difficult to gauge, particularly for females. Males continue to grow in weight, shoulder height and tusk circumference throughout their lifetime and, with experience, it is not difficult to distinguish a 25 year old from a 35 year old or a 35 year old from a 50 year old. In addition, not only do bulls continue to grow but their head shape changes significantly by widening across the forehead and at the base of the tusks to give a more hour-glass appearance when viewed from the front.<sup>6</sup> Other characteristics such as the size of the head in relation to the body and the thickness of the neck and trunk are also of use.



*Tess', a 23 year-old female*

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Female growth levels off at about 25 years of age and the subsequent slight increase in shoulder height is barely perceptible. However, females continue to grow in back length and this dimension has been used as a guide to judging age.<sup>7,8,9</sup> As with males, tusk length and circumference increase throughout the lifespan but overall appearance is characterized by an increasingly bony look around the shoulders, a lower ear carriage and a tendency to deepening depressions above the eye. In Amboseli the author's estimates of age using all these characteristics have proved remarkably accurate when checked against tooth eruption and wear of elephants who have died.<sup>10</sup>

## Survey Results

**Table I**  
Groups Observed and their Distribution

Type of Group	No. of Groups	Median Group Size	Group Range	Group Interquartile Range	% of Total Groups
Cow/Calf	63	10	2—120	7—18	82
Bull	10	3	1—12	1—3	13
Single Bull	4				5
All Groups	77	10	1—120	4—17	100

The 77 groups seen totalled 1,046 animals with an average number of 13.6 elephants per group. The full distribution by group size is given in Figure 1. Age estimates were made for 56 groups containing a total of 629 animals. The careful drawings made of the ears of at least two animals in each group and the notes of any other individual characteristics such as damaged ears or missing tusks led to eight groups being eliminated from the age structure analysis because they were known or suspected to have been surveyed twice. The final sample was of 48 groups containing a total of 536 individuals all with assigned ages and representing 23% of the estimated Park population.

## Age Structure

The overall age structure of the Tarangire sample is shown in Figure 2 and compared with that of Amboseli elephants in Figure 3. All 262 calves under 10 years old were aged to the year and are displayed in Figure 4.

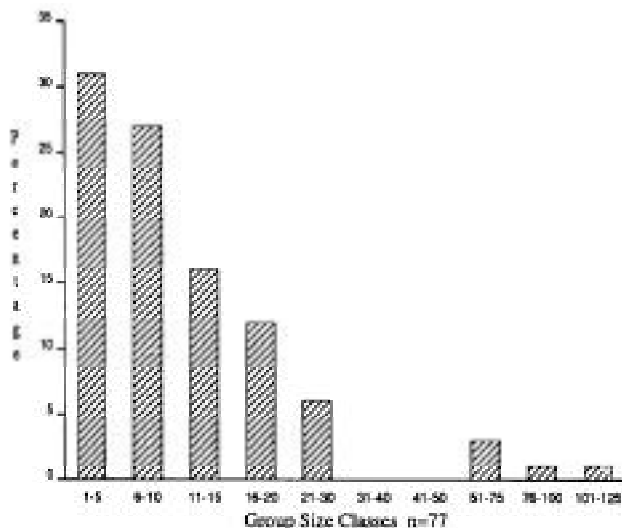


Figure 1. Elephant Group Size Distribution: Tarangire. September 1989

Table II presents the age and sex structure of both the Tarangire sample and the total Amboseli population. The sex of animals under 10 years was not determined in Tarangire. However, in Amboseli the female to male sex ratio for calves under five years old was 1:1 and for five to ten year-olds was 1.4:1. Assuming these ratios were valid for Tarangire, the under ten-year-olds divide into 73 females and 73 males under five and 68 females and 48 males over five. On this basis, the overall sex structure in the sample was 311 females and 225 males, or 1.4:1. The comparable figure for Amboseli in 1989 was 1.3:1.

To conform with Poole's results in other East African populations,<sup>12</sup> an adult sex ratio of all animals 15 years and older was calculated as 2.3:1 (female to male) as opposed to 1.5:1 in Amboseli.

**Table II**  
Age and Sex Structure: Tarangire and Amboseli

	Age classes <sup>#</sup>									Total
	0A	0B	IA	IB	2	3A	3B	4	S	
Tarangire										
Female	73*	68*	48	42	32	24	16	8	0	311
Male	73*	48*	52	29	17	6	0	0	0	225
Amboseli										
Female	87	88	32	39	67	42	13	35	10	413
Male	84	62	26	31	35	35	16	22	3	314

\*Interpolated

<sup>#</sup>To conform with the surveys already conducted by J. Poole in Tsavo, Mikumi and Queen Elizabeth National Parks<sup>11</sup>, the following age classes were assigned to the animals surveyed in Tarangire:

Age Class	Age	Age Class	Age	Age Class	Age
0A	0—4.9	IB	15—19.9	3B	30—34.9
0B	5—9.9	2	20—24.9	4	35—49.9
IA	10—14.9	3A	25—29.9	5	50—64.9

Based on Amboseli data of age of first oestrus in females and age of onset of musth in males, a third sex ratio was computed using the number of females 10 or over to that of males 25 or over.<sup>13</sup> Under this definition the sex ratio of breeding females to breeding males in Tarangire was 28:1 or 97% females and 3% males. Only six males over 25 were seen during the Tarangire survey and none of these was over 30. In Amboseli the corresponding sex ratio of breeding adults was 3.1:1 or 75% females and 25% males.

Males in several populations in East Africa have been shown to be sexually mature with viable quantities of sperm in a range from a mean of 10 to a mean of 17 years old and thus males in this age range are physically capable of impregnating females even though socially they may meet with difficulty.<sup>14,15,16</sup> For Tarangire an analysis was carried out using a lower age for breeding males. Taking all males of 15 years or older and keeping all females of 10 and over, the breeding adult sex ratio in Tarangire becomes 3.3:1, or 77% females and 23% males.

Although it was strikingly obvious that there were very few adult females in the older age classes, the family groups in Tarangire did not appear to contain many orphans. All of the groups included one or more adult females, but simply had very young matriarchs by Amboseli standards. The oldest females seen were 35 to 40 years old and there were only eight of these: no elephant cows were over 40. Orphans were defined as calves under 10 with no mother, and in an effort to determine how

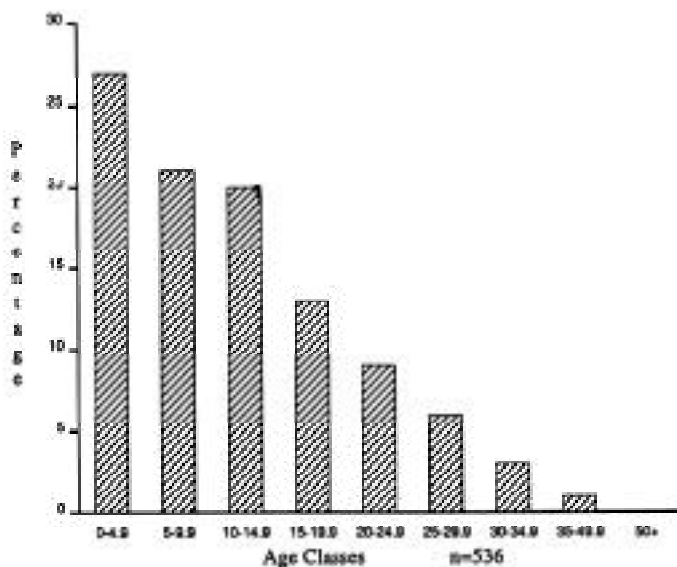


Figure 2. Age Structure for Tarangire Elephants, September 1989

many there were in the Tarangire families, the proportion of calves under 10 to adult females of 10 and over was calculated. For Tarangire this ratio was 1.5:1 while in Amboseli there were 1.3 calves for every adult female.

### Behaviour

The behaviour of the Tarangire elephants to the approach of the research vehicle was greatly dependent on their location in the Park. None of the cow/calf groups was as calm as a typical

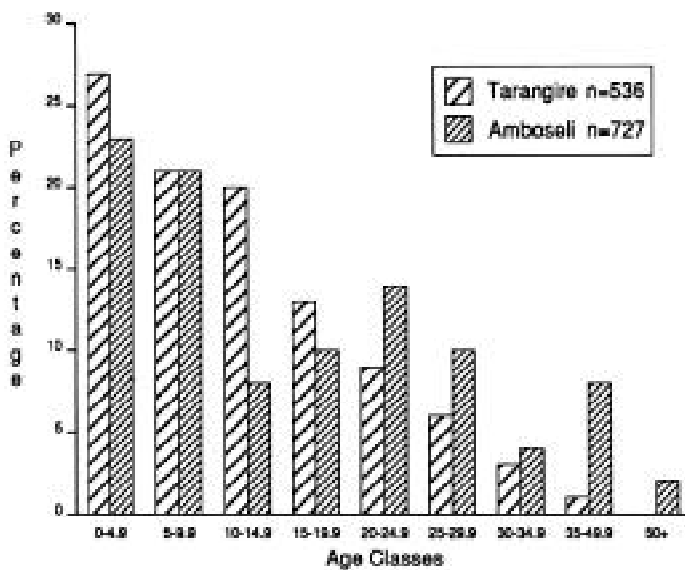


Figure 3. Elephant Age Structure Comparison: Tarangire & Amboseli, September 1989

Amboseli group but the elephants in the northern part of the Park were far more habituated to vehicles than expected. Most groups were wary of us at first sighting but calmed down once the engine was turned off. A few females made mock charges or shook their heads. The bulls, especially those that fed around the lodge, were even more accustomed to cars than the cows. In the central and southern parts of the Park the elephants were much less tolerant of intrusion. At the approach of a vehicle or upon detecting its presence by odour they ran away or charged or lifted their trunks and smelled the wind and then moved away at a walk. Even so they did not go far, only attempting to keep a distance of about 200 metres between themselves and the vehicle. No groups showed intense fear behaviour.

### Conclusions

The survey indicated that elephants in large numbers are concentrated around the Tarangire River in the north and the Silale Swamp in the central part of the Park with a daily movement pattern of travelling towards the river or swamp in the morning and away in the evening. By midmorning there were always numerous groups of elephants along the Tarangire River in the north.

The Warden, Issac Muro, reported that there was little evidence of poaching in the Park (pers. com.) and the behaviour of the elephants using the northern part of the Park support this view. In addition, group size and dynamics in the Tarangire sample indicate a relatively undisturbed population. It has been suggested that elephants gather into large groups when they are harassed, by poachers or otherwise, and/or have lost many adults. Elephants also congregate when environmental conditions allow and they then move and feed in social aggregations.<sup>17</sup> These two types of large groupings can be distinguished by the dynamics of the herd. Disturbed elephants move in tight formation, bunched together to present a wall of elephants; social aggregations usually form in and after the wet season and are much looser with greater inter-individual distance.<sup>18</sup> In the Tarangire sample the groups encountered were generally small and discrete with a median size of 10. There were only four groups of over 30 and these appeared to be loose aggregations made up of families and a few bulls. The largest herd, numbering 120, was exceptionally relaxed when approached and was strung out in a long column moving away from the river. There was no indication that it was in any way disturbed.

The age structure and sex ratios derived from the Tarangire sample indicate that the population experienced relatively severe poaching sometime in the past, together with some evidence that illegal hunting continues today. The great majority, 68%, of the population was under 15 years old and only 4% were 30 or more; all the older animals were females. In contrast, 52% of the Amboseli population was under 15 and of the 14% aged 30 years and over 41% were males. In the Tarangire sample there were only eight females over 35 and none over 40; in Amboseli there were 58 females over 30 including 10 of over 50.

Poachers tend to kill adult males first since they have the largest tusks. When the males are greatly reduced in number and become difficult to find, poachers turn to the adult females and kill the larger and thus older ones, before finally turning to young males and females.

The age and sex structure of the Tarangire sample suggest that most of the large adults in the population have been killed but that poachers have not yet reached the stage of killing younger animals. As mentioned earlier, many deaths occurred in the 1970s when carcasses of freshly killed elephants were frequently observed: during the 1980s ground and aerial observations suggest less intensive poaching. At the same time the age structure of the sample indicates that the population has been breeding and successfully rearing calves for the last 10 years. Calves were well represented in every year except 1988, and the low birth rate that year may simply have resulted from a lack of availability of females who were neither pregnant nor in lactation anoestrus.<sup>19</sup>



A three to four year-old calf

The puzzling aspect of the relatively high reproductive rate of the Tarangire elephants was the lack of breeding bulls. It has been suggested that in populations with no or few males over 25 lowered fertility may occur because females prefer older males and young males are inexperienced.<sup>20</sup> The Tarangire data are not conclusive in regard to available males but calves are

being produced. It is possible that there are older males present that were not found during the survey. However, the northern part of Tarangire, which is thought to be favoured by bulls,<sup>21</sup> was well covered during the survey and, indeed, was where most of the bulls were found. Additional information was provided on the Tarangire elephants by a panoramic sequence of photographs taken by John Sutton in May 1989 of a large herd of 300 animals. While in Amboseli a herd of this size would usually have at least one or two large males present, none was revealed by examination of the photographs.

It may be that younger males in Tarangire have been able to mate successfully with females in the absence of competition from older bulls. Under conditions where there is little male-male competition, either musth may not play as important a role in mating success as it does in a population with an abundance of males or males may come into musth at a much earlier age.

The key to the reproductive success of the Tarangire elephants probably lies primarily with the structure and composition of the families together with the lessening of poaching pressure during the last decade. Most of the families appeared to be intact in the sense that there were one or more adult females present in each. The Amboseli records show that calf survivorship is affected by many factors including among others: age of the mother, size of the family, number of allomothers (older female calves who take care of young calves), environmental conditions, sex of the calf and deaths and disturbance in the family.<sup>22,23,24</sup> In many cases after a matriarch died in Amboseli the cohesion of the family broke down and there was splintering into subgroups for periods of up to two years and more. During these periods other calves died as well as the matriarch's. In most of these incidents the family eventually reformed and leadership was taken over by the next oldest female.<sup>25</sup> It is possible that the Tarangire females experienced similar periods of disruption in

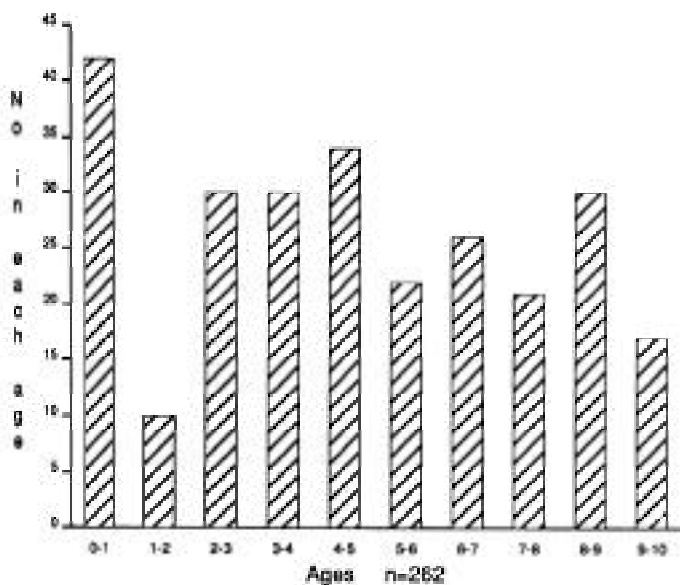
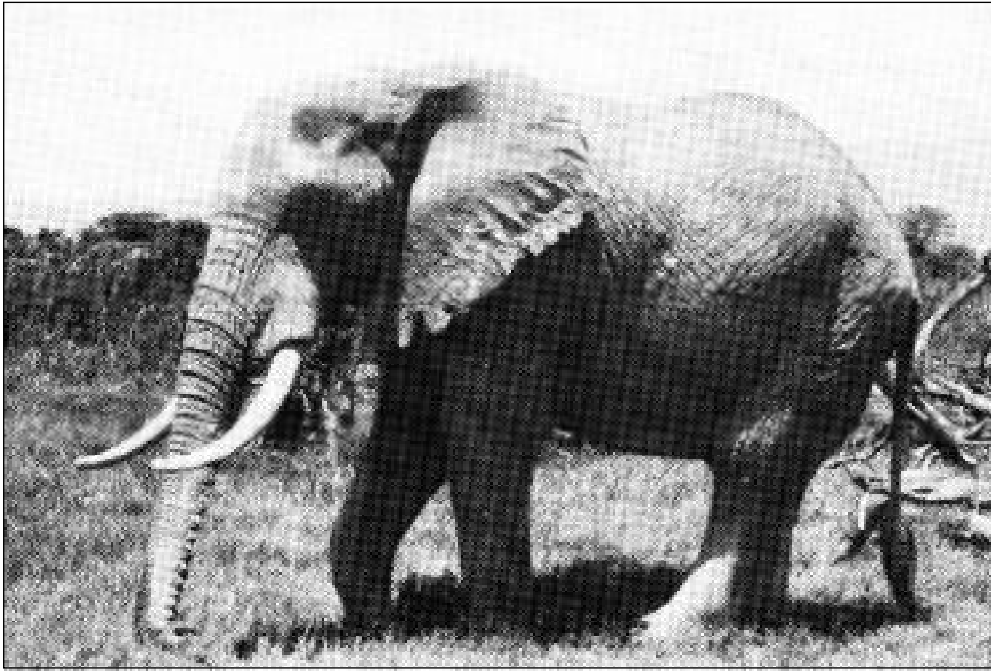


Figure 4. Age Structure: Tarangire Calves, September 1989



A 21 year-old male

the 1970s but have now regrouped and bonded under the leadership of younger matriarchs. At the same time environmental conditions have been relatively favourable in terms of rainfall in northern Tanzania in the 1980s.

The Tarangire elephants appear to be thriving despite the serious losses they experienced in the 1970s. There is reason to be optimistic that other populations that have been reduced by

poaching can also recover; although it would be dangerous to assume that any population can resume breeding in the way that the Tarangire elephants have. One such as reported in Mikumi, with 39% of families lacking adults and another 33% mainly composed of orphans, may take many years to recover because the social environment for the successful rearing of calves has been seriously disrupted.<sup>26</sup>

Assessing the demographic structure of elephant populations throughout Africa should be an essential part of elephant conservation strategies in order to know where efforts can be best placed. It must be stated that overall numbers should not be the only consideration in determining the status of a population.

The elephants in the northern part of Tarangire provide a spectacular and very pleasurable viewing experience for visitors to the Park. The Tarangire elephants are an asset important to the Tanzania National Parks system because they are easily visible in the dry season and habituated to tourists. At the present time Tarangire is the best place in Tanzania to view elephants and every effort should be made to maintain the successful conservation and anti-poaching measures taken in the area.

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