

Selection of Specific Age and Sex of Asian Elephant in Captivity as Cultural and Economic Identity



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1: Research Scientist, Asian Nature Conservation Foundation, Innovation Centre, Indian Institute of Science, Bangalore - 560 012, Karnataka; **2:** Forest Veterinary Officer, Department of Forests and Wildlife, KONNI, 695564 Kerala; **3:** Research Associate, Compassion Unlimited Plus Action (CUPA), Veterinary College Campus, Hebbal, Bangalore 560 024, & Wildlife Rescue & Rehabilitation Centre (WRRC), Bannerghatta Biological Park, Bangalore – 560083, Karnataka

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Authors: Surendra Varma, E.K Eshwaran and S.R Sujata

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Compassion Unlimited Plus Action (CUPA),
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Publications officer,
Asian Nature Conservation Foundation (ANCF)
Innovation Centre,
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Email: publications@asiannature.org

Contents

Preface	1
Acknowledgements	3
Executive Summary	4
Introduction and objectives	6
Methodology	6
Results	7
Population number and distribution	7
Population structure	10
Origin of elephants	11
Selection specific typeset	12
Shoulder height	12
Body length	13
Tusk and tush dimensions	15
Population status and future of captive elephants in Kerala	17
Discussion	22
References	24
Appendix 1: Details of elephants obtained through micro-chipping of them in Kerala	26
Appendix 2: Projected numbers of male and female elephants using Gale's (1974) mortality rates	43
Appendix 3: Projected numbers of male and female elephants using Schmidt and Mar (1996) mortality rates	44
Appendix 4a: Projected numbers of male elephants using Sukumar et al., (1997) mortality rates	45
Appendix 4b: Projected numbers of female elephants using Sukumar et al., (1997) mortality rates	45

Preface

Kerala state in southern India is known as the “elephant state”. It has a relatively large wild and captive elephant population. Kerala has some of the best elephant habitats in the world. The status of elephants in captivity is different: although the state supports a large number of elephants in captivity, the population is biased towards specific age and sex. Their health status and the existence of such a large number of elephants in captivity is a cause for concern. There is a long history of keeping elephants in the state, but at no time systematic efforts were made to know the total number of elephants found in the state. Number of elephants kept in the state has not been systematically enumerated.

The selection of specific age and sex of elephants in captivity as a cultural and economic identity of the state has had a lot of influence on the status of elephants in the wild across the country as well as on the welfare of elephants in captivity, especially in the state. Male elephants of specific reproductive age are known to undergo the biological process of musth and this period overlaps with festival seasons where they are heavily decorated, displayed and each elephant is known to attend 40-100 programs/ season located at distances of 35-150 km. During this time, elephants are subjected to constant movement across the state, exposed to huge crowds, noises including the fire-crackers burst during the occasion. Festival season coincides with high humidity and ambient temperature and these processes, even with good intentions of providing welfare for the animal does not permit actual welfare measures to be practiced.

The first step in initiating welfare measures for elephants in captivity in Kerala is to know the total number of elephants found in the state and their distribution and details of ownership. Details such as morphological measurements (body length, height or tusk size or volume, for example) provide scope for knowing the selection of specific age and sex class and the preference for a specific type of animal. The existence of only of a specific age and sex class does not provide opportunity for the population to grow. There are efforts to ban elephant entry into the state, traditional interests of keeping elephants are falling, finding trained mahouts increasingly becoming difficult and the negative publicity of elephants attacking or killing public (more specifically mahouts) influences the state’s tourism industry.

Utilizing the data obtained for the micro-chipping operation of captive elephants in Kerala, this document estimates the total number of elephants, their age, sex, ownership and source. From the results of body measurements (height, body length, tusk/tush length and girth, tusk volume) along with population parameters, inferences are drawn on the status of captive elephant population in Kerala. Although the details of population status and demography are available, there is difficulty in obtaining information on reliable age specific mortality of elephants in captivity in Kerala. However, an attempt was made to review existing literature on annual mortality of elephants in captivity. Using this, the scope for population growth of elephants in captivity in Kerala was made. For this, three different data sets available on annual mortality have been used to predict the growth and decline of elephants in captivity in Kerala. In addition to this, data on elephants’ life expectancy is used to reach inference on the future of elephants in captivity in Kerala.

The findings indicate that Kerala now has reached a state necessitating a critical review of its captive elephant status and their existing welfare conditions. Given the trend of decline in captive elephant numbers, the interesting part would be that for Kerala to have adult males to maintain its cultural and

economic identity, it will have to look for such elephants from elsewhere. This has to be from the wild, or from forest camps or from any other institution. If Kerala's male elephants are not included, in all India level, it is observed that only 0.22% elephants in captivity are 30 to 40 year old males. If Kerala has to replace its 400 adult males (of 30 to 40 years) within 20 years, it cannot be achieved from the wild.

It is important to note that the large number of males of a specific typeset would have contributed a lot in maintaining viability of elephants in the wild. Considering the difficulty in keeping elephants in captivity, their welfare issues, and also the need for maintaining viability of elephants in the wild, releasing such a large number into wild would solve many of the welfare and conservation issues. If elephants are tested for health, disease status and provided an intermediate near-natural setting in order to adapt to the wild, the option of releasing such large numbers of elephants into the wild could be explored. If such a large scale release of elephants into the wild is not possible or practical, selectively some males could be released into the regions where the population sex ratio is highly biased towards females. The intention of releasing elephants into the wild may be severely criticized or may not be practically feasible, however, these existing large number of males, may act as good as 'sperm' bank if the technology of preserving sperm is explored and may act as solution to the declining large male elephant population in the wild.

Acknowledgements

The captive elephants of Kerala were implanted with microchips for definite identification and accounting of the population. The programme was from 2nd October 2006 to December 2008 with an additional camp during June 2009. The special interest shown by the Hon. Minister for Forest and Wildlife, Sri Binoy Viswom, The Principal Chief Conservator of Forests Sri T.M. Manoharan, the Chief Wildlife Wardens during these period Sri, Valliyil Gopinath IFS, Late Sri V. S. Varghese IFS, Sri J.K.Tiwari IFS and Sri Ouseph IFS, the limitless support of the Director of Animal Husbandry dept Dr.Vijayakumar and his team members of the different Elephant Squads were invaluable factors for the success of the programme. Veterinary experts Dr. Arun Zacharia and Dr. V.M. Abdul Gafoor and other forest officials need special mention. The service of Sri Arul Kumar during micro-chipping operations was exemplary.

Executive Summary

Kerala has a mixed population of captive elephants from all over India. There is an indication that the display of specific age and sex classes of elephant forms a cultural and economic identity of the state. However, the preference for specific age and sex class or quality of animal may negatively affect the population growth of elephants in captivity. This report is also a first effort at predicting trends in captive population using known mortality rates from other studies or observations.

As part of implementation of the Declaration of Wildlife Stock rules 2003, part of the WP Act 1972, the captive elephants of Kerala were implanted with microchips for definite identification and accounting of the population. The effort to micro-chip elephants provided a scope for the first ever systematic and scientific approach to identify the actual number of elephants in captivity in the state.

Microchips were implanted in 702 elephants (male/ female), during 2006-2008. It was found that the captive elephants in Kerala belonged to four types of owners (Figures 2a, b, c, and d) such as Private individuals (Pvt), Temples/ ashrams, Forest Camps (FC) and Zoos.

Of 702 elephants 72% of elephants were kept under private ownership, Temples and private ownership together contributed 97% of captive elephants of the state. The elephants with forest camps and zoo contributed only 3% of the elephants kept under captivity. Figure 3 gives the number of elephants across regimes.

Region wise distribution of males and females, irrespective of age classes, was highly biased towards males for temples and private ownership. Out of 702 elephants 681(97%) elephants age was known. The mean age of males across all the regimes was 34 and for females it was 39. Male age classes of 30 to 50 years alone, contributed to 52% of the population.

The sex ratio of elephants kept in captivity was 1: 4.8 (Female: Male) showing a skewed ratio favouring males. Male calves, juveniles and senior elephants comprised less than 1% of the sampled population. Occurrence of sub-adults was 8%, adult population (26 – 50 years) accounted for 70% of all the males. The age group from 31 – 55 years dominated among females, forming 12% of the total elephants sampled.

Elephants in Kerala were owned by 449 owners, suggesting 2 elephants per owners. The distribution of elephants shows that the number of elephants per owner varied: it was minimum for private individuals (1: 1.5: owner: elephant number) followed by zoo (1:2) and comparable values were observed for temples (1: 3.5) and forest camps (1:3.6).

The acquisition of males was more from Bihar than comparable with that of Kerala itself. Maximum numbers of females were sourced from within the state. Elephants in Kerala state are kept primarily as a reflection of cultural or social status of individual owners. This influences the owners' interest in selecting the best animal. The results indicate an interest in keeping elephants with notable characters such as height, body length and tusk size.

Shoulder height, body length and tusk size measurement of male elephants indicate that there is selection of specific typeset. Mean shoulder height of males was 270 cm and about 447 male elephants (80%) were in the 250 to 300 cm height class. Mean body length of males was 309cms and

56% of males measured 300 to 350 cm in body length. Tusk length of males studied ranged from 8-156cm and 420 elephants (73%) had tusk measurement of 60 to 100 cm.

The percentage of occurrence of each age class suggests that calves formed a negligible proportion of the population and juveniles too formed less than 1% of a combined population indicating a poor breeding population or poor survivability of young ones.

Insight into the future of elephants in captivity in Kerala, using three studies of Gale (1974), Schmidt and Mar (1996) and Sukumar, et al., (1997) with the assumption that addition of elephants into Kerala from neighboring regions does not happen, indicates interesting results. Gale's rates of mortality suggest that in 18 years the captive population will be reduced to zero individuals. With the rate estimated by Schmidt and Mar, within 30 years, the captive elephant population in Kerala would be reduced to nil. With the mortality rate observed by Sukumar, et al., (1997) the rate of decline of captive elephants is expected to take place within 11-12 years.

As a fourth alternative, three scenarios have been used to determine the demography of the observed population using various reports on longevity. Even if all the elephants were to survive for the observed life span, most male elephants in captivity would have disappeared in a maximum of 40 years. Females in the reproductively active age group (20 – 50 years) formed 72% of the population and were expected to survive between 25 and 50 years.

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Introduction and objectives

Kerala has a mixed population of captive elephants from all over India, the real owners, as per law, of many elephants are in different states and it is the 'custodians' who are managing these elephants in the state. The issue of ownership is obviously creating many legal and management hassles. Due to ban on import of elephants and other factors, no addition of captive elephants has taken place since August 2007 in the state. Reports suggest that transactions of 16 to 17 elephants used to take place every year and the same has come down to just 4 to 5 elephants/year. As part of the implementation of the Declaration of Wildlife Stock rules 2003, part of the WP Act 1972, the captive elephants of Kerala were implanted with microchips for definite identification and accounting of the population. Display of specific age and sex classes of elephants in Kerala state symbolizes the cultural and economic identity of the state. As mentioned elsewhere, this bias towards keeping specific age and sex class influence the status of male elephants in the wild and their welfare in captivity. It is important to note that the preference for specific age and sex class or quality of animal may negatively affect the population growth of elephants in captivity.

Knowledge about population characteristics such as numbers, sex, age, deaths, births, etc., helps in projecting the future of the studied population in terms of self-sustainability and framing of policy decisions (Gutiérrez, et al., 1996). Studies on captive Asian elephants' demography have been conducted (Sukumar, et al., 1997; Mar, 2007). A captive population is characterized by different management regimes; the studies mentioned previously were limited to a forest-based system of regulated work for the elephants; our attempt is to cover varied management regimes: forest based systems, temples and individual owners.

Collecting data on population related parameters is a challenging effort. The effort to micro-chip captive elephants in Kerala, however, provided a scope for the first ever systematic and scientific approach to identify the actual number of elephants in captivity for the state. Attempts were made to measure the height, body length, length of tusks and tushes and from these measurements, preference for elephants with specific characteristics such as height or body length or tusk length among the elephant owners in Kerala could be made. The data on various measurements could be of use for future studies on allometric growth (Sukumar, 1988).

Age-structure forms a base for any demographic model, more so, for a species with well established aging methods. With a framework of age-frequency data, an effort was made at predicting trends in captive population using known mortality rates from other studies or observations. It is assumed that the conclusions drawn through this investigation may motivate others to gather information on existing conditions, an important factor for predicting the future of captive elephants in Kerala.

Methodology

The Forest Veterinary Officer, Authorized Divisional Forest Officer of the District, Animal Husbandry department Veterinarians and representatives of the Revenue dept organized Micro-chipping (Figures 1a, b and c) and registration across the state. The programme was carried out from 2nd October 2006 to December 2008 with an additional camp during June 2009. A total of 84 camps were organized during this period. The associations of the elephant owners and mahouts and occasionally certain NGOs facilitated at the local level for organization and conduct of the camps. Repeated camps were conducted; the location and number depended on the total number of elephants, their distribution and demand from the facilitators. Wide publicity was given through

mass communication media about the programme and its benefits. Small groups of elephants were brought to a specified point as announced earlier in consultation with the facilitators.



a



b



c

Figures 1a,b, and c: Micro-chipping operation of captive elephants in Kerala (a and b), note the equipments associated with micro-chipping operation (c)

The data on animals, ownership, insurance and mahouts were noted down. The basic body measurements were recorded and the microchip was implanted. Overall, data regarding age, sex, location of birth, body measurements and temperament of the elephants was collected. The animals were subjected to a primary health assessment including basic blood analysis. A microchip certificate was issued then and there. A registration certificate is also being issued comprising all collected data.

Results

Population number and distribution

Microchips were implanted in 702 elephants (male/ female), during 2006-2008. It was found that the captive elephants in Kerala belonged to four types of owners (Figures 2a, b, c, and d) such as Private individuals (Pvt), Temples/ ashrams, Forest Camps (FC) and Zoos. Forest camps are government (Department of Forests and Wildlife) run institutions wherein elephants are allowed to free range in natural forests during the day and are kept chained at night. The elephants are used for forest protection activities and for tourism. Zoos are government (Department of Forests and Wildlife) run institutions maintaining animals for education, research and as a recreational space. Elephants are kept for display purpose alone. Temples are religious institutions managed by private individuals (or groups) or by the government. Clubbed among privately owned temples are “ashrams.”



a



b



c



d

Figures 2a, b, c and d: Examples of elephants from four different management regimes, forest camp (a), private ownership (b), temple (c) and zoo (d)

Of 702 elephants 72% of elephants were kept under private ownership and temples and both together contribute 97% of captive elephants of the state. The forest camps and zoos contribute only 3% of the elephants kept under captivity. Figure 3 gives the number of elephants across regimes.

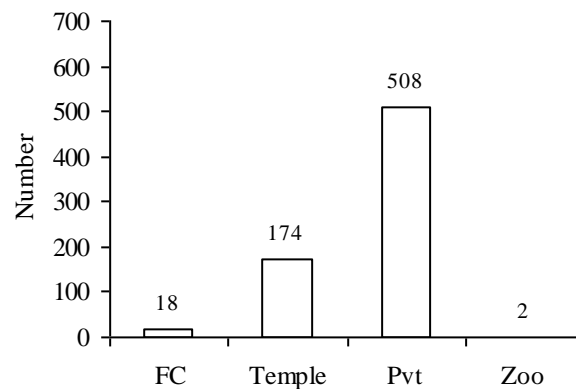


Figure 3: Distribution of elephants across regimes

Region wise distribution of male and females irrespective of age classes is highly biased towards males for temples and private ownership. Forest department with a total of 18 elephants has more females and zoos have equal number of males and females (table 1) Exclusive distribution of elephants among the temple is given in figure 4.

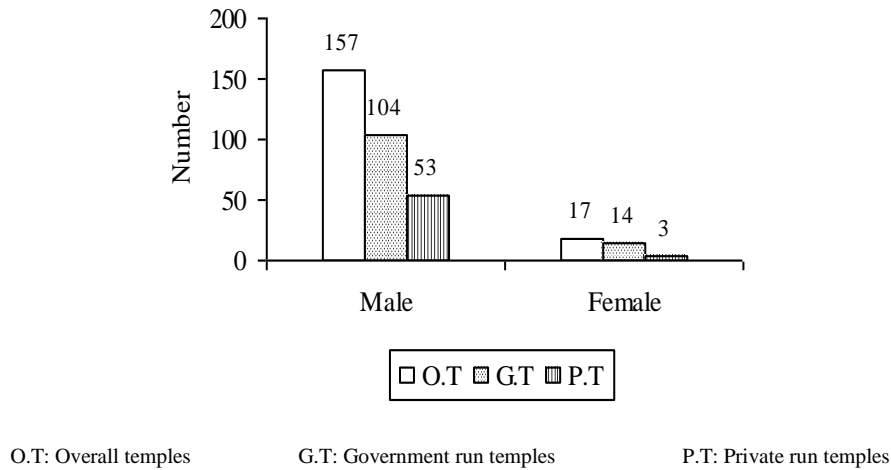


Figure 4: Distribution of elephants among temples

Out of 702 elephants, 681(97%) elephants age is known. The mean age of males for all the regime was 34.1(SE=0.5, N=565) and for females it was 38.6(SE=1.3, N=116). The variation across the age of both sexes was negligible indicating the population bias towards adult animals. Male age classes of 30 to 50 years alone, contribute 52% of the population. Figure 5 gives the mean age of elephants in different regimes; the total number of males whose age was known was 565, the total number of females with known age was 116.

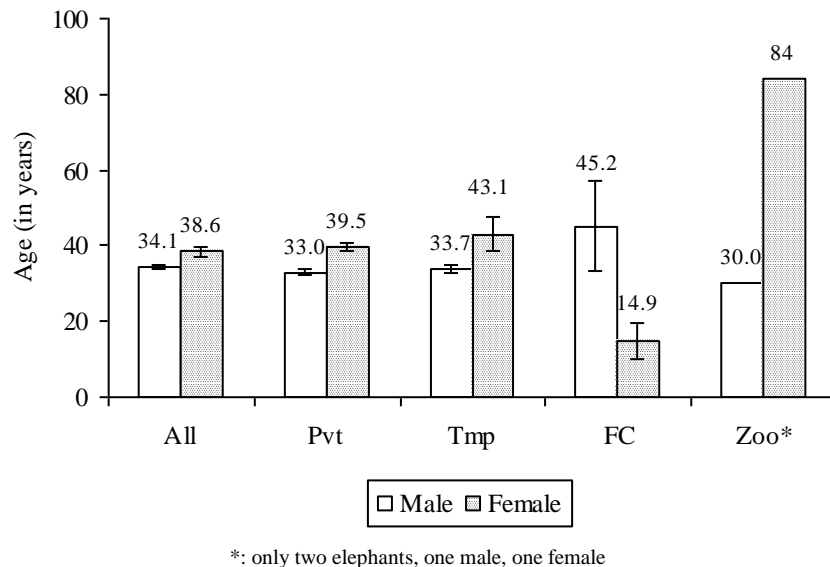


Figure 5: Mean age of males/ females across regimes

Figure 6 gives the mean age of elephants among the government and private run temples.

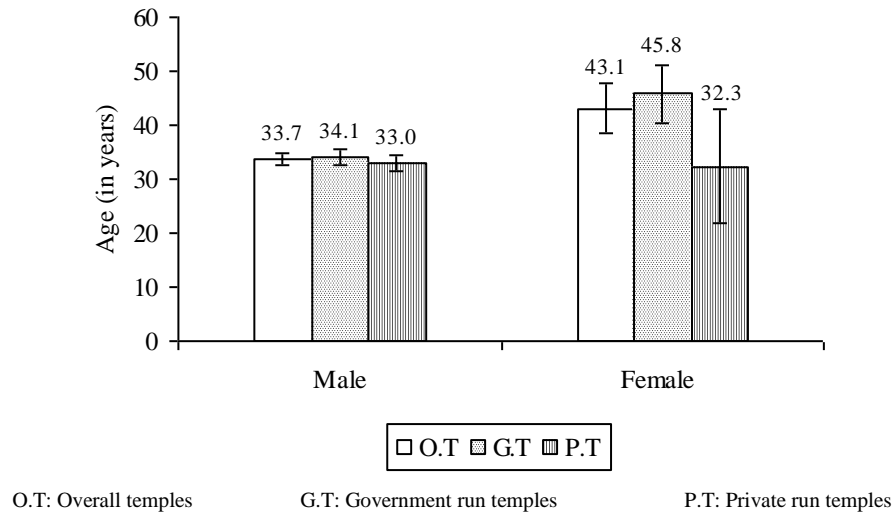


Figure 6: Mean age of males/ females among government and private run temples

Population structure

Of the 682 elephants whose ages were known, 83% were males and 17% were females. Figure 7 gives occurrence of male and female elephants across age groups. The sex ratio was 1: 4.8 (Female: Male) showing a skewed ratio favouring males. 45% of males comprised of the age group 31- 45 years. Male calves (elephants aged less than one year), juveniles (between 1- 5 years) and senior elephants (more than 60 years) comprised less than 1% of the sampled population. Sub-adults (6 – 15 years), however, showed an increase in per-cent occurrence (8%), followed by an adult population (16 – 30 years) with an occurrence of around 5%. The age group from 31 – 55 years dominated among females, forming 12% of the total elephants (n= 682) sampled. Calves (elephants aged less than one year) and senior elephants (between 61 – 70 years) were absent. Juveniles (between 1- 5 years), sub-adults (6 – 15 years), adults (between 16 – 25 years) each comprised less than 1% of the population.

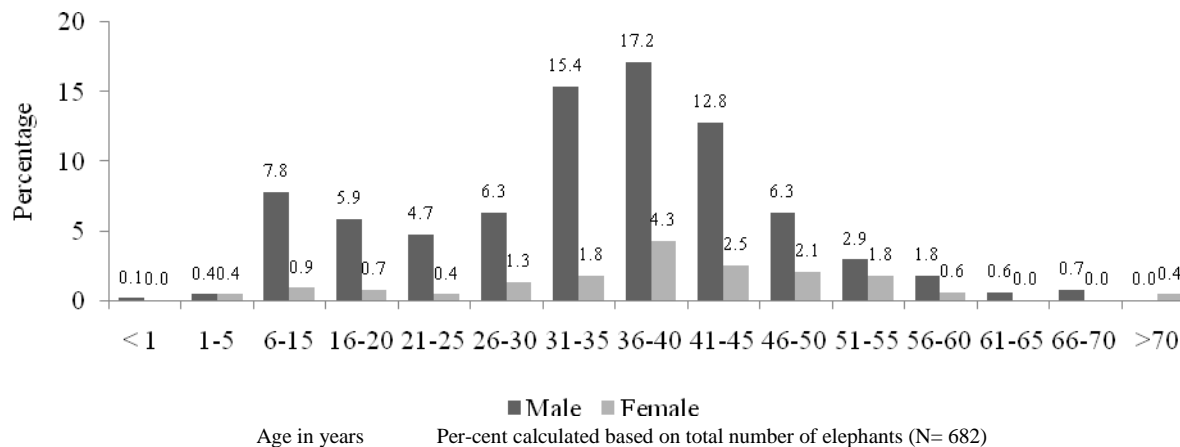


Figure 7: Percentage of occurrence of different age classes of male and female elephants

Elephants in Kerala are owned by 449 owners, suggesting 2 elephants per owner. The elephants were maintained by four types of regimes, with some institutions or individuals keeping more than one elephant. Among private owners, maximum number of elephants was seen in Kottayam district (86) followed by Thrissur (50), Kollam (47). Kasargod, Kannur, Wayanad, Mallapuram and Idukki districts maintained less than 10 elephants with private owners. The distribution of elephants shows that the number of elephants per owner varied: it was minimum for private individuals (1: 1.5: owner: elephant number) followed by zoo (1:2) and comparable values for temples (1: 3.5) and forest camps (1:3.6). Among the temples, government run temples had the highest ratio of owner to elephant (Travancore Devaswom Board— 40 elephants; Guruvayoor Devaswom Board—65; Cochin Devaswom Board—13). Table-1 gives the number of owners of each regime and corresponding number of elephants.

Table 1: Sex based distribution of elephants across different regimes in Kerala

Management type	Number of owners (number of animal/owner)	Male (percentage)	Number of elephants Female (percentage)	Total number of elephants
Forest camp	5(3.6)	8 (44.0)	10 (66.0)	18
Zoo	1(2.0)	1(50.0)	1(50.0)	2
Private owners/individuals	345 (1.5)	417 (82.0)	91 (8.0)	508
All Temples/ Ashram	50 (3.5)	157(90.0)	17 (10.0)	174
Government temples	3 (39.3)	104 (88.0)	14 (12.0)	118
Private temples	47(1.2)	53 (94.0)	3 (6.0)	56

Origin of elephants

Of the 583 males, location of birth was known for 78%; of 119 female elephants, location of birth was known for 84% animals. It can be seen that acquisition of males was more from Bihar and comparable with that of Kerala itself. Interestingly, neighboring states contributed relatively less to the captive population of Kerala as compared to Bihar/ Assam. Maximum numbers of females were sourced from within the state, but the total number of females was itself low in the entire population. Figure 8 and 9 give the percentage of occurrence of elephants from different locations in Kerala.

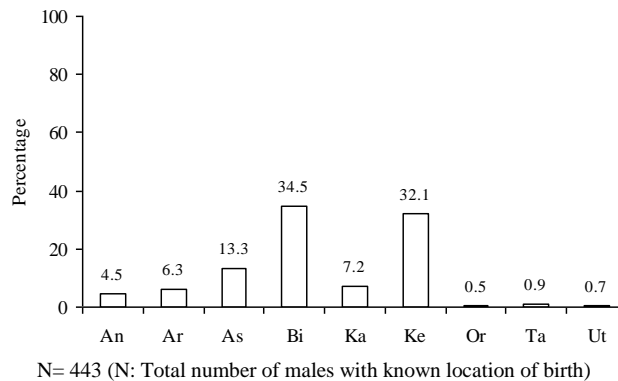


Figure 8: Percentage of occurrence of males from different regions

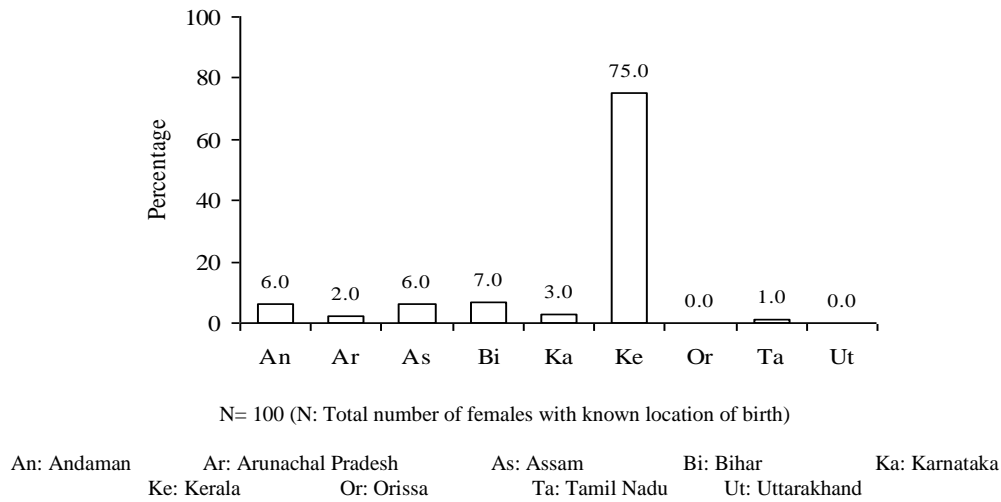


Figure 9: Percentage of occurrence of females from different regions

The actual origin of the elephant within the state is a reflection of large scale exchange of elephants among the owners and the actual origin of these elephants may not be from within the state. It is assumed that the original location would be Bihar. Elephants to Bihar itself would be sourced from N.E Indian states.

Selection specific typeset

Elephants in Kerala state are kept primarily to reflect the cultural or social status of individual owners. This influences the owner's interest in selecting the best animal. The results indicate the interest in keeping elephants with notable characteristics such as height (figure 10a), body length and tusk size (Figure 10b).



a



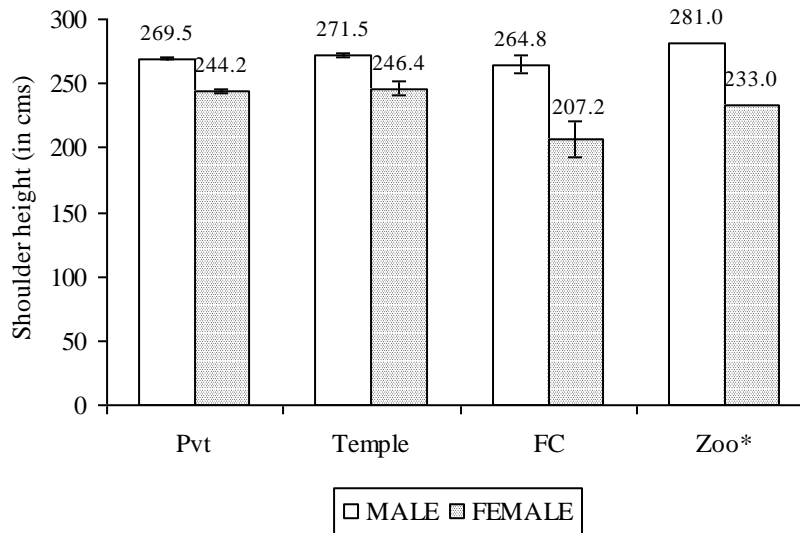
b

Figures 10a and b: Selection of specific typeset: male elephants decorated and displayed (a) and measuring tusk of a male elephant

Shoulder height

Mean shoulder height of males was 269.8cm (SE= 1.0, N= 561) ranging from 99 – 322cm and about 450 elephants (80%) of them were under 250 to 300 cm height class. Mean shoulder height of

females were 241.3cm (SE= 1.9, N= 118) ranging from 142-281cm and 70 elephants (59 %) come under 200 to 250 cm height class. The shoulder height of FC female elephants correlates with the mean age of the animals which was the least among all the regimes. Figure 8 gives the mean shoulder height of elephants classified across regimes.

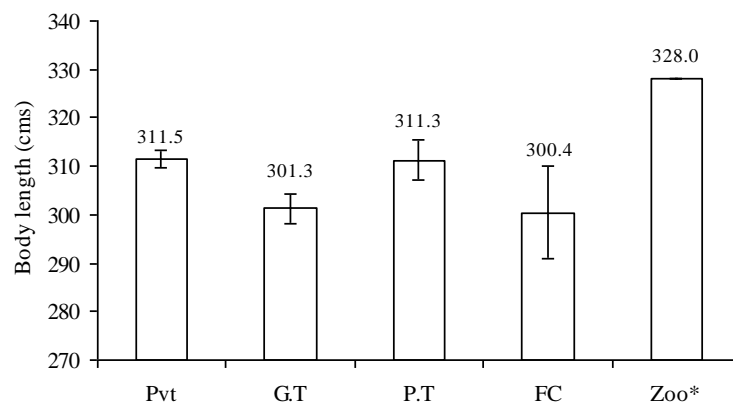


*: Zoo maintained one male and one female elephant only

Figure 8: Mean shoulder height of male/ female elephants

Body length

Mean body length of males (considering all elephants together) was 309.5cms (SE= 1.4, N= 579) ranging from 118-436 cm and 56% of males measure 300 to 350 cm of body length. Mean body length of females was 289.9cm (SE= 2.8, N= 118) ranging from 173-380cm. Figure 9 and 10 give a comparison of body lengths of male and females across regimes.



Pvt: Private owners G.T: Government run temples P.T: Private run temples FC: Forest camps
*: only one male

Figure 9: Mean body length of males across regimes

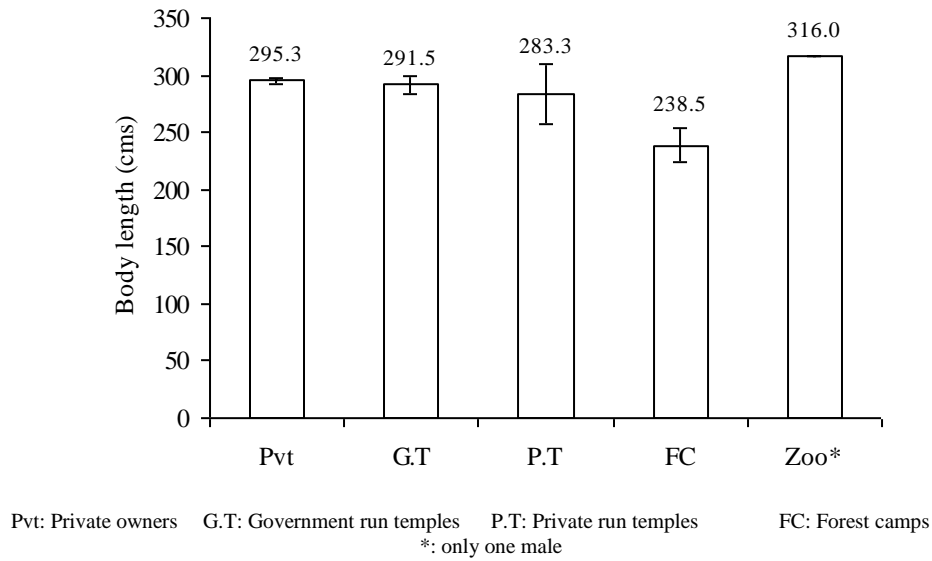


Figure 10: Mean body length of females across regimes

Irrespective of sex of the elephant, the two variables, shoulder height and body length, showed a correlation coefficient value of 0.67 (N= 697) (Figures 11). There is a bias of keeping elephants with maximum body length and height (Figure 11)

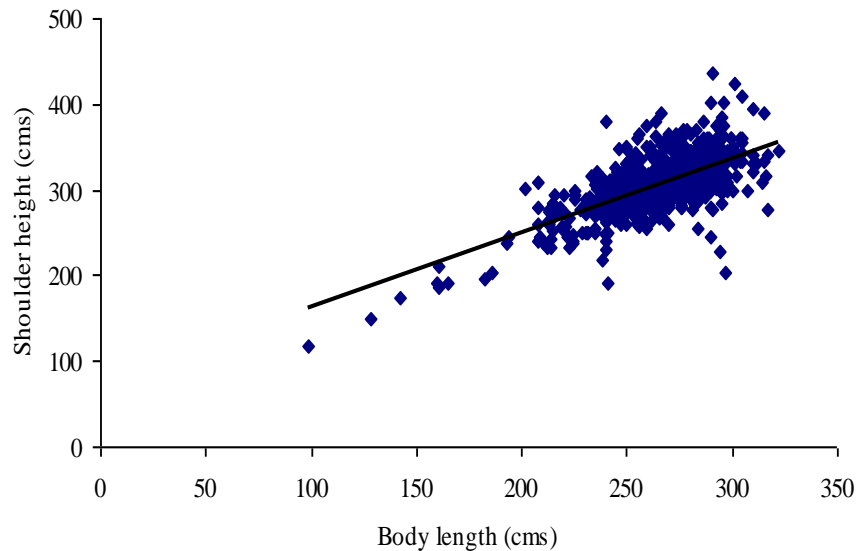


Figure 11: Correlation between shoulder height and body length

The distribution of age of female elephants seems similar to that of males (Figure 11a and 11b) but the correlation values were different ($r = 0.52$, $N = 118$ for females and 0.79 , $N = 561$ for males) implying greater variation in shoulder height among females of comparable age.

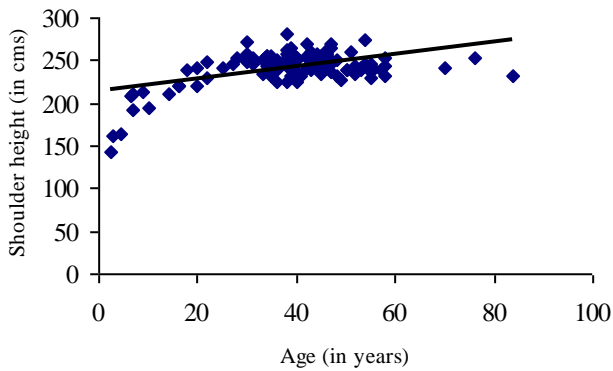


Figure 11a: Correlation between female age and shoulder height

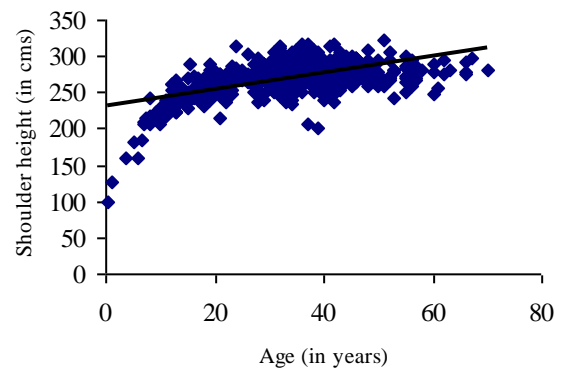


Figure 11b: Correlation between male age and shoulder height

When data from this survey was compared with previous data (Table 2), each age class of elephants from Kerala showed greater shoulder height. The shoulder height was inclusive of both sexes.

Table 2: Comparison of shoulder height measurements of elephants

Age class	Mean height (cm)	Number of elephants	
10-30	210.3	19	Toke gale (1974)
31-50	213	32	
51-70	213.3	33	
0-9	192.6	25	This study
10-30	255.8547	172	
31-50	272.6929	420	
51-70	267.8276	58	
0-9	161.15		Arivazhagan and Sukumar (2008) using formula, for wild elephants, based on earlier study for captive elephants
10-30	225.8889		

Tusk and tush dimensions

Length and girth of tusk/ tush was measured for male/ female elephants (Table- 3a and b). Mean tusk length for males was 69.6cm (SE= 0.6, N= 1125 where N represents number of measurements of left and right tusks). Length ranged from 8- 156cm and 420 elephants (73%) had tusk measurement of 60 to 100 cm, modal value was 72cms (n= 14). Tusk length and age of male elephants showed a correlation of less than 0.5 (correlation coefficient = 0.4, number of tusk measures = 573, number of age measures = 564). The girth of tusk may indicate the quality of tusk and mean girth of tusk (mean of both left and right tusk girth) was 34.4cms (SE=-0.32, N=562). 93% (526 animals) belonged to the tusk girth class of 20 to 60cm. The result of correlation between ages of male elephant's and girth of tusk is given in Figure 13 Correlation between age and tusk girth was 0.6 (correlation coefficient = 0.6, number of age measures = 564, number of tusk girth measures= 562). Tusk girth measures are considered to be reliable age indicators as compared to tusk length which vary more (Watve and Sukumar, 1997). For female elephants, mean tush length was 15.2cms (SE=

0.8, N= 35, where N represents number of measurements of left and right tush). Tush length ranged from 5-27cm. Tush length and age were not correlated (correlation coefficient = -0.099, figure 12), while this value was 0.429 for correlation between tush girth and age of female elephant (Figure 13).

Table-3a: Tusk dimensions for male elephants from different management regimes in Kerala

Mean left tusk length (cm)	Tusk dimensions Male		Mean right tusk girth (cm)
	Mean right tusk length (cm)	Mean left tusk girth (cm)	
69.7 (0.8)*	69.4 (0.8)	34.5 (0.3)	34.5 (0.3)

Table-3b: Tush dimensions for female elephants

Mean left tush length (cm)	Tush dimensions Female		Mean right tush girth (cm)
	Mean right tush length (cm)	Mean left tush girth (cm)	
15.3 (1.2)*	15.1 (1.2)	12.8 (0.6)	12.1 (0.8)

*: Standard Error values

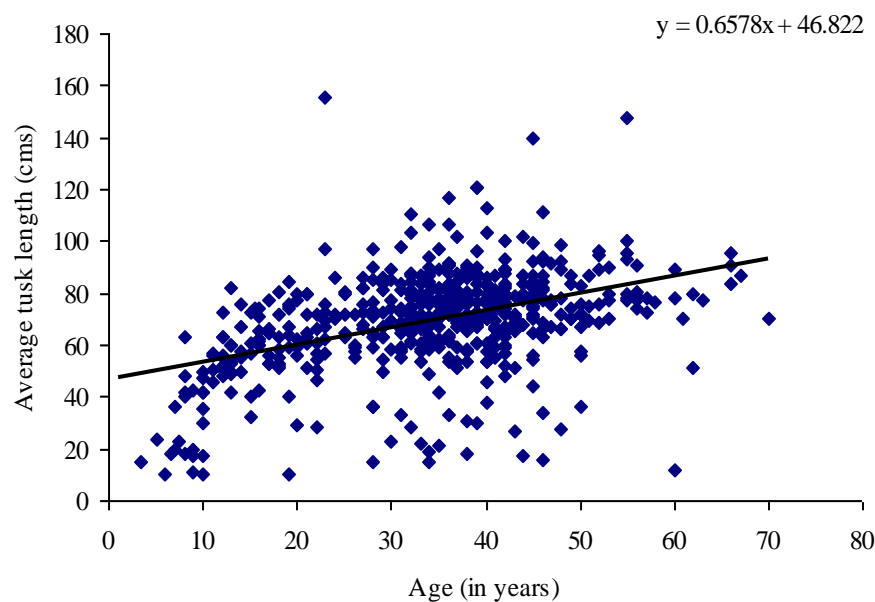


Figure 12: Correlation between average tusk length and age of male elephants

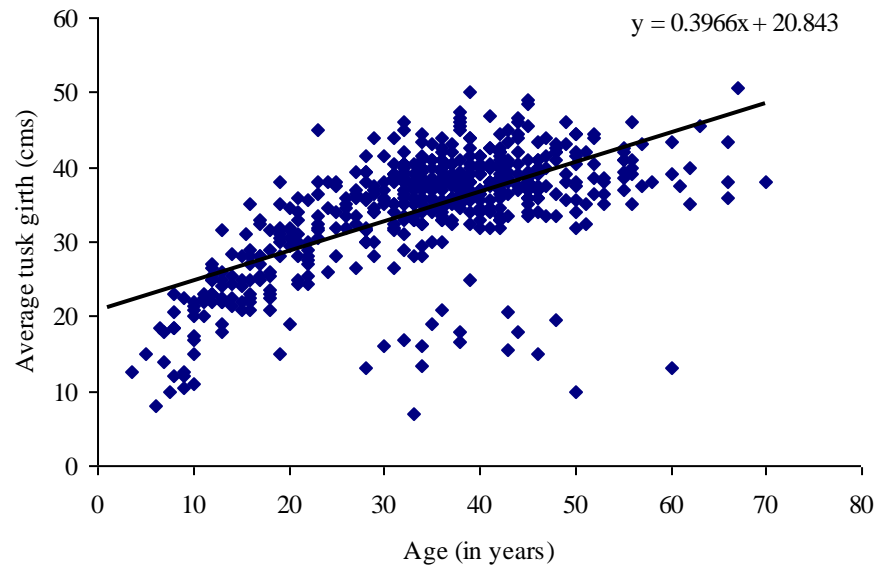


Figure 13: Correlation between average tusk girth and age of male elephants

When volume of tusk was calculated, considering the tusk to be an elliptical cone, it ranged from 0.4 – 171.7 litres, modal value was 44.6lt. (figure 14). Corresponding to tusk volume, modal value for age of elephant was 42 years (n= 31). This would imply a total volume of 1383 litres of tusk accounting for maximum occurrence among captive elephants.

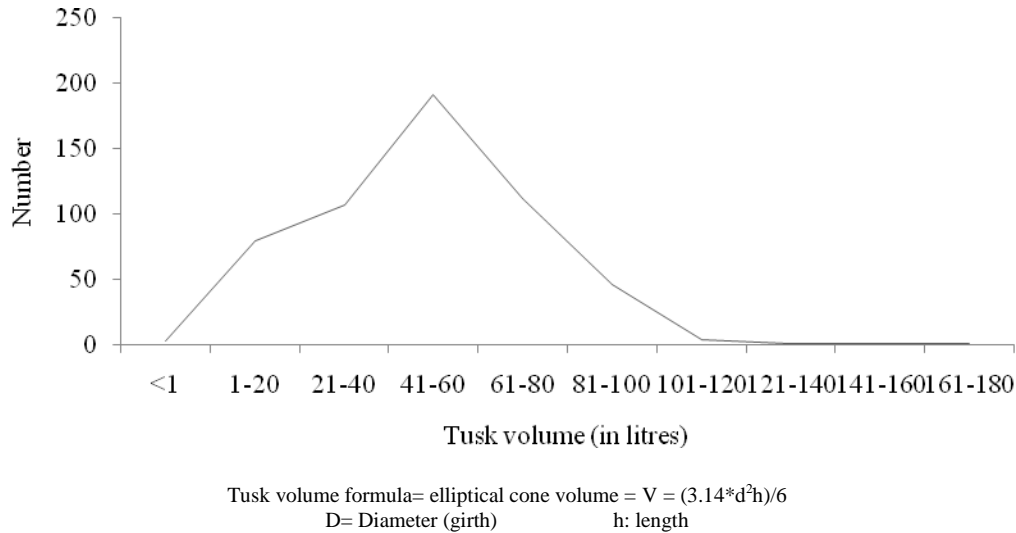


Figure 14: Distribution of tusk volume across observed elephants

Population status and future of captive elephants in Kerala

The percentage occurrence of each age class suggests that (Figure 5) calves formed a negligible proportion of the population and juveniles too formed less than 1% of a combined population indicating a poor breeding population or poor survivability of young ones.

The demographic profile of this population can provide some insight into the future of elephants in captivity in Kerala. For this, two assumptions have to be made:

- Addition of elephants into Kerala from neighboring regions does not happen
- Considering the ownership of elephants, the use of the animals for work and shifting to different locations resulting in potential sources of stressors (Mar, 2007), it becomes important to have some information on the life-span of these animals. This, however, has not been the focus of past studies leading to little or no information on mortality rates for captive elephants in Kerala. Hence, rates observed in previous studies can be used to determine the future of this population

Three studies have been used to project future of this population:

- a. Gale (1974) investigation on working elephants of the Burma Timber Enterprise
- b. Schmidt and Mar (1996) work on the population structure of elephants in Myanmar Timber Enterprise

These two studies/observations are based on captive elephants used for timber/logging operations.

- c. Sukumar, et al., (1997) work on the demography of captive elephants in forest camps of Tamil Nadu.

It should be noted that the annual mortality rates based on elephants maintained in Forest Camps may differ from those of elephants maintained in un-natural captive settings, such as those observed in Kerala, as FCs are based in a forest setting. Such rates would, however, indicate the minimum number of years elephants would survive in Kerala, if there is no reproduction.

- d. Using available data on life expectancy (all data refer to captive elephants):
 - i. Life span of 60 years (Ferrier, 1947)
 - ii. Life span of 60-70 years (Gale, 1974)
 - iii. Life span of an average of 50 to 70 years (Mikota et al., 1994)

Table 4 gives the mortality rates observed by Gale in the then Burmese Timber Enterprise. These elephants were used in timber operations; mortality rates presented may differ three decades later with improved veterinary care and awareness.

Table 4: Annual mortality rates across age groups and sex (Gale, 1974)

Age group (in years)	Mortality percentage (male + female) across 16 years of observation*	Number of elephants	Annual rate of mortality (expressed as percent)
< 9	11%	78	0.7
10-17	4%	27	0.2
18-35	26%	185	1.6
36-54	31%	222	1.9
55-70	28%	202	1.8
Total	100	714	

*: These rates were calculated using total number of dead elephants

With an initial population of 682 elephants, using Gale's rates, the population declines (see table 5); thus, in 18 years the captive population will be reduced to zero individuals (see appendix 2 for more details). The observed birth rate was 0.1%, i.e., less than one birth per 100 reproductively active females. Reproductively active females (including potentially active females, i.e., female juveniles/sub-adults) formed 17% of the observed population. The rate of growth through births is less than the **minimum** mortality rate for the population implying increased mortality as compared to births.

Table 5: Projected numbers of male and female elephants across three generations

Age group (in years)	Annual rates of decline for Gale's population	0 th year Percentage occurrence*	1 st year Percentage occurrence*	2 nd year Percentage occurrence*
< 9	0.7	3.7	3.0	2.3
10-17	0.2	8.8	8.6	8.4
18-35	1.6	33.7	32.1	30.5
36-54	1.9	48.1	46.2	44.3
55-70	1.8	5.4	3.6	1.8

*: refers to observed population in Kerala

Using Schmidt and Mar (1996) based on their study on the population demography of working elephants of the Myanmar Timber Enterprise (Table 6), it can be seen that the population shows a gradual decline across generations. With this rate of decline, it would take 30 years for the population to be reduced to nil (see appendix 3 for more details). Table 6 gives the mortality rates across age groups, averaged across 15 years for which data was available.

Table 6: Mortality rates across age groups (Schmidt and Mar, 1996)

	Calves (untrained, < 5y)	Calves (trained , 5-18y)	Adults (> 18y)
Mortality rates (%)*	8.1	2.1	2.8

*: rates calculated using total number of elephants in each age-group

Table 7: Projected numbers of male and female elephants across years

	< 5 years	5-18 years	> 18 years	
	0.9	12.9	86.2	1 st year
	0	10.8	83.4	2 nd year
		8.7	80.6	3 rd year
		6.6	77.8	4 th year
		4.5	75	5 th year
		2.4	72.2	6 th year
		0.3	69.4	7 th year
		0	66.6	8 th year

Percentage of
occurrence
(male and
female
considered
together)

Using knowledge gained by Sukumar, et al., (1997) from the population demography of forest camp elephants in Tamil Nadu (Table 8), the rate of decline is expected to take 11-12 years and within these years the population could be reduced to zero. Table 9 and 10 show the decline in population of males and females respectively, across years and appendix 4a and 4b gives details of reduction in numbers, up to zero.

Table 8: Annual mortality rates across age groups (Sukumar, et al., 1997)

Age (in years)	Mortality rates (male)	Mortality rates (female)
0-1	15.5	23.8
1-2	3.7	10.5
2-5	1.9	5.3
5-10	0.9	1.8
10-20	0.13	0
20-40	0.9	0.16
40-60	3.8	1.1
60-80	21.4	7.2

Table 9: Projected numbers of male elephants across years

Percentage of occurrence of elephants and change in population across the years for males							
Annual mortality rates	Age group	1 st year	2 nd year	3 rd year	4 th year	5 th year	6 th year
15.5	0-1	0.1	0	0	0	0	0
3.7	1-2	0.1	0	0	0	0	0
1.9	2-5	0.1	0	0	0	0	0
0.9	5-10	2.2	1	0	0	0	0
0.13	10-20	10.7	10.6	10.5	10.3	10.2	10.1
0.9	20-40	41.7	40.8	39.9	39.0	38.1	37.2
3.8	40-60	26.1	22.3	18.5	14.7	10.9	7.1
21.4	60-80	1.8	0.0	0	0	0	0

Table 10: Projected numbers of female elephants across the years

Percentage occurrence of elephants and change in population across the years for females							
Annual Mortality rates	Age group	1 st year	2 nd year	3 rd year	4 th year	6 th year	7 th year
23.8	0-1	0.0	0.0				
10.5	1-2	0.0	0.0				
5.3	2-5	0.4	0.0				
1.8	5-10	0.6	0.0				
0.0	10-20	0.7	0.7	0.7	0.7	0.7	0.7
0.16	20-40	7.0	6.9	6.7	6.6	6.4	6.2
1.1	40-60	7.9	6.8	5.7	4.6	3.5	2.4
7.2	60-80	0.3	0.0	0.0			

If there's one striking aspect about the elephant population in Kerala, it's the predominance of adult males and the low captive birth rate. Even a slow decline in the numbers of elephants will not ensure a stable population as the birth rate is less than 0.5%.

As a fourth alternative, three scenarios have been used to determine the demography of the observed population using various reports on longevity. Figure 14 and 15 show the relative abundance of each age-class considering different life-spans. Numbers reduce with an increase in age, evident from the figures.

Among male elephants, the dominant age group observed, in terms of numbers, was between 31 to 45 years, constituting 55% of all the males observed (n= 565). The number of years of potential survival varied between 20 – 40 years for this demography. Individuals aged 5 years or less formed only 0.7%, their life in captivity varying between 60-70 years. Those aged 55 years or more formed 4% of the males, potential survival varying between 4 – 14 years. Even if all the elephants were to survive for the observed life span, most male elephants in captivity would have disappeared in a maximum of 40 years.

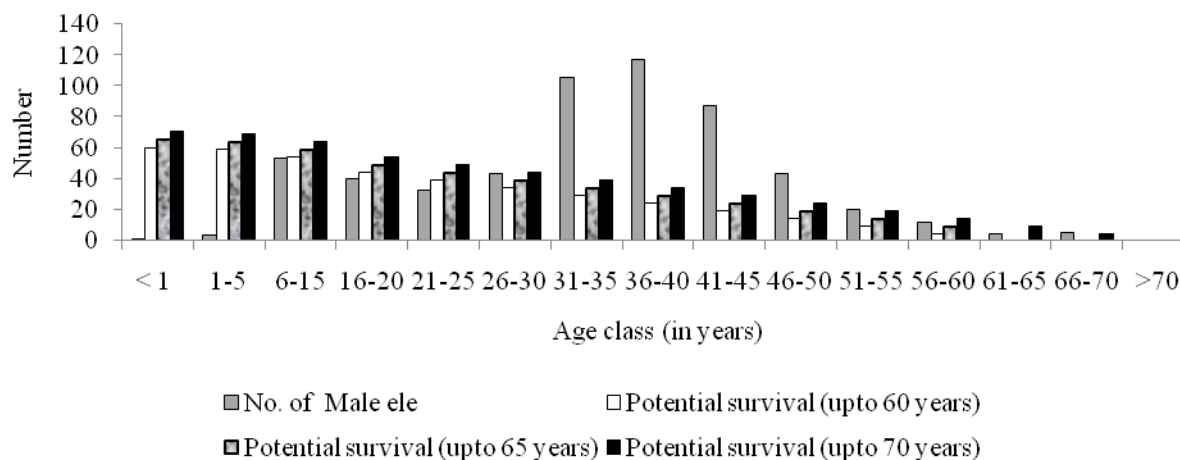


Figure 14: Projected numbers of male elephants

Among female elephants, in terms of numbers, the dominant age group was 36 to 50 years, constituting 51% of observed females (n= 117). Number of years of potential survival for this group varied between 15 – 35 years. Elephants aged 5 years or less formed 3% of the observed elephants and could survive for 60- 70 years. Those aged 55 years or more formed 6% of the female population and could survive between 4 – 14 years. Females in the reproductively active age group (20 – 50 years) formed 72% of the population and could survive between 25 – 50 years. With this background of survival of reproductively active females, if birth rate is also considered (0.1%), i.e., one birth for every thousand elephants, it would require introduction of new elephants into this population to add to the numbers to make any significant impact through the process of captive births or an increase in the percent of captive births.

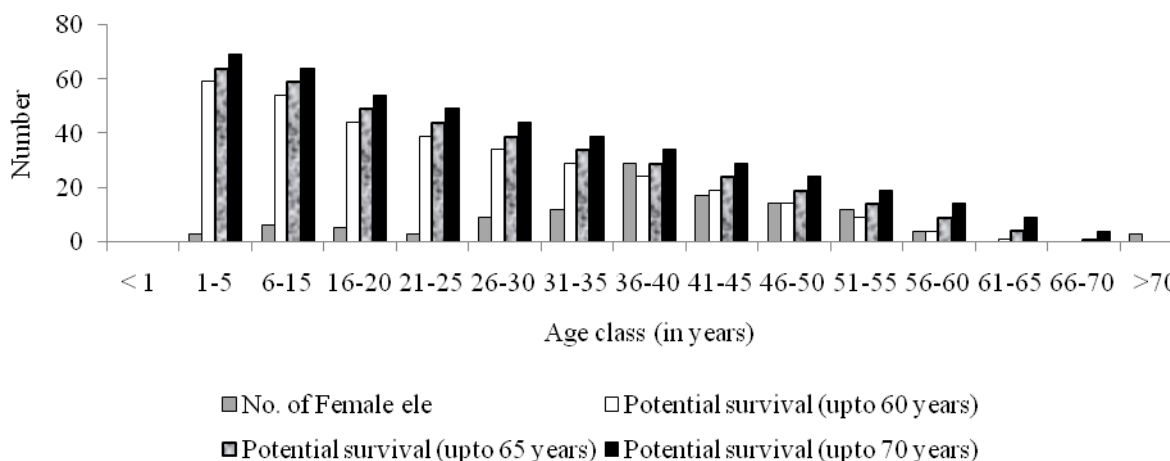


Figure 15: Projected numbers of female elephants

The survival of all the elephants to their expected life span will not ensure a sustained existence of captive elephants in the event of low birth rates. Another way of increasing numbers of this population would be introduction of elephants through trade. This would have to involve bringing in younger elephants (calves, juveniles, sub-adults) in sufficient numbers, which is at present one-fifth for males and one-seventh for females of the proportion of the dominant age-group. Two reasons for this to be an unlikely event is: (a) preference for adult elephants of a certain age group— 31-45 years for males, 36-45 years for females (b) financial cost of trade in elephants in large numbers.

Discussion

Information on population parameters can be invaluable not just in providing a demographic profile of the population, but also in helping to frame policy decisions for management purposes. Body measurements could be an indicator of health status and could provide insight into the preferred range regarding size of animals. Dominant demographic constituents, its effect on the future of the captive population and the related effect of removal from the wild can be known if relevant data is available. Combined with management regimes, population data will help in showing an association, if any, between regimes and preferred demographics.

1. Number of male elephants, considering all elephants together, outnumbered females; ratio of male to female was 1:0.2. Of this, 72% of males were held by private owners, while 27% were maintained by temples. Among temples, 66% of the males were maintained by Government run temples (total number of males with temples = 157).
2. Ratio of male to females was highest for FC (1: 1.25), followed by zoo (1:1). Private owners maintained a ratio of 1:0.22 and minimum was seen for temples (1: 0.11); ratio for Government run temples was 1: 0.14, for private run temples, it was 1: 1:0.06).
3. Mean age of male elephants was comparable across regimes being in the range of 30-45y. Mean age of female elephants was comparable across private owners and both types of temples, being in the range of 32-46yrs.
4. Shoulder height, body length and tusk size measurement of male elephants indicate that there is selection of specific typeset. Mean shoulder height of males was 270 cm and about 447 male elephants (80%) were under 250 to 300 cm height class. Mean body length of males was 309cms and 56% of males measure 300 to 350 cm of body length. Tusk length of males

studied ranged from 8- 156cm and 420 elephants (73%) had tusk measurement of 60 to 100 cm.

5. Watve and Sukumar (1997) found lower parasitic loads in elephants with longer tusks implying a correlation between health and tusk length. The occurrence of elephants in captivity, 70% of whose tusk length varied from 60-100cms, may reflect a situation of “captured” (in the sense of being unavailable to the wild) tuskers with lesser parasitic load
6. Shoshani and Eisenberg (1982) mention an average shoulder height of 3.2m (320cm) for males and 2.54 m (254cm) for females. Mean shoulder height for males was 270cm in this study while shoulder height for females was 241cm implying smaller animals across both sexes. However, the elephants in Kerala appear to be taller when past studies are compared (Table-2) considering age classes.
7. Private ownership was the predominant management regime accounting for 72% of the elephants followed by temples (25%). Among temples, 68% of the elephants were owned by Government run temples. Forest camps accounted for only 3% while zoos contributed only 0.3%.
8. The ratio of owner to number of elephants was minimum for private ownership (1:1.5) implying maintenance of less than two elephants per owner
9. The presence of tusked males in this population (98%, n= 583), and its unavailability to contribute to the gene pool in the wild is comparable to the loss experienced by wild populations caused by poaching of tuskers. Sukumar, et al., (1998) estimated a loss of 300+ tuskers from the wild over a 20 year period. The Kerala population has 500+ tuskers accounting for a total loss of 26,519 litres of tusk volume (tusk length ranged from 8-156cm and girth ranged from 7-53cm). In Periyar Tiger Reserve, the effect of poaching has been a highly skewed sex ratio and absence of calves in the wild leading to declining growth rates. The absence of potentially viable males due to its use for captive purposes could have an effect similar to poaching of tusked males from the wild. This would be all the more significant if these males had been sourced from the wild. Kerala’s male elephants account for 16% of captive males in a study population (Varma, et al., in press), of this only 0.3% were captive born, most were acquired through purchase.

Eighty percent of male elephants were sourced from the three states of Bihar, Kerala and Assam. This implies loss of tusked males to that extent from the wild as captive births of males in a study population of 1545 captive elephants throughout India was only 9% (Varma, et al., in press).

The mortality rates/ life span data used in this investigation was as relevant, say, 20-30 years ago as it is for this study. The application of different rates/longevity records is futile in the absence of knowledge of population parameters for captive elephants a couple of decades ago. If the same trend existed 20-30 years ago, the population could have collapsed by now. The availability of information on the status of the captive population 20-30 years ago, transaction rates, source of transaction, etc., would have helped build a population profile and predict its status for the future. Efforts to collect data may have been initiated, but fragmented. Because of this deficiency, there is no data available on mortality rates for this study. Micro-chipping of elephants has solved this problem by providing detailed information about sex, age, numbers and body measurements and attempts to predict future of captive elephants in Kerala through different mortality rates has provided some insight on current status of captive elephants in Kerala.

The other interesting aspects of population status is that the number of elephants and specific sex and age class needed for Kerala in its main source of Bihar state is falling. A notable decline of elephant displayed in the Sonepur mela from where most of the elephants were reported to be purchased for Kerala is visible (Varma et al., 2010). Laws restricting buying and transporting elephants, non availability of trained mahout and other factors will influence the future of captive elephants in the state.

Captive elephants of Kerala, when viewed from all angles such as shoulder height, age, tusk length, tusk girth, show a clear bias towards specific measurements— male elephants are preferred aged between 30-45y, with tusk length between 60-70cms, shoulder height between 250- 270cms— as this preference becomes more specific, availability of elephants with such characteristics becomes difficult. Of the 701 elephants microchipped, only 31% were said to be born in Kerala, 77% of the male elephants born in Kerala were aged between 30- 50 years. On the one hand, captive births within the state is negligible, on the other, acquisition through purchase from other states is not a solution as captive elephants with such specific characteristics across the country is not the same as in Kerala, given that this preference is not seen throughout India. Considering all factors together, it becomes apparent that the current population of elephants in Kerala will not be able to sustain itself in the coming decades.

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Appendix 1: Details of elephants obtained through micro-chipping of them in Kerala

.no	Nameof the elephant	Sex	Age	Ownership	District
1	Mahadevan (Maheswaran)	Male	17	Ashram Art of Living	Thiruvananthapuram
2	Lekshmi	Female	16	Ashram Amrtha	Kollam
3	Raman	Male	8	Ashram Amrtha	Kollam
4	Anjana	Female	2.5	FC	Ernakulam
5	Asha	Female	4.5	FC	Ernakulam
6	Neelakandan	Male	12	FC	Ernakulam
7	Parvathy	Female	3	FC	Ernakulam
8	Sunitha	Female	38	FC	Ernakulam
9	Mony	Male	62	FC	Kollam
10	Eva	Female	7	FC	Pathanamthitta
11	Meena	Female	18	FC	Pathanamthitta
12	Priyadarshni	Female	25	FC	Pathanamthitta
13	Soman	Male	66	FC	Pathanamthitta
14	Surendran	Male	10	FC	Pathanamthitta
15	Dinesan	Male	55	FC	Wayanad
16	Kunju	Male	NA	FC	Wayanad
17	Surya	Male	NA	FC	Wayanad
18	Ammu	Female	7	FC	Thiruvananthapuram
19	Jayasree	Female	37	FC	Thiruvananthapuram
20	Minna	Female	6.5	FC	Thiruvananthapuram
21	Renji	Male	66	FC	Thiruvananthapuram
22	Kannan	Male	NA	Private	Idukki
23	Gopalan	Male	40	Private	Ernakulam
24	Unnikrishnan	Male	39	Private	Thrissur
25	Govindankutty	Male	46	Private	Kottayam
26	Mahesh	Male	36	Private	Ernakulam
27	Sundari	Female	52	Private	Kozhikode
28	Arjun	Male	43	Private	Kozhikode
29	Suseela	Female	35	Private	Kozhikode
30	Varun	Male	20	Private	Kannur
31	Sankarankutty	Male	27	Private	Kottayam
32	Gangadaran	Male	38	Private	Kottayam
33	Meera	Female	35	Private	Kottayam
34	Sreeraman	Male	36	Private	Kottayam
35	Vijayan	Male	34	Private	Kottayam
36	Ganesan	Male	39	Private	Kottayam
37	Sheela	Female	35	Private	Kottayam
38	Sundari	Female	16	Private	Kottayam
39	Balagopalan	Male	42	Private	Pathanamthitta
40	Appu	Male	41	Private	Ernakulam

41	Ramu (Elias) Ganapathy	Male	16	Private	Ernakulam
42	Saraswathy	Male	60	Private	Kannur
43	Manikandan	Male	39	Private	Kannur
44	Arjunan	Male	45	Private	Ernakulam
45	Saaj Prasad	Male	NA	Private	Thrissur
46	Karuvattoor Vignesh	Male	39	Private	Palakkad
47	Poothrukovil Ganapathy	Male	47	Private	Thrissur
48	Unnikrishnan	Male	12	Private	Alappuzha
49	Ganeshan Alias Kuttikrishnan	Male	57	Private	Alappuzha
50	Mohanan	Male	38	Private	Idukki
51	Harikuttan	Male	31	Private	Kottayam
52	Vijayan	Male	49	Private	Kollam
53	Bastin Vinayachandran	Male	38	Private	Thrissur
54	Bastin Vinayasankar	Male	32	Private	Thrissur
55	Mohanan	Male	52	Private	Ernakulam
56	Kannan	Male	39	Private	Idukki
57	Uttoly Ayyappan	Male	23	Private	Thrissur
58	Madhavan	Male	43	Private	Thiruvananthapuram
59	Arun Ayyappan	Male	32	Private	Ernakulam
60	Pattathu Sreekrishnan	Male	41	Private	Thrissur
61	Lekshmi	Female	43	Private	Idukki
62	Ambady Kannan Kalarikavu	Male	6.5	Private	Thrissur
63	Usha	Female	48	Private	Kottayam
64	Lekshmikkutty	Female	45	Private	Kottayam
65	Sreekuttan	Male	25	Private	Alappuzha
66	Ganapathy	Male	32	Private	Kottayam
67	Sivan Thottakkad	Male	35	Private	Kottayam
68	Keerthi	Female	52	Private	Kottayam
69	Ramachandran	Male	41	Private	Kottayam
70	Sankarankutty	Male	38	Private	Kottayam
71	Sreenivasan	Male	50	Private	Kottayam
72	Lekshmi (Roopa)	Female	30	Private	Kottayam
73	Sekharan	Male	42	Private	Kottayam
74	Santhakumari	Female	44	Private	Kottayam
75	Vijaya Lakshmi	Female	31	Private	Kottayam
76	Krishna Das	Male	50	Private	Ernakulam
77	Krishna Prasad	Male	38	Private	Ernakulam
78	Kuttikrishnan (Alias Sreeparameswaran)	Male	44	Private	Ernakulam
79	Lohi Prasad	Male	31	Private	Kollam
80	Vasanthi	Female	44	Private	Pathanamthitta
81	Shenoy Chandrasekharan	Male	56	Private	Ernakulam
82	Sreenivasan	Male	42	Private	Ernakulam

83	Hamsa Raj	Male	58	Private	Wayanad
84	Sonu Unnikrishnan	Male	7	Private	Kollam
85	Baladevan	Male	32	Private	Kollam
86	Rajagopal	Male	36	Private	Kollam
87	Sree Vinayakan	Male	48	Private	Kollam
88	Parameswaran	Male	28	Private	Kottayam
89	Anandapadmanabhan	Male	42	Private	Kottayam
90	Kangazha Narayanankutty	Male	42	Private	Kottayam
91	Anupama	Female	33.5	Private	Alappuzha
92	Kumar	Male	18	Private	Kottayam
93	Mullath Vijayakrishnan	Male	13	Private	Thrissur
94	Ganapathy	Male	33	Private	Thrissur
95	Konark Ganapathy	Male	29	Private	Thrissur
96	Arjun	Male	31	Private	Kottayam
97	Mangal	Male	24	Private	Kottayam
98	Arjun (Babumon)	Male	38	Private	Kottayam
99	Sankarankutty	Male	42	Private	Kottayam
100	Balakrishnan	Male	50	Private	Ernakulam
101	Chandu Nandileth	Male	7.5	Private	Thrissur
102	Lekshmi	Female	36	Private	Kannur
103	Kannan	Male	28	Private	Kollam
104	Mahavishnu	Male	18	Private	Kollam
105	Kochuganeshan	Male	11	Private	Kollam
106	Kutty Sankaran	Male	46	Private	Thrissur
107	Chembukavu Vijay Kannan	Male	25	Private	Thrissur
108	Bolonath	Male	35	Private	Kottayam
109	Raja	Male	26	Private	Kollam
110	Lekshmi Bai	Female	14	Private	Kottayam
111	Sreekandan	Male	27	Private	Kollam
112	Mohandas	Male	40	Private	Kollam
113	Mangalath Edamana Ganesan	Male	32	Private	Thrissur
114	Viswanathan	Male	19	Private	Kollam
115	Devadathan	Male	50	Private	Palakkad
116	Devanarayanan	Male	45	Private	Thrissur
117	Kiran Ganapathy	Male	41	Private	Kottayam
118	Kiran Narayanankutty	Male	38	Private	Kottayam
119	Mangalamkunnu Kannan	Male	46	Private	Palakkad
120	Mangalamkunnu Appu	Male	16	Private	Palakkad
121	Mangalamkunnu Ayyappan	Male	36	Private	Palakkad
122	Lakshmi	Female	34	Private	Ernakulam
123	Indira (Maria)	Female	40	Private	Kottayam
124	Kannan	Male	0.5	Private	Kottayam
125	Malathy	Female	27	Private	Kottayam

126	Beena	Female	30	Private	Kottayam
127	Kannan	Male	29	Private	Kottayam
128	Sivankutty	Male	36	Private	Kottayam
129	Edakkulathur Devanarayanan	Male	12	Private	Thrissur
130	Murukan	Male	41	Private	Kollam
131	Vinayakan	Male	19	Private	Kollam
132	Sunder Singh	Male	15	Private	Kollam
133	Arjun	Male	48	Private	Thrissur
134	Mohanan	Male	43	Private	Kottayam
135	Rambha	Female	28	Private	Kottayam
136	Neelakandan	Male	32	Private	Pathanamthitta
137	Saraswathy	Female	46	Private	Kozhikode
138	Leela	Female	38	Private	Kottayam
139	Ayyappankutty (Raja)	Male	8	Private	Palakkad
140	Manjeri Arjunan	Male	46	Private	Thrissur
141	Ganapathy (Devanarayan)	Male	43	Private	Kottayam
142	Vijay	Male	49	Private	Thiruvananthapuram
143	Karnan Kadayinikkad	Male	33	Private	Kottayam
144	Bola	Male	32	Private	Kollam
145	Dhananjayan	Male	32	Private	Kozhikode
146	Parukkutty	Female	55	Private	Alappuzha
147	Lekshmi	Female	42	Private	Idukki
148	Aneesha	Female	36	Private	Ernakulam
149	Elavumthadathil Unnikrishnan	Male	52	Private	Ernakulam
150	Puthussery Prabhu	Male	28	Private	Thrissur
151	Rajendran	Male	NA	Private	Palakkad
152	Reghuram Manisseri	Male	39	Private	Palakkad
153	Mukundan - Mangalamkunnu	Male	34	Private	Palakkad
154	Bhagavathy	Female	52	Private	Kozhikode
155	Ganeshan	Male	13	Private	Kottayam
156	Kesavan	Male	42	Private	Kottayam
157	Pala Kannan	Male	36	Private	Kottayam
158	Ganeshan	Male	31	Private	Kottayam
159	Sai Krishnan	Male	11	Private	Kollam
160	Nakulan	Male	36	Private	Pathanamthitta
161	Manmohan	Male	9	Private	Kannur
162	Vijayan	Male	36	Private	Kozhikode
163	Savithri	Female	43	Private	Malappuram
164	Sundari	Female	58	Private	Malappuram
165	Laila	Female	45	Private	Kozhikode
166	Manikantan	Male	40	Private	Ernakulam
167	Rajalekshmi	Female	46	Private	Kottayam
168		Male	NA	Private	Thrissur

169	Ganesh	Male	46	Private	Kollam
170	Rajasekharan	Male	31	Private	Kottayam
171	Madavan (Samsher Singh)	Male	33	Private	Kottayam
172	Unnikrishnan	Male	40	Private	Pathanamthitta
173	Mohanan	Male	48	Private	Kottayam
174	Ayyappankutty	Male	43	Private	Kottayam
175	Gowri Nandan	Male	5	Private	Thiruvananthapuram
176	Jayaram Kannan	Male	47	Private	Ernakulam
177	Ambika	Female	50	Private	Kollam
178	Chathapuram Baby	Male	30	Private	Palakkad
179	Mavelikkara Krishnankutty	Male	17	Private	Alappuzha
180	Hiran	Male	52	Private	Wayanad
181	Rajeevan	Male	42	Private	Kottayam
182	Rani	Female	47	Private	Wayanad
183	Ayyappan	Male	14	Private	Idukki
184	Unnikuttan	Male	20	Private	Kottayam
185	Saseendran	Male	56	Private	Ernakulam
186	Sethu lekshmi	Female	55	Private	Kottayam
187	Ganeshan	Male	14	Private	Kannur
188	Akbar	Male	55	Private	Kottayam
189	Lekshmi	Female	47	Private	Kottayam
190	Ayyappan Kutty	Male	37	Private	Idukki
191	Unni	Male	32	Private	Idukki
192	Ayyappan	Male	40	Private	Palakkad
193	Jayadevan	Male	36	Private	Ernakulam
194	Suma	Female	39	Private	Thiruvananthapuram
195	Ollukkara Jayaram	Male	21	Private	Thrissur
196	Puthuppally Kesavan	Male	35	Private	Kottayam
197	Aromal	Male	7	Private	Alappuzha
198	Vasudevan	Male	50	Private	Kollam
199	Sekharan	Male	26	Private	Kottayam
200	Vishnu	Male	35	Private	Ernakulam
201	Balan	Male	10	Private	Kollam
202	Vijayalekshmi	Female	49	Private	Alappuzha
203	Mini	Female	34	Private	Malappuram
204	Gangadharan	Male	42	Private	Malappuram
205	Appu	Male	19	Private	Malappuram
206	Ramachandran	Male	42	Private	Malappuram
207	Manikantan	Male	41	Private	Alappuzha
208	Ganapathy	Male	38	Private	Palakkad
209	Mohanakrishnan	Male	39	Private	Palakkad
210	Vijayan	Male	46	Private	Palakkad
211	Kesavan	Male	50	Private	Palakkad

212	Mini	Female	22	Private	Kottayam
213	Parameswaran	Male	NA	Private	Thrissur
214	Uttoly Mahadevan	Male	8	Private	Thrissur
215	Adisankaran	Male	32	Private	Palakkad
216	Rajasekharan	Male	40	Private	Thiruvananthapuram
217	Ganesan	Male	10	Private	Thiruvananthapuram
218	Oottoly Ganapathy	Male	37	Private	Thrissur
219	Oottoly Padmanabhan	Male	37	Private	Thrissur
220	Ashokan	Male	41	Private	Kottayam
221	Ganapathy	Male	35	Private	Alappuzha
222	Vasudevan	Male	44	Private	Kozhikode
223	Kaveri	Female	43	Private	Kozhikode
224	Devidasan	Male	22	Private	Palakkad
225	Ayyappankutty	Male	NA	Private	Kottayam
226	Mahadevan	Male	42	Private	Palakkad
227	Cheerth Cheriya Rajeev	Male	34	Private	Thrissur
228	Sree Padmanabhan	Male	22	Private	Kollam
229	Sreeraman	Male	18	Private	Kottayam
230	Kallumpuram Kannan	Male	32	Private	Palakkad
231	Kesavan	Male	35	Private	Palakkad
232	Kasthuri Bai	Female	54	Private	Kollam
233	Parukkutty	Female	55	Private	Kasaragod
234	Vanaja	Female	45	Private	Kottayam
235	Kiran Kannan	Male	39	Private	Kottayam
236	Sivankutty	Male	35	Private	Alappuzha
237	Prasad	Male	22	Private	Ernakulam
238	Unnikrishnan	Male	38	Private	Ernakulam
239	Lekshmi	Female	44	Private	Kozhikode
240	Uma	Female	36	Private	Alappuzha
241	Bahadur Alia	Male	30	Private	Kollam
242	Paramakkavu Narayanan	Male	60	Private	Thrissur
243	Ayyappan (Swaminadhan Ganesan)	Male	50	Private	Thrissur
244	Arunkumar	Male	35	Private	Ernakulam
245	Unnikrishnan	Male	32	Private	Kottayam
246	Ramachandran	Male	36	Private	Kottayam
247	Sulthan	Male	55	Private	Kottayam
248	Ganapathy	Male	35	Private	Pathanamthitta
249	Gajendran	Male	31	Private	Pathanamthitta
250	Karnan	Male	20	Private	Pathanamthitta
251	Deepu	Male	37	Private	Pathanamthitta
252	Krishnankutty	Male	51	Private	Kottayam
253	Unnikkuttan	Male	13	Private	Kottayam
254	Indira	Female	58	Private	Malappuram

255	Padmini	Female	57	Private	Malappuram
256	Ganagalakshmi	Female	38	Private	Kannur
257	Rajagopalan	Male	39	Private	Ernakulam
258	Rembha	Female	39	Private	Palakkad
259	Ramachandran	Male	39	Private	Kottayam
260	Kannan	Male	12	Private	Kollam
261	Sunder Singh	Male	28	Private	Kollam
262	Ayyappan	Male	38	Private	Kollam
263	Ganga Prasad	Male	43	Private	Kollam
264	Indira	Female	38	Private	Thiruvananthapuram
265	Sree Raman	Male	37	Private	Kottayam
266	Venugopal	Male	35	Private	Kottayam
267	Ayyappan	Male	9	Private	Ernakulam
268	Gopalankutty	Male	57	Private	Malappuram
269	Sathi (Sarala)	Female	48	Private	Kozhikode
270	Rajeevan	Male	34	Private	Kottayam
271	Meenakshi	Female	40	Private	Kottayam
272	Kuttysankaran	Male	42	Private	Ernakulam
273	Jimmy	Female	39	Private	Malappuram
274	Vishnu	Male	39	Private	Ernakulam
275	Krishnan	Male	36	Private	Thrissur
276	Ravisankar	Male	32	Private	Thrissur
277	Muralikrishnan	Male	32	Private	Palakkad
278	Kunju	Male	36	Private	Ernakulam
279	Kannan (Alias Govindan)	Male	39	Private	Ernakulam
280	Velayudhan	Male	42	Private	Kozhikode
281	Sree Lakshmi	Female	9	Private	Kozhikode
282	Nanu Ezhuthachan Sreenivasan	Male	52	Private	Thrissur
283	Devikrishnan	Male	38	Private	Thrissur
284	Vishnu Narayanan	Male	19	Private	Ernakulam
285	Poomully Arjunan	Male	38	Private	Palakkad
286	Soman	Male	45	Private	Alappuzha
287	Aswin (Achu)	Male	19	Private	Pathanamthitta
288	Rajagopalan	Male	38	Private	Kottayam
289	Sekharan	Male	45	Private	Kottayam
290	Mahadevan	Male	44	Private	Kottayam
291	Prakash Sankar	Male	36	Private	Thrissur
292	Mony alias Sankaran	Male	42	Private	Kollam
293	Gopalakrishnan Alias Manikantan	Male	31	Private	Palakkad
294	Abhimanyu	Male	16	Private	Kollam
295	Kalidasan	Male	24	Private	Thrissur
296	Guruvayoorappan - Mangalamkunnu	Male	44	Private	Palakkad
297	Mangalamkunnu Ganapathy	Male	62	Private	Palakkad

298	Mangalamkunnu Karthikeyan	Male	29	Private	Palakkad
299	Mangalamkunnu Kesavan	Male	38	Private	Palakkad
300	Ramachandran Mangalamkunnu	Male	38	Private	Palakkad
301	Vijayan - Mangalamkunnu	Male	49	Private	Palakkad
302	Pushpa	Female	NA	Private	Kottayam
303	Sreekrishnapuram Vijay	Male	11	Private	Palakkad
304	Manikantan	Male	17	Private	Ernakulam
305	Madhusankar	Male	42	Private	Palakkad
306	Bramadatta	Male	43	Private	Kottayam
307	Ganeshan	Male	39	Private	Kottayam
308	Lucky Prasad	Male	34	Private	Kottayam
309	Lucki	Female	51	Private	Kottayam
310	Bhadra	Female	22	Private	Kottayam
311	Puthuppally Sadhu	Male	42	Private	Kottayam
312	Mothy	Male	32	Private	Ernakulam
313	Lekshmanan	Male	37	Private	Kollam
314	Kalidasan - Palode	Male	45	Private	Palakkad
315	Kuttikrishnan	Male	36	Private	Kozhikode
316	Gajendran (Prithwiraj)	Male	40	Private	Kozhikode
317	Ramankutty	Male	43	Private	Alappuzha
318	Rajasekharan	Male	49	Private	Kottayam
319	Sankarankutty (Kannan)	Male	23	Private	Alappuzha
320	Ammu Alias Vally	Female	20	Private	Thiruvananthapuram
321	Ayyappan	Male	32	Private	Kollam
322	Vijayalakshmi	Female	45	Private	Kozhikode
323	Kannan	Male	10	Private	Thiruvananthapuram
324	Ganesan	Male	37	Private	Thiruvananthapuram
325	Pattathanam Kesavan	Male	27	Private	Kollam
326	Mahadevan	Male	35	Private	Kollam
327	Arjunan	Male	30	Private	Kollam
328	Ochira Mohan	Male	36	Private	Alappuzha
329	Karnan	Male	45	Private	Thiruvananthapuram
330	Anantha Padmanabhan	Male	35	Private	Thiruvananthapuram
331	Ayyappan	Male	33	Private	Thiruvananthapuram
332	Karnan	Male	34	Private	Thiruvananthapuram
333	Parthan	Male	31	Private	Thiruvananthapuram
334	Unnikkuttan	Male	8	Private	Thiruvananthapuram
335	Kavitha	Female	20	Private	Kollam
336	Indira	Female	34	Private	Thiruvananthapuram
337	Rajasekharan	Male	29	Private	Ernakulam
338	Vijayan	Male	46	Private	Kollam
339	Rajiswaran	Male	29	Private	Kollam
340	Parannur Gopan	Male	39	Private	Thrissur

341	Ganeshan	Male	16	Private	Pathanamthitta
342	Kannan	Male	38	Private	Pathanamthitta
343	Murukan	Male	34	Private	Pathanamthitta
344	Vinayakan	Male	34	Private	Pathanamthitta
345	Vishnu	Male	14	Private	Pathanamthitta
346	Vaijyanthi	Female	50	Private	Thiruvananthapuram
347	Rajan	Male	42	Private	Kottayam
348	Mohan	Male	42	Private	Thiruvananthapuram
349	Vettathu Govindankutty	Male	21	Private	Thrissur
350	Manik	Male	27	Private	Kollam
351	Sivasankar	Male	51	Private	Thrissur
352	Sudheer Alias Sreekrishnan	Male	34	Private	Thrissur
353	Mahadevan	Male	34	Private	Pathanamthitta
354	Deepak	Male	31	Private	Alappuzha
355	Reena	Female	38	Private	Wayanad
356	Rani	Female	39	Private	Wayanad
357	Mahadevan Alias Manik	Male	45	Private	Thiruvananthapuram
358	Gopalan alias Ramu	Male	46	Private	Thiruvananthapuram
359	Cherpalassery Manikantan	Male	12	Private	Palakkad
360	Cherpalassery Vishnu	Male	43	Private	Palakkad
361	Mangalamkunnu Krishnankutty	Male	45	Private	Palakkad
362	Ayyappadas	Male	33	Private	Thrissur
363	Vishnu	Male	39	Private	Kottayam
364	Mahadevan Palode	Male	30	Private	Palakkad
365	Achuthankutty	Male	13	Private	Pathanamthitta
366	Raveendran	Male	39	Private	Kollam
367	Vishnunarayanan (Doram Singh)	Male	16	Private	Kottayam
368	Kannan	Male	3.5	Private	Thrissur
369	Bijat Prasad (Rajasekharan)	Male	27	Private	Kollam
370	Bhadra	Female	33	Private	Malappuram
371	Thanka (Monisha)	Female	43	Private	Kottayam
372	Sivaprasad	Male	47	Private	Idukki
373	Jayasree	Female	40	Private	Alappuzha
374	Suresh	Male	42	Private	Kollam
375	Sankaran Kutty	Male	28	Private	Kottayam
376	Sreedevi	Female	39	Private	Kozhikode
377	Babu	Male	50	Private	Kozhikode
378	Guruvayoorappan	Male	28	Private	Kottayam
379	Ganasan	Male	NA	Private	Ernakulam
380	Vinayakan	Male	10	Private	Kollam
381	Vinod	Male	33	Private	Kollam
382	Rajasekharan	Male	48	Private	Kollam
383	Amakavu Vishnu (Motti Prasad)	Male	37	Private	Palakkad

384	Indrajith	Male	9	Private	Thrissur
385	Gangadharan	Male	34	Private	Pathanamthitta
386	Unnikrishnan	Male	40	Private	Pathanamthitta
387	Prasad	Male	38	Private	Kottayam
388	Manik	Male	25	Private	Kottayam
389	Anil Babu	Male	35	Private	Kottayam
390	Indira	Female	46	Private	Wayanad
391	Manikkam - Achu	Male	21	Private	Kollam
392	Rajasekharan	Male	14	Private	Alappuzha
393	Meera	Female	36	Private	Kottayam
394	Kunju	Male	19	Private	Thrissur
395	Karthikeyan	Male	45	Private	Palakkad
396	Sreekuttan	Male	28	Private	Malappuram
397	Bushra	Female	40	Private	Malappuram
398	Muthu	Male	28	Private	Kozhikode
399	Devanarayanan	Male	45	Private	Kollam
400	Gopalankutty	Male	38	Private	Kottayam
401	Pallimattam Ramankutty	Male	32	Private	Ernakulam
402	Sivankutty	Male	33	Private	Kottayam
403	Ganapathy	Male	30	Private	Alappuzha
404	Meena	Female	30	Private	Kottayam
405	Panackal Padmanabhan	Male	26	Private	Kollam
406	Keru	Male	8	Private	Kollam
407	Koyiparambil Ayyappan	Male	50	Private	Thrissur
408	Lekshmi	Female	33	Private	Idukki
409	Ramachandran	Male	35	Private	Pathanamthitta
410	Arjun	Male	35	Private	Kottayam
411	Arjun	Male	40	Private	Kottayam
412	Mahadevan	Male	15	Private	Kollam
413	Anil	Male	42	Private	Thiruvananthapuram
414	Umamaheswaran	Male	39	Private	Thrissur
415	Vishnu Sankar	Male		Private	Thrissur
416	Ganeshan S N	Male	27	Private	Kottayam
417	Unnikrishnan	Male	48	Private	Kottayam
418	Sivaprasad	Male	27	Private	Kottayam
419	Mahesh - Manikantan	Male	39	Private	Kollam
420	Kuttikrishnan	Male	26	Private	Alappuzha
421	Sankarankutty	Male	48	Private	Idukki
422	Ganapathy Kaveri	Male	38	Private	Kollam
423	Neelakantan	Male	49	Private	Kottayam
424	Sankarankutty	Male	40	Private	Kottayam
425	Kesavan	Male	32	Private	Kottayam
426	Sooryan	Male	37	Private	Thrissur

427	Sri Ram	Male	NA	Private	Thrissur
428	Yadhukrishnan	Male	20	Private	Ernakulam
429	Vinod	Male	37	Private	Kottayam
430	Sivan	Male	1	Private	Kollam
431	Karnan	Male	33	Private	Kollam
432	Anandapadmanabha	Male	34	Private	Kollam
433	Shyam	Male	9	Private	Kottayam
434	Kochayyappan	Male	35	Private	Kottayam
435	Gopalakrishnan	Male	NA	Private	Thrissur
436	Gangadharan	Male	32	Private	Kottayam
437	Siva	Male	20	Private	Kollam
438	Santha	Female	53	Private	Wayanad
439	Gopalan	Male	NA	Private	Ernakulam
440	Ayyappan	Male	34	Private	Kottayam
441	Vinayan	Male	35	Private	Thrissur
442	Abhimanew	Male	34	Private	Kottayam
443	Devadathan	Male	23	Private	Kollam
444	Unnikrishnan	Male	22	Private	Kollam
445	Ayyappan - Lava	Male	21	Private	Thiruvananthapuram
446	Chandru	Male	34	Private	Ernakulam
447	Rajeswari	Female	30	Private	Kottayam
448	Sivasankaran	Male	30	Private	Kollam
449	Chembakam	Female	30	Private	Kottayam
450	Rajan	Male	39	Private	Kottayam
451	Ganapathy	Male	37	Private	Kottayam
452	Gangadharan	Male	51	Private	Kottayam
453	Mahadevan	Male	34	Private	Thrissur
454	Balakrishnan	Male	42	Private	Ernakulam
455	Rajasekharan	Male	46	Private	Palakkad
456	Aswathy	Female	53	Private	Pathanamthitta
457	Gireesan	Male	44	Private	Ernakulam
458	Cherplassery Sekharan	Male	42	Private	Palakkad
459	Vallabha Das	Male	35	Private	Kottayam
460	Krishnankutty	Male	40	Private	Kottayam
461	Ganeshan	Male	34	Private	Thiruvananthapuram
462	Govindankutty - Palode	Male	36	Private	Palakkad
463	Kamala	Female	40	Private	Kottayam
464	Ganapathy Valiyaveetil	Male	33	Private	Kottayam
465	Indira	Female	40	Private	Kozhikode
466	Raju	Male	22	Private	Kollam
467	Sekharan	Male	28	Private	Kollam
468	Adiyatt Ayyappan	Male	17	Private	Thrissur
469	Vishnu	Male	22	Private	Kozhikode

470	Cherpulassery Parthan	Male	31	Private	Kollam
471	Neelakantan	Male	26	Private	Kollam
472		Female	39	Private	Ernakulam
473	Mekhanath	Male	16	Private	Thrissur
474	Kuttysankaran	Male	41	Private	Alappuzha
475	Edakunni Arjunan	Male	40	Private	Thrissur
476	Mangalamkunnu Aravindan	Male	36	Private	Palakkad
477	Ganapathy	Male	6	Private	Kollam
478	Parasuraman	Male	38	Private	Kollam
479	Rao	Male	42	Private	Kollam
480	Padmanabhan	Male	28	Private	Ernakulam
481	Koottanal Devadathan	Male	45	Private	Thrissur
482	Ramachandran (Thampi)	Male	55	Private	Kottayam
483	Ganeshan (Uzhavoor)	Male	44	Private	Kottayam
484	Pampady Rajan	Male	32	Private	Kottayam
485	Sundaran	Male	37	Private	Kottayam
486	Beegam	Female	36	Private	Kottayam
487	Beegam	Female	55	Private	Kottayam
488	Vinayakan	Male	33	Private	Kottayam
489	Kesavan	Male	37	Private	Kottayam
490	Erattupetta Ayyappan	Male	37	Private	Kottayam
491	Roopa	Female	38	Private	Pathanamthitta
492	Rosely	Female	39	Private	Idukki
493	Babu	Male	36	Private	Kottayam
494	Letha	Female	39	Private	Kottayam
495	Ganashan Vazhayil	Male	40	Private	Kottayam
496	Sankarankutty	Male	53	Private	Wayanad
497	Ayyappan	Male	46	Private	Kozhikode
498	Durgaprasad	Male	40	Private	Kottayam
499	Ganeshan	Male	47	Private	Kottayam
500	Ayyappankutty	Male	38	Private	Kottayam
501	Rajan	Male		Private	Palakkad
502	Unnikkuttan	Male	40	Private	Kottayam
503	Pampampottu Sivan	Male	39	Private	Thrissur
504	Gopalan Kutty	Male	43	Private	Kollam
505	Rajendran	Male	28	Private	Pathanamthitta
506	Lekshmi	Female	40	Private	Kottayam
507	Seemavathy	Female	35	Private	Kottayam
508	Kama Krishnan	Male	41	Private	Kottayam
509	Dulari	Female	41	Private	Kottayam
510	Chandran	Male		Private	Alappuzha
511	Raju	Male	37	Private	Alappuzha
512	Mohan Singh	Male	42	Private	Kottayam

513	Chundampatta Krishnankutty	Male	35	Private	Palakkad
514	Nagerimana Ayyappan	Male	NA	Private	Thrissur
515	Nagerimana Vasudevan	Male	38	Private	Thrissur
516	Kannan Thamarayoor	Male	23	Private	Thrissur
517	Govindan Kutty	Male	41	Private	Kottayam
518	Ramankutty	Male	34	Private	Ernakulam
519	Kariyath Mahadevan	Male	36	Private	Ernakulam
520	Gopal	Male	38	Private	Kozhikode
521	Parannur Nandan	Male	37	Private	Thrissur
522	Santha	Female	46	Private	Ernakulam
523	Kesavan	Male	29	Private	Kottayam
524	Reghuram (Ramachandran)	Male	61	Private	Thrissur
525	Lekshmikutty	Female	39	Private	Kottayam
526	Mohanan	Male	33	Private	Kottayam
527	Indira	Female	47	Private	Palakkad
528	Vallapuzha Gajendran	Male	53	Private	Palakkad
529	Ayyappan	Male	52	Private	Ernakulam
530	Megharjunan	Male	13	Temple KMD	Thrissur
531	Rajashekharan	Male	41	Temple Pvt	Palakkad
532	Sivasundaran	Male	22	Temple Pvt	Kannur
533	Padmanabhan	Male	44	Temple Pvt	Palakkad
534	Achuthan	Male	34	Temple Pvt	Kannur
535	Thirumala Gajendran	Male	19	Temple Pvt	Ernakulam
536	Sivan	Male	13	Temple Pvt	Kollam
537	Nandakumar	Male	50	Temple Pvt	Kollam
538	Manikantan	Male	11	Temple Pvt	Kollam
539	Ayyappan	Male	31	Temple Pvt	Thrissur
540	Sankarankulangara Udayan	Male	45	Temple Pvt	Thrissur
541	Kallankulangara Rajagopal	Male	43	Temple Pvt	Palakkad
542	Sreevally	Female	36	Temple Pvt	Kottayam
543	Prasad	Male	21	Temple Pvt	Kannur
544	Thayankavu Manikantan	Male	29	Temple Pvt	Thrissur
545	Darsini	Female	45	Temple Pvt	Thiruvananthapuram
546	Sree Parameswaran	Male	37	Temple Pvt	Palakkad
547	Pullukulangara Ganesan	Male	46	Temple Pvt	Alappuzha
548	Manikantan	Male	40	Temple Pvt	Kollam
549	Kuttisankaran (Gajarajan)	Male	31	Temple Pvt	Alappuzha
550	Sreehari	Male	33	Temple Pvt	Ernakulam
551	Thechikkottu Kavay Devidasan	Male	18	Temple Pvt	Thrissur
552	Thechikkottu Kavay Ramachandran	Male	42	Temple Pvt	Thrissur
553	Ramachandran	Male	41	Temple Pvt	Kollam
554	Parameswaran	Male	15.5	Temple Pvt	Thrissur
555	Manikandan	Male	44	Temple Pvt	Thrissur

556	Thirumullakkavu Manikantan	Male	33	Temple Pvt	Thrissur
557	Thiruvani kavu Rajagopal	Male	39	Temple Pvt	Thrissur
558	Kongadu Kuttisankaran	Male	44	Temple Pvt	Palakkad
559	Poothrakovil Sringarikarnan	Male	25	Temple Pvt	Thrissur
560	Chathapuram Vizhnu (Ganapathy)	Male	33	Temple Pvt BMKD	Palakkad
561	Viswanathan	Male	15	Temple Pvt BMKD	Kottayam
562	Chemboothra Devidasan	Male	35	Temple Pvt CKK	Thrissur
563	Thirumala Gajendran	Male	33	Temple Pvt CTDC	Ernakulam
564	Kalidasan	Male	46	Temple Pvt KBKC	Thrissur
565	Sreenivasan	Male	23	Temple Pvt KD	Thrissur
566	Ramu	Male	19	Temple Pvt KNDK	Alappuzha
567	Arjunan	Male	39	Temple Pvt KUKGD	Thrissur
568	Kuttankulangara Ramdas	Male	45	Temple Pvt KUKGD	Thrissur
569	Vijayan	Male	42	Temple Pvt MKP	Alappuzha
570	Mahadevan	Male	32	Temple Pvt MRKLGRAD	Kollam
571	Manikantan	Male	NA	Temple Pvt NSDKSSD	Kollam
572	Kaleedasan	Male	19	Temple Pvt OLDO	Thrissur
573	Narayanankutty	Male	39	Temple Pvt PMTT	Pathanamthitta
574	Paramekkavu Rajendran	Male	55	Temple Pvt PRKD	Thrissur
575	Parappukavu Kalidasan	Male	41	Temple Pvt PRKD	Thrissur
576	Paramekkavu Devidasan	Male	40	Temple Pvt PRKD	Thrissur
577	Paramekkavu Sree Padmanabhan	Male	33	Temple Pvt PRKD	Thrissur
578	Thiruvambady Ramabhadran	Male	47	Temple Pvt THBDYD	Thrissur
579	Thiruvambady Chandrasekharan	Male	32	Temple Pvt THBDYD	Thrissur
580	Thiruvambady Sivasundar	Male	37	Temple Pvt THBDYD	Thrissur
581	Thiruvambady Unnikrishnan	Male	36	Temple Pvt THBDYD	Thrissur
582	Chandra Sekharan	Male	45	Temple Pvt-SKD	Kannur
583	Ambalappuzha Vijayakrishnan	Male	38	Temple TD	Alappuzha
584	Avoor Kannan	Male	18	Temple TD	Alappuzha
585	Harippad Skandan	Male	18	Temple TD	Alappuzha
586	Kandiyo or Premsankar	Male	18	Temple TD	Alappuzha
587	Mavelikkara Unnikrishnan	Male	32	Temple TD	Alappuzha
588	Panmana Saravanan	Male	17	Temple TD	Alappuzha
589	Vettikkattu Chandrasekharan	Male	42	Temple TD	Alappuzha
590	Sasthamkotta Neelakantan	Male	15	Temple TD	Kollam
591	Cheryvally Kusumam	Female		Temple TD	Kottayam
592	Thiru Neelakantan	Male	36	Temple TD	Kottayam
593	Thirunnakkara Sivan	Male	38	Temple TD	Kottayam
594	Manikantan - Oomalloor	Male	36	Temple TD	Pathanamthitta
595	Mohanan - Aranmula	Male	46	Temple TD	Pathanamthitta
596	Parthasarathy - Aranmula	Male	45	Temple TD	Pathanamthitta
597	Rajan - Malayalappuzha	Male	48	Temple TD	Pathanamthitta

598	Kunnnanthanam Sivasankaran	Male	23	Temple TD	Thiruvananthapuram
599	Lekshmi	Female	58	Temple TD	Thiruvananthapuram
600	Vadakkan Paravoor Sasi	Male	48	Temple TD	Ernakulam
601	Kodungoor Vijayanthy	Female	42	Temple TD	Kottayam
602	Aadinad Sudeesh	Male	32	Temple TD	Thiruvananthapuram
603	Asramam Gopalakrishnan	Male	28	Temple TD	Thiruvananthapuram
604	Jayaraj	Male	13	Temple TD	Thiruvananthapuram
605	Mullakkal Balakrishnan	Male	38	Temple TD	Thiruvananthapuram
606	Prameela	Female	70	Temple TD	Thiruvananthapuram
607	Sanjayan	Male	31	Temple TD	Thiruvananthapuram
608	Thrikkadavoor Sivaraju	Male	36	Temple TD	Thiruvananthapuram
609	Uma	Female	NA	Temple TD	Thiruvananthapuram
610	Velinelloor Manikandan	Male	32	Temple TD	Thiruvananthapuram
611	Krishnankutty	Male	70	Temple TD	Kollam
612	Dakshayani	Female	76	Temple TD	Thiruvananthapuram
613	Karthikeyan	Male	35	Temple TD	Thiruvananthapuram
614	Sivakumar	Male	55	Temple TD	Thiruvananthapuram
615	Anjaneyan	Male	35	Temple TD	Thiruvananthapuram
616	Chandrasekharan	Male	45	Temple TD	Thiruvananthapuram
617	Devanarayanan	Male	18	Temple TD	Thiruvananthapuram
618	Kalidasan	Male	20	Temple TD	Thiruvananthapuram
619	Kannan	Male	13	Temple TD	Thiruvananthapuram
620	Saraswathy	Female	30	Temple TD	Thiruvananthapuram
621	Sivasankaran	Male	10	Temple TD	Thiruvananthapuram
622	Vallabhan	Male	14	Temple TD	Thiruvananthapuram
623	Ayyappankutty	Male	53	Temple-CD	Thrissur
624	Balaraman	Male	53	Temple-CD	Thrissur
625	Chandrashekharan	Male	46	Temple-CD	Thrissur
626	Achuthankutty	Male	37	Temple-CD	Thrissur
627	Seetha	Female	47	Temple-CD	Thrissur
628	Sivakumar	Male	39	Temple-CD	Thrissur
629	Devaswaom Girisan	Male	63	Temple-CD	Thrissur
630	Deveswom Narayanan	Male	56	Temple-CD	Thrissur
631	Deveswom Ramachandran	Male	42	Temple-CD	Thrissur
632	Devidasan	Male	35	Temple-CD	Thrissur
633	Ravipuram Govindan	Male	34	Temple-CD	Thrissur
634	Seetharaman	Male	55	Temple-CD	Thrissur
635	Sreeraman	Male	25	Temple-CD	Thrissur
636	Achuthan	Male	36	Temple-GD	Thrissur
637	Adithyan	Male	10	Temple-GD	Thrissur
638	Akshay Krishnan	Male	17	Temple-GD	Thrissur
639	Appu	Male	39	Temple-GD	Thrissur
640	Arjun	Male	16	Temple-GD	Thrissur

641	Balakrishnan	Male	32	Temple-GD	Thrissur
642	Balaram	Male	21	Temple-GD	Thrissur
643	Balu	Male	22	Temple-GD	Thrissur
644	Chandrasekharan	Male	36	Temple-GD	Thrissur
645	Chenthamarakshan	Male	21	Temple-GD	Thrissur
646	Damodardas	Male	12	Temple-GD	Thrissur
647	Devadas	Male	33	Temple-GD	Thrissur
648	Devi	Female	42	Temple-GD	Thrissur
649	Gajendra	Male	16	Temple-GD	Thrissur
650	Gokul	Male	15	Temple-GD	Thrissur
651	Gopalakrishnan	Male	45	Temple-GD	Thrissur
652	Gopi Kannan	Male	32	Temple-GD	Thrissur
653	Gopikrishnan	Male	40	Temple-GD	Thrissur
654	Indrasen	Male	35	Temple-GD	Thrissur
655	Junior Achuthan	Male	23	Temple-GD	Thrissur
656	Junior Kesavan	Male	21	Temple-GD	Thrissur
657	Junior Lekshmanan	Male	50	Temple-GD	Thrissur
658	Junior Madhavan	Male	34	Temple-GD	Thrissur
659	Junior Vishnu	Male	31	Temple-GD	Thrissur
660	Kannan	Male	45	Temple-GD	Thrissur
661	Keerthi	Male	12	Temple-GD	Thrissur
662	Kesavan	Male	38	Temple-GD	Thrissur
663	Kesavankutty	Male	41	Temple-GD	Thrissur
664	Krishna	Male	NA	Temple-GD	Thrissur
665	Krishna Narayanan	Male	17	Temple-GD	Thrissur
666	Krishnan	Male	44	Temple-GD	Thrissur
667	Kuttikrishnan	Male	60	Temple-GD	Thrissur
668	Kuttysankaran	Male	57	Temple-GD	Thrissur
669	Lekshmi Krishna	Male	34	Temple-GD	Thrissur
670	Lekshminarayanan	Female	10	Temple-GD	Thrissur
671	Madhavankutty	Male	45	Temple-GD	Thrissur
672	Mukundan	Male	28	Temple-GD	Thrissur
673	Murali	Male	30	Temple-GD	Thrissur
674	Nandan	Male	36	Temple-GD	Thrissur
675	Nandini	Female	47	Temple-GD	Thrissur
676	Narayanankutty	Male	56	Temple-GD	Thrissur
677	Navaneeth Krishnan	Male	23	Temple-GD	Thrissur
678	Padmanabhan	Male	67	Temple-GD	Thrissur
679	Parthan	Male	12	Temple-GD	Thrissur
680	Peethambaran	Male	13	Temple-GD	Thrissur
681	Prakasan	Male	45	Temple-GD	Thrissur
682	Radhakrishnan	Male	52	Temple-GD	Thrissur
683	Rajasekharan	Male	41	Temple-GD	Thrissur

684	Ramachandran	Male	66	Temple-GD	Thrissur
685	Ramankutty	Male	56	Temple-GD	Thrissur
686	Ramu	Male	42	Temple-GD	Thrissur
687	Ravikrishnan	Male	29	Temple-GD	Thrissur
688	Reshmi	Female	31	Temple-GD	Thrissur
689	Sankara Narayanan	Male	34	Temple-GD	Thrissur
690	Sathyanarayanan	Male	42	Temple-GD	Thrissur
691	Seshadri	Male	16	Temple-GD	Thrissur
692	Sidharthan	Male	29	Temple-GD	Thrissur
693	Sreedharan	Male	36	Temple-GD	Thrissur
694	Sreekrishnan	Male	10	Temple-GD	Thrissur
695	Thara	Female	54	Temple-GD	Thrissur
696	Umadevi	Female	42	Temple-GD	Thrissur
697	Unnikrishnan	Male	24	Temple-GD	Thrissur
698	Valiya Vishnu	Male	42	Temple-GD	Thrissur
699	Vinayakan	Male	40	Temple-GD	Thrissur
700	Vineeth Krishnan	Male	29	Temple-GD	Thrissur
701	Maheswari	Female	84	Zoo	Thiruvananthapuram
702	Raja (Rajkumar)	Male	30	Zoo	Thiruvananthapuram

NA: Details not available

FC: Forest Camp:

Temple KMD: Koodalmanikyam Devaswom

Temple Pvt Temple Private

Temple Pvt BMKD: B. Madhusudhanakurup, Kangazha Devaswom,

Temple Pvt CKK: Chemboothra, Kodungalloorkavu Kshethram

Temple Pvt CTDC: Cochin Thirumala Devaswom Committee

Temple Pvt KBKC: Karuvanthole Bhagavathy Kshetra Committee,

Temple Pvt KD: Kattukulangara Devaswom,

Temple Pvt KNDK: Kunnathur Devaswom, Kuttamperoor

Temple Pvt KUKGD: Kuttankulangara Devaswom

Temple Pvt MKP: Mannar Kurattikkadu Pottambalam

Temple Pvt NSDKSSD: Nedumankavu Sree Dharamasastha Kshethra Samrakshana Samithi

Temple Pvt OLDO: Olarikkara Devaswom, Olarikkara

Temple Pvt PMTT: Puthenkavumala Mahadeva Temple, Thiruvalla

Temple Pvt PRKD: Paramakkavu Devaswom

Temple Pvt THBDYD: Thiruvambady Devaswom M. Madavankutty

Temple Pvt-SKD: Sri Kottiyoor Devaswom

Temple TD: Travancore Devaswom Board

Temple-CD: Cochin Devaswom Board

Temple-GD: Guruvayoor Devaswom

Appendix 2: Projected numbers of male and female elephants using Gale's (1974) mortality rates

	Age group (in years)							
	< 9	17-Oct	18-35	18-35 [‡]	36-54	36-54 [‡]	55-70	55-70 [‡]
Annual rates of decline for Gale's population [†]	0.7	0.2	1.6	1.6	1.9	1.9	1.8	1.8
0 th year								
Percentage occurrence*	3.7	8.8	33.7	7.4	48.1	6.5	5.4	13.9
1 st year	3	8.6	32.1	5.8	46.2	4.6	3.6	12.1
2 nd year	2.3	8.4	30.5	4.2	44.3	2.7	1.8	10.3
3 rd year	1.6	8.2	28.9	2.6	42.4	0.8	0	8.5
4 th year	0.9	8	27.3	1	40.5	0		6.7
5 th year	0.2	7.8	25.7	0	38.6			4.9
6 th year	0	7.6	24.1		36.7			3.1
7 th year		7.4	22.5		34.8			1.3
8 th year			20.9		32.9			0
9 th year			19.3		31			
10 th year			17.7		29.1			
11 th year			16.1		27.2			
12 th year			14.5		25.3			
13 th year			12.9		23.4			
14 th year			11.3		21.5			
15 th year			9.7		19.6			
16 th year			8.1		17.7			
17 th year			6.5		15.8			
18 th year					13.9			

*: refers to observed population in Kerala

[†]: Mortality rates were calculated using total number of dead animals observed

[‡]: Age group repeated to allow for shift in individuals from previous age-class

Appendix 3: Projected numbers of male and female elephants using Schmidt and Mar (1996) mortality rates (Schmidt and Mar (1996) mortality rates were calculated using total number of animals observed in each age class)

	Age Group (in years)		
	< 5y	5- 18y	> 18y
*Percentage occurrence (male and female considered together) 0 th year	0.9	12.9	86.2
1 st year	0	10.8	83.4
2 nd year		8.7	80.6
3 rd year		6.6	77.8
4 th year		4.5	75
5 th year		2.4	72.2
6 th year		0.3	69.4
7 th year		0	66.6
8 th year			63.8
9 th year			61
10 th year			58.2
11 th year			55.4
12 th year			52.6
13 th year			49.8
14 th year			47
15 th year			44.2
16 th year			41.4
17 th year			38.6
18 th year			35.8
19 th year			33
20 th year			30.2
21 th year			27.4
22 th year			24.6
23 th year			21.8
24 th year			19
25 th year			16.2
26 th year			13.4
27 th year			10.6
28 th year			7.8
29 th year			5
30 th year			0

*: refers to observed population in Kerala

Appendix 4a: Projected numbers of male elephants using Sukumar et al., (1997) mortality rates

*Annual mortality rates (Males)	Age group (in years)									
	0-1	1-2	2-5	5-10	10-20	20-40	20-40 [‡]	40-60	40-60 [‡]	60-80
0 th year	0.1	0.1	0.1	2.2	10.7	41.7	9.4	26.1	32.7	1.8
1 st year	0.0	0.0	0.0	1.3	10.6	40.8	8.5	22.3	28.9	0.0
2 nd year	0.0	0.0	0.0	0.4	10.5	39.9	7.6	18.5	25.1	0.0
3 rd year	0.0	0.0	0.0	0.0	10.3	39.0	6.7	14.7	21.3	0.0
4 th year	0.0	0.0	0.0	0.0	10.2	38.1	5.8	10.9	17.5	0.0
5 th year	0.0	0.0	0.0	0.0	10.1	37.2	4.9	7.1	13.7	0.0
6 th year					9.9	36.3	4.0	3.3	9.9	
7 th year					9.8	35.4	3.1	0.0	6.1	
8 th year					9.7	34.5	2.2		2.3	
9 th year					9.5	33.6	1.3		0.0	
10 th year					9.4	32.7	0.4			
11 th year							0.0			

*: refers to observed population in Kerala

[‡]: Age group repeated to allow for shift in individuals from previous age-class

Appendix 4b: Projected numbers of female elephants using Sukumar et al., (1997) mortality rates

*Annual mortality rates (Females)	Age group (in years)									
	0-1	1-2	2-5	5-10	10-20	20-40	20-40 [‡]	40-60	40-60 [‡]	60-80
0 th year	0.0	0.0	0.4	0.6	0.7	7.0	0.7	7.9	5.4	0.3
1 st year	0.0	0.0	0.0	0.0	0.7	6.9	0.5	6.8	4.3	0.0
2 nd year					0.7	6.7	0.4	5.7	3.2	0.0
3 rd year					0.7	6.6	0.2	4.6	2.1	
4 th year					0.7	6.4	0.1	3.5	1.0	
5 th year					0.7	6.2	0.0	2.4	0.0	
6 th year					0.7	6.1		1.3		
7 th year					0.7	5.9		0.2		
8 th year					0.7	5.8		0.0		
9 th year					0.7	5.6				
10 th year					0.7	5.4				

*: refers to observed population in Kerala

[‡]: Age group repeated to allow for shift in individuals from previous age-class

PROJECT TEAM

Field investigators

Dr. E.K. Eswaran
and
Mr. Surendra Varma

Research team

Ms. S. R. Sujata
Compassion Unlimited Plus Action (CUPA)

Dr. Roshan K Vijendravarma
Post Doctoral Researcher, Department of Ecology and Evolution,
University of Lausanne, 1015-Lausanne
Switzerland

Editorial, layout & design support

Ramesh Belagere

Adviser

Prof. R. Sukumar
Centre for Ecological Sciences (CES), Indian Institute of Science (IISc), IISc, Bangalore 560 012

Co-Investigators

Mrs. Suparna Baksi-Ganguly & Dr. Shiela Rao

Compassion Unlimited Plus Action (CUPA),
Veterinary College Campus, Hebbal, Bangalore 560 024, &
Wildlife Rescue & Rehabilitation Centre (WRRC),
Bannerghatta Biological Park,
Bangalore – 560083

Principal Investigator

Mr. Surendra Varma

Asian Elephant Research & Conservation Centre (A Division of Asian Nature Conservation
Foundation (ANCF)), Innovation Centre, Indian Institute of Science, Bangalore 560 012

Compassion Unlimited Plus Action (CUPA) is a non-profit public charitable trust registered in 1991 that works for the welfare of all animals. Since 1994, CUPA has worked in close collaboration with government departments and agencies on various projects. CUPA's mission is to protect animals from abuse and violence and do what may be required to alleviate their suffering at the hands of humans. CUPA does not differentiate among pet, stray or wild animals, since all of them may require assistance and relief from cruelty, neglect and harm. The organisation's objective has been to design services and facilities which are employed fully in the realisation of these goals.

Asian Nature Conservation Foundation (ANCF) is a non-profit public charitable trust set up to meet the need for an informed decision-making framework to stem the rapidly declining natural landscape and biological diversity of India and other countries of tropical Asia. The Foundation undertakes activities independently and in coordination with governmental agencies, research institutions, conservation NGOs and individuals from India and abroad, in all matters relating to the conservation of natural resources and biodiversity, endangered flora and fauna, wildlife habitats and environment including forests and wetlands. It participates and disseminates the procured information, knowledge and inferences in professional, academic and public foray.

World Society for Protection of Animals (WSPA) With consultative status at the United Nations and the Council of Europe, WSPA is the world's largest alliance of animal welfare societies, forming a network with 910 member organisations in 153 countries. WSPA brings together people and organisations throughout the world to challenge global animal welfare issues. It has 13 offices and thousands of supporters worldwide.

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Figure 2a, b, c, 10b: Surendra Varma

Front Cover, back Cover and Figure 10a: Marshal.C.Radhakrishnan



Kerala state in southern India is known as elephant state. It has a relatively large number of wild and captive elephant population. The selection of specific age and sex of elephants in captivity as cultural and economic identity of the state has/had a lot of influence of the status of elephants in the wild across the country and welfare of elephants in captivity more specifically in the state. There is a long history of keeping elephants in the

state, but no systematic efforts were made to know the total number of elephant found in the state. The first step in initiating welfare measures for elephants in captivity is to know the total number of elephants found in the state and their distribution. This document is a first ever scientific attempt to understand the population status,



demographic details and future of captive elephants in the

State

