

**POPULATION STRUCTURE OF ELEPHANTS IN PERIYAR
TIGER RESERVE SOUTHERN INDIA**

**INTERNAL REPORT
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I. INTRODUCTION

Relentlessly increasing human population and its demand on land for developmental activities evicted elephants from most their former ranges both in Asia and Africa. The present ranges are nothing but a remnant of its original home and most of it restricted to the hilly areas where the developmental activities do not find inroads. The continuous developmental activities in the elephant ranges resulting fragmentation of the once large contiguous habitats. Therefore, the four major populations in India; north, northeast, central and south Indian (Sukumar, 1985) are further getting isolated into still smaller populations. Apart from the loss and fragmentation of habitats, degradation of existing habitats due to grazing and fire wood collection is also another threat to many of the elephant populations.

Sex ratio of polygynous mammals are naturally female biased. On top of it, the selective poaching of males (as only males possess the tusk) for ivory have further skewed the sex ratio of Asian elephant. The more unequal the sex ratio, the lower the effective population size. The

skewing of sex ratio may also decrease the effective population size (Harris *et al.*, 1989). With the loss, fragmentation and degradation of its habitats on the one hand and the ivory poaching on the other hand, the survival of Asian elephant has been threatened very adversely.

In India, ivory poaching is a serious problem to the south Indian population (Sukumar, 1989). A review of literature on the population structure of elephants in south India (Sukumar, 1985; Daniel *et al.*, 1987; Nair *et al.*, 1985; Ramakrishnan *et al.*, 1998) reveals that among the south Indian populations, elephants population in Periyar Tiger Reserve is seriously affected by ivory poaching. The sex ratio is skewed more towards females progressively over the years from 1:6 (in 1969), 1:19 (in 1977), 1:71 (in 1980-82) to 1:122 (in 1987-89).

It is important to know not only the population trend (increasing, stable or declining) but also the demography parameters, such as age structure, sex ratio, fertility and mortality for the conservation of any species. In this context, a short-term study was carried out on the population structure of elephant in Periyar Tiger Reserve, Kerala.

II. STUDY AREA

The Periyar Tiger Reserve is located in the Western Ghat of Kerala state, southern India. This reserve lies between 9° 15' and 9° 40' N latitudes

and 76° 55' and 77° 25' E longitudes (Fig. 1). It covers an area of 770 km² with a reservoir extent over 26 km². Periyar was amongst the first Project Tiger Reserve declared in 1973 and included into elephant reserve (No. 10) category more recently under “Project Elephant”.

The terrain is hilly and the altitude varies from 200m to 2014m with an average of 1200m. There are two major watersheds *viz.* Periyar and Mullayar with its numeral perennial and seasonal tributaries provides water source for wild animals. The temperature varies from 15°C to 31°C. It receives an average rainfall of 2000mm annually both from southwest and northeast monsoons with former gives more rainfall than the latter. The vegetation composition varies from tropical wet evergreen (305km²), semi-evergreen (275 m²) interspersed with moist deciduous (98 km²) and grasslands (12 km²).

Apart from elephant, the Periyar Tiger Reserve also harbours other large herbivores like Gaur (*Bos gaurus*), Sambar (*Cervus unicolor*) spotted deer (*Axis axis*). It also supports three large carnivores *viz.* Tiger (*Panthera tigris*), Leopard (*Panthera pardus*) and Indian Wild dog (*Cuon alpinus*).

III. METHODS

To record the direct sighting of elephant herds and bulls, a systematic visit was made to different parts of the Tiger Reserve on foot and in boat during May 2000. Whenever an elephant herd or bull sighted information

such as place & date of sighting, number and age-sex composition of the herd *etc* were recorded. Characteristic features of individual elephant (if any) was also recorded in order to differentiate individual herds and bulls.

Age estimation

Age classification was done based shoulder height described by Sukumar *et al.*, 1988). All the elephants that were sighted were classified into calf (<1 year), juvenile (2-5 year), sub-adult (5-15 years) and adult (>15 years). For the purpose of detailed analysis, approximate age of each individual was recorded with class interval (of 2 to 5 years).

Sex Classification

Since in Asian elephant only males grow the tusk, sex identification was done using tusk character. However, sex differentiation was not possible for the elephants below two years in all the cases, as tusk growth is prominent only after the second year onwards. A special effort was taken to identify the tuskless males (Makhnas), however it was accurate in the case of adults and sub-adult age classes, as differentiating a makhna from female at juvenile stage was not possible in all the situations due to poor visibility.

Types of classification

All the herds and solitary individual sighted were brought under three types of classifications *viz.*, type I, type II and type III.

Type I: Sightings in which all the individuals in the herd were age-sexed,

Type II: Sightings in which all the individuals in the herd were not classified but it was sure that there was an adult male or no adult male and

Type III: Sightings in which where all the individuals in the herd were not counted and age-sexed.

IV. RESULTS & DISCUSSION

In total, twenty-two herds and solitary individual consisted of 145 elephants were sighted. Of which, informations on age-sex were collected for 128 (88%) elephants (21 herds). The age-sexes of the rest 17 elephants could not be collected due to poor visibility. Within the 128 elephants, eight elephants (one sighting of a herd consisted of six individuals and two sightings of an old solitary female) were re-sighted.

Sex ratio

Overall male female sex ratio was 1:10. However, the sex ratio is skewed towards female progressively from juvenile (1:3.3), sub-adult (1:9) to adult category (1:53). The present result shows that the adult male ratio appeared to be better than the earlier reports (1:71 in 1980-82; 1:122 1987-89; 1:101 in 1998). However, the sex ratio estimated in the present study was based on very small sample size (n=128). The sample size 128 is just 10% of the total population of the Periyar Tiger Reserve. Thus differences between the present study and the earlier studies could be a function sample size than actual increase of male numbers in the population. Though the sex ratios were not skewed much in sub-adult (1:9) and juvenile (1:3.3) classes compared to adult class (1:59), but these would reduce the recovery of adult male ratio into the population

as there were few sub-adults and juveniles left out to reach the next stage.

Percentage of various age-sex classes

The 128 elephants age-sexed during the study period consisted of one adult male giving a percentage of 0.78 (Table 1) in the total population. The percentage of males estimated in the present study was very low when compared to that of earlier estimate (8% in 1969, 3.1% in 1978-80) in Periyar and in the other populations (Mudumalai-Bandipur in 1994, 4%). Similarly percentage of sub-adult males and juvenile males were also less when compared to earlier studies (Nair *et al.*, 1985; Ramakrishnan *et al.*, 1998). It was not possible to sex the calves (n=10) and therefore, an equal sex ratio was assumed as studies on captive elephant shown that sex ratio at birth were equal.

Table 1. Percentage of various sex classes of elephants recorded in Periyar Tiger Reserve, Kerala during May 2000 (n=128)

Major age classes	Male	Female	Total
Adults	0.8	44.2	45.0
Sub-adults	2.5	22.5	25.0
Juveniles	5.0	16.7	21.7
Calves*	4.15	4.15	8.3

* Sex ratio based on assumption

Detailed age structure distribution of male and females is given in Fig.1. The figure shows that only younger males found in the population

and even in the younger age class also, males proportion were lesser than the females in all the age categories. There seem to be no or very few males above twenty age classes, an age from then most of the males show the sign of musth, a breeding behaviour.

Fecundity

Based on the ten calves and 53 adult females identified in this study, the fecundity worked to be 0.19/adult female/year, which was higher than the earlier estimate (0.075/adult female/year) of Periyar population (Ramakrishnan *et al.*, 1998). Pregnancy and inter-calving interval is very long in the case of elephant. A high calving rate in a particular year will result in very low calving rate in the subsequent year, as very few females left for calving. Therefore, the variations observed in the fecundity rate between the present study and the earlier study could be due to inter annual variations. However, the fecundity rate calculated in the present study was still lower as compared to that of other south Indian population (Sukumar, 1989; Baskaran & Desai 2000).

V. LITRATURE CITED

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Appendix 1. Details of different areas visited & animals sighted in Periyar Tiger Reserve during the month May 2000

Date	Places visited	Animals sighted	Remarks
13/5/2000	Thondiyar Malai Area	Elephant	-
14/4/2000	Nelliampatti, Manakavala & Kavalapara Area	Elephant, Gaur & Sambar	-
15/5/2000	Paravalavu, Ayyappankurukku & Periyar dam site	Elephant, Gaur & Sambar	-
16/5/2000	Karadi Kavala, Mangaladevi Temple & Bradipara	Nilgiri Tar, Elephant & Gaur	
16/5/2000	Edapalayam	Wild dog & Sambar	Hunting
17/5/2000	Karadi Kavala, Poovarasu, Pacha Kadu, Vanakavala & Nelliampathi	Elephant, Gaur & Sambar	-
18/5/2000	Potthukandam Area, Vanchu Vayal & Circular Rd.	Elephant, Stripe-necked Mongoose & Gaur	-
19/5/2000	Uppupara, Sabarimala Temple Area & Kozhiganam Area	Elephant & Gaur	-
20/5/2000	Anjurulli Area	Elephant	-
23/5/2000	Thondiyar,	Elephant, Barking deer & Wild dog	-
24/5/2000	Kavalapara, Periyar dam, Mullakudy & Thanikudy	Elephant, Gaur & Sambar	-
25/5/2000	Thanikudy, Nelliparakandam & Melapara	Gaur, Tiger & Sambar	-
26/5/2000	Thanikudi & Kumarikulam Area	Elephant, Gaur & Sloth bear	-
27/5/2000	Thanikudy	Stripe-necked Mongoose	-