

RADIO TRACKING OF ELEPHANTS

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SYNOPSIS

As a result of radiotracking it was possible to improve the range maps made from standard ground observations for the three groups at Manyara. The new maps showed that although the elephants kept mainly within the Park they did occasionally venture outside. This data is of great significance to the National Park's management. The maps also showed that even though they were hemmed in by human settlement on three sides and by a Lake on the fourth side, the elephants did not use all the land that was available to them.

It has been shown that the movements and ranges of elephants vary greatly not only from area to area but also from one individual to another. It seems likely that the factors controlling these differences are related to the nutritional requirements and "wildness" or "tameness" of the individuals concerned.

RADIO TRACKING OF ELEPHANTS

In the absence of hard data, there have been many speculations about the movements of elephants. In some areas, it has been asserted that elephants migrate 480 - 640 km (300 - 400 miles) in their search for suitable food. (See refs. Sikes 1970). The largest movement reported in the literature as definite is over 185 km (115 miles). (Wing & Buss 1970). More recently it has been suggested on the basis of aerial counts that their movements are comparatively small and that no elephants have a range that is more than approximately 48 km (30 miles) across, or of 50 - 260 km² in area (Laws 1969 & 1970).

Between 1968 and 1970 I. Douglas-Hamilton radiotracked three elephants in the Lake Manyara National Park, one in the Tarangire National Park and one with Dr. Croze in the Serengeti National Park, as part of a five year research programme on the ecology and behaviour of the African elephant.

The objectives were to record movements and ranges in very different habitat types, and also within Manyara to compare differences between individuals of both sexes and varied temperaments. The three animals in Manyara were already well-known and it was hoped to increase the accuracy of the available range maps by following the radiotagged animals into areas of dense bush that normally made observation impossible.

METHOD.

Immobilizations were made with M99 (Reckitt and Colman) with the help of Dr. Harthoorn. The radiotracking equipment was designed and constructed by Dr. Howard Baldwin of Sensory Systems Laboratories, Tucson, Arizona. In the later versions the equipment gave a range of 50 km initially, and lasted for about four months. The transmitters were embedded in fibreglass, shaped to sit comfortably on the back of an elephant's neck, and attached to a collar of 3 1/2" machine belting which was counterweighted at the bottom with a piece of lead so that the transmitter should remain on top. The receiving equipment could be mounted

on the struts of an aeroplane, or on a car, or carried on foot, thus providing maximum operational flexibility.

The movements were recorded by measuring the straight line distances between radio fixes made at specific time intervals. On the occasions when the actual meandering courses were continuously plotted, they were found to exceed the straight line values by a considerable margin. Nevertheless, it was impractical to employ continuous tracking for all the groups and for the purpose of comparing one set of observations with another, the straight line values provided a satisfactory record.

In all cases but one, the individuals radiotracked were members of family units. From direct observations of these individuals and from other data on the social behaviour of elephants (Douglas-Hamilton, 1966, 1967, 1969 and in preparation), it is considered that the movements of each individual were identical to those of the family to which it belonged.

RESULTS

24 Hourly Movements

All animals from the three study areas were plotted at 24 hourly intervals thus allowing comparisons to be made between Manyara, Tarangire and Serengeti. The shortest change of position of any elephant over 24 hours was 0.2 km and the longest was over 30 km. Within this span the mean movements of different individuals varied significantly.

The results summarized in Table I (see end of text) show that the Manyara elephants moved the least with a mean 24 hourly change of position that varied between 1.9 and 2.9 km. In contrast, the Tarangire family moved on average 5.7 km/24 hours and the Serengeti family 21.4 km/24 hours.

The range sizes increased in the same way. They were determined by measuring the area enclosed by a line joining the outside position records. The Manyara elephants utilized between 23 km² and 52 km² while the Tarangire group had a range of 330 km². It was impossible to estimate the area of the Serengeti elephants' range as there were too few observations, but if the longest axis across a range is used as a measure of its

size, then the Serengeti elephant had the largest range, with a long axis of more than 64 km, compared to 30 km for Tarangire and between 15 and 26 km for Manyara.

The probable explanation for these variations in movements and range sizes are as follows. The Manyara elephants live in an area of high primary productivity with an abundant food supply, including a forest that is irrigated all round the year by a series of springs. There is a wide diversity of habitat types all easily accessible and in close proximity of each other within the relatively small area of the National Park. Elephants do not have to move far between the escarpment, the forest, the swamp, the Acacia tortilis woodlands and the rich alkaline pastures. The advantages to animals of frequenting the boundary zones between habitat types has been described by Lamprey (1963) and Manyara is exceptionally well endowed with these. In contrast, Tarangire is a much more arid environment with vegetation types whose boundaries are spread far apart. Yet even here Lamprey found that elephants tended to frequent the boundary zones. It is likely that to maintain a sufficiently varied diet and even to get from the river to their feeding areas, the Tarangire elephants are forced to move much greater distances and to cover a much larger total area than their Manyara counterparts.

An additional factor restricting the Manyara population is the growth of the surrounding human populations which has displaced them and which now confines them within less than half their former range (Douglas-Hamilton 1969). Yet surprisingly no single bull or family unit at Manyara utilized the entire area at its disposal, although the population as a whole did. This self imposed restriction and the high fertility and good condition of the Manyara elephants lead to the conclusion that their movements are mainly governed by their nutritional needs and that they have no reason to move more than 3 - 5 km/24 hours. The effect of human influence on their movements is discussed later.

The Serengeti movements are large for a different reason. The sample was only drawn from a short period when the elephants were extremely disturbed. The population from which the experimental animal was taken is known to be very nervous. It appears that the disturbances

caused by the immobilization and the subsequent aerial radio locations caused the elephants to move abnormally fast and in a consistent direction away from the scene of the darting. Unfortunately the transmitter failed after four days and all further information was lost, but even in this short time, the distance across their range suggested that their total range had the highest value of the three different areas. Why it should be higher than that of the Tarangire elephant remains a matter for speculation. Only further long term observations can resolve this question (Croze work in progress).

Daily and Nightly Movements in Manyara

In Manyara it was possible to make much more detailed observations, and these animals were plotted either continuously or at 12 hourly intervals, usually at dawn or dusk so that the daily and nightly distances covered could be recorded. The straight line daily movements of the elephants varied between 0.2 and 8.2 km, and the nightly movements between 0.4 and 3.5 km. The values summarized in Table I show significant differences between individuals in the mean daily and nightly movements. Family 7 had approximately the same mean daily movements as M9, but both were significantly greater than those of F16. The movements by night of F16 and F7 were similar but both were greater than the nightly movements of M9. These tendencies are summarized in Table 2. The differences here have been tested by the median test (Siegel 1956) and found to be significant.

TABLE 2

DAY MOVEMENT	"TAME" F7	"TAME" M9	"WILD" F16
NIGHT MOVEMENT	"WILD" F16	"TAME" F7	"TAME" M9

A possible explanation for the daily differences between the groups is that the members of Family 16 were extremely nervous elephants, much wilder than those of Family 7 or Male 9. Consequently they tended to hide during the day, by lying up in dense thickets and keeping far away from the tourist roads. In fact it was only possible to plot their

movements by radio locations made from the aeroplanes. By avoiding the extensive road networks, their movements became very restricted. In contrast, Family 7 and Male 9 were thoroughly habituated to the presence of motor cars and would pass within 20 yards of them without showing signs of disturbance. By night, however, the "wild" Family 16 was free of all traffic and tended to move more than it did by day, although not more than the "tame" Family 7.

As a result of radiotracking it was possible to improve the range maps made from standard ground observations for the three groups at Manyara. The new maps showed that although the elephants kept mainly within the Park they did occasionally venture outside. This data is of great significance to the National Park's management. The maps also showed that even though they were hemmed in by human settlement on three sides and by a lake on the fourth side, the elephants did not use all the land that was available to them.

SUMMARY

The sizes of daily movements and ranges of elephants are described for five different individuals in three different areas. It has been shown that the movements and ranges vary greatly not only from area to area but also from one individual to another. It seems likely that the factors controlling these differences are related to the nutritional requirements and "wildness" or "tameness" of the individuals concerned.

Although observations made in Manyara and Tangire supported the idea that elephant movements are small compared to previous estimates, the Serengeti record revives the possibility that some elephants do cover very large distances.

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	M E A N V A L U E S					No. of position records	Period of study	Season	
	RANGE		24 Hour straight line movement	24 Hour day + night movement	12 Hour night movement				24 Hour day movement
	longest axis	area							
<u>MANYARA</u>									
"Tame" Family 7	2.7 km	1.7 km	4.4 km	2.9 km	26	52 km ²	127 days	Wet & dry	
"Wild" Family 16	1.2 km	1.6 km	2.8 km	1.9 km	19.5	42 km ²	110 days	Wet & dry	
"Tame" Male 9 Food very abundant	2.5 km	0.9 km	3.4 km	2.5 km	15	23 km ²	18 days	Dry	
<u>TARANGIRE</u>									
"Wild" Family I Food Scarce	-	-	-	5.7 km	30	330 km ²	61 days	Wet & Dry	
<u>SERENGETI</u>									
"Very wild" Family I Food abundant	-	-	-	21.4 km	64km across	-	4 days	Wet	

TABLE I