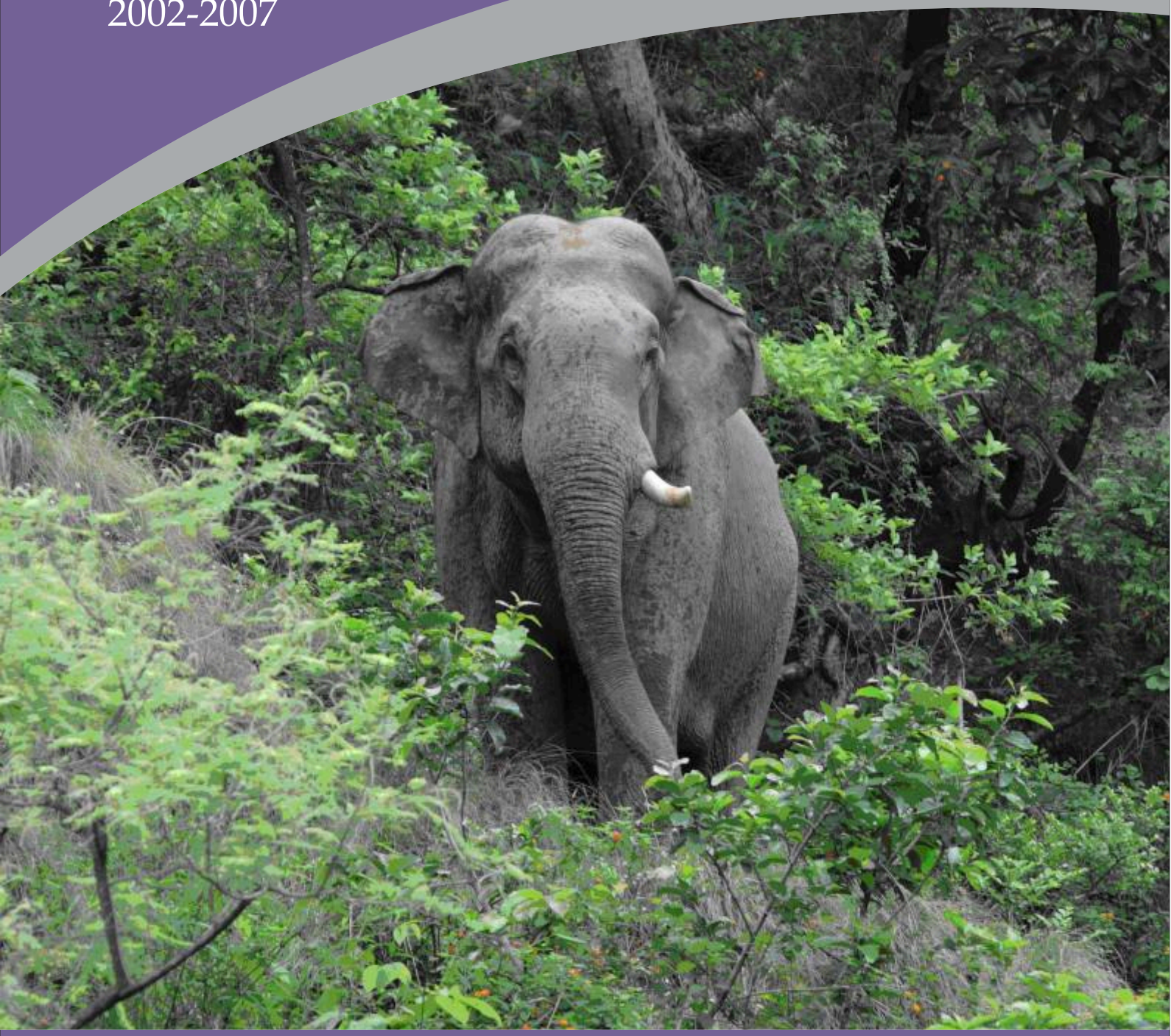
Population age-sex ratios of elephants in Rajaji-Corbett National Parks, Uttaranchal

the Elephant Sanctuary in Tennessee

Final Report on elephant age-sex ratios in Rajaji NP

2002-2007



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Contents

Acknowledgements

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Introduction

The Asian elephant (Elephas maximus) is an endangered mammal with an estimated 35,000 to 50,000 elephants occurring in 13 countries across Asia (Kemf and Santiapillai 2000). Asian elephants are long-lived animals that reproduce slowly and live in forested habitats; observations of them in the wild are difficult to obtain. Therefore, demographic status is uncertain for many Asian elephant populations. The estimates of population numbers or densities are some of the basic information required to formulate proper management and conservation strategies for elephants. However, very few Asian elephant populations have been studied (Katugaha et al. 1999, Sukumar 1991). Population estimates using scientific repeatable methods are rare and therefore the usefulness of population estimates across the elephant range in Asia to assess viability is limited. In addition to data on demographic parameters (i.e. age-sex structure, estimates of inter-calving period, age of first conception, mortality rates) are very important to asses the status and viability of a population, yet such data is non-existent for the majority of Asian elephant populations.

The Asian elephant in India occurs in five major dis-jointed populations totaling 17,000 to 22,000 individuals (Anon 1993). In north-west India, an estimated 800-1000 elephants occur in Rajaji-Corbett National Parks and the adjoining forest areas(Singh 1995, Johnsingh and Joshua 1994) . This range has been designated as Elephant Reserve No. 11 by the Government of India under Project Elephant. Though ecological research on elephants in this area began in 1986, a detailed study on the elephant demography in this tract started in 1996. The study on elephant demography concentrated mainly to the areas to the west of the river Ganges between 1996 and 1999. However, the population age-sex ratios in Corbett NP were monitored every year for a month in summer, during this period, when most of the elephants were concentrated around the Chaurs (grass lands). The study results indicated that the elephant population in this tract had one of the least skewed sex ratios (1:1.87 Male:Females in Rajaji NP and 1:1.5-2.17 Male:Females in Corbett NP).

However, increase in mortality of adult males in early 2001 due to poaching in this tract is a cause for worry and this project is being implemented with the aim of adding, in a small way, to the Government efforts to conserve elephants in Uttaranchal State by regular monitoring of elephant age-sex ratios.
The objectives was;

1.To monitor the age-sex ratios of the elephant population across the elephant habitat in Uttaranchal, with special emphasis on Rajaji-Corbett National Parks August 2002 to Dec 2007.

Study Area

This study was conducted in RNP west of the Ganges River (Fig. 1- area within the red boundary) between August 2002 to December 2007. The area includes the Rajaji and Motichur sanctuaries and portions of the Shivalik and Dehradun east Forest Divisions covering an area of approximately 500 km2. The distinct spine of the Shivalik ridge forms a natural boundary between Rajaji and Motichur sanctuaries. Terrain in the Rajaji Sanctuary consists of deeply dissected steep southern slopes of the Shivaliks hill range, which form a series of sharp ridges interspersed with V-shaped valleys running from north-east to south-west. The southern portion of the sanctuary is flat land constituting the northern fringe of the Gangetic plain (J.B. Sale, Wildlife Institute of India, unpublished report). The altitude ranges from 400 to 1,000 m above sea level. Rajaji Sanctuary is divided into hills and plains. Over 140,000 people live along the periphery (D. Kumar, Wildlife Institute of India, unpublished report). Their main form of livelihood is agriculture. The study area is bounded by intense cultivation to the north and south and to the east it is bounded by the suburbs of the town Haridwar on the bank of the Ganges River. To the west the Delhi-Dehradun highway separates the RNP from the Shivalik Forest division.

Rainfall ranged from 1,300 to 1,900 mm / year with most of the rain falling during the monsoon months of July to October. However there are brief periods of rainfall throughout the year. Three distinct seasons are recognized: winter (November to March), summer (March to July) and monsoon (July to November). The major vegetation associations in this area are Tropical Dry deciduous dominated by Shorea robesta, tropical mixed forest containing Shorea robesta, Mallotus philipensis, and Ehretia laevis, miscellaneous forests with Zizyphus spp.,

Helictres isora, Anoegesis latifolia, Dendrocalamus strictus and plantations with Dalbergia sisoo, Acacia catechu, Garuga pinnata and Aeilanthus excelsa. In addition to elephants, which number about 160 to 200, the study area provides habitat for other large mammals including sambar (Cervus unicolor), chital (Cervus axis), muntjak (Muntiacus muntjak), nilgai (Boselaphus tragocamelus), goral (Nemorhaedus goral), wild pig (Sus scrofa), tiger (Panthera tigiris), and leopard (Panthera pardus). There are > 4,000 nomadic pastoralists (i.e., gujjars) and about 8,300 of their livestock within the study area. These gujjar families live scattered all over the study area in small colonies. The majority of the people in and out of RNP depend on the forests in the study area to meet their fuel wood and forage requirements.

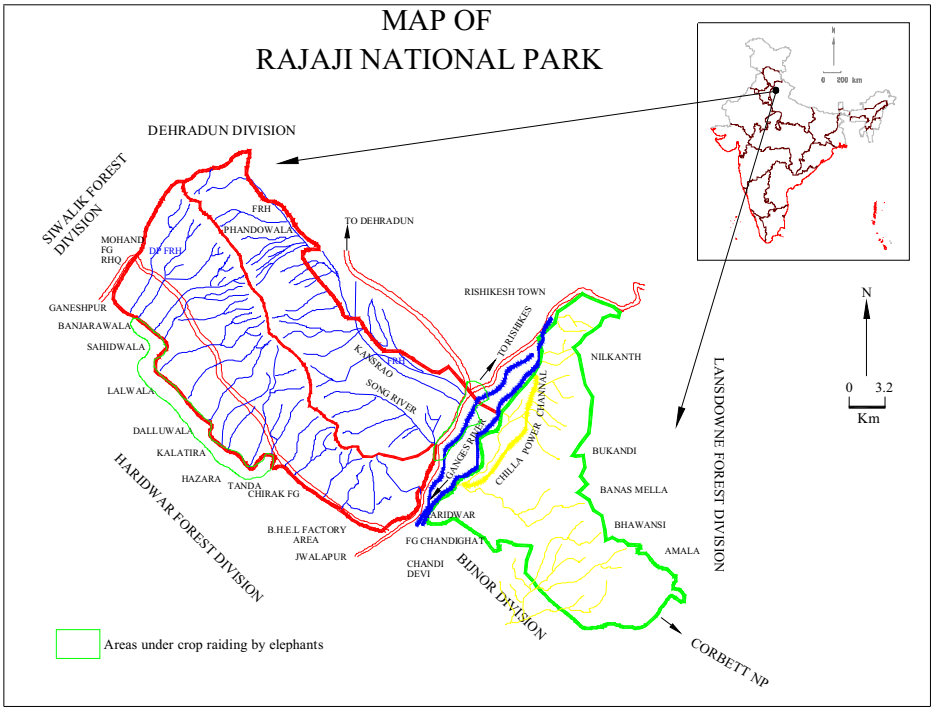

Fig. 1. Map of Rajaji NP (Study area is area enclosed within the red boundary)

Methods

Forest blocks starting from east to west were chosen one after another sequentially and searched for elephants for about approximately 4 hours in a single search. Over 1200 days of field work was carried out during the period August 2002 to 31st December 2007. Field assistants collected information on population characteristics like age-sex ratios by observing elephants and capturing them on photographs. Whenever a female group was encountered, the elephants were classified into various age-sex categories based on relative height and morphological characteristics. Younger elephants (< 15-years) will be classified by

comparing their height to the oldest adult female in the group (Eisenberg and Lockhart 1972). The older elephants will be classified based on morphological characteristics like degree of ear fold and depression of the buccal cavity and forehead. Elephants were placed in broad age-classes aged groups; Elephants were placed in broad age-classes aged groups; calves (< 1 year old), juveniles (1-5 years old), sub-adults (5 -15 years) and adults (> 15 years).

We give examples of using photographic technique for identifying individual bulls in appendix 1. All adult males, whether solitary or in groups, are easy to classify. Results and discussion

Results and discussion

Between August 2002-December 2007, over 1200 days were spent in the area, west of river Ganges, looking for elephant groups or solitary males or all male groups to classify them into the various age-sex categories defined in the methods above. We encountered elephants 1561 times out of which 1276 encounters resulted in elephants being fully classified into age-sex categories. We encountered solitary males on 549 occasions; most of them adult males. A total of 5305 elephants were classified over a period of 5 years (Table 1). Only data for fully classified groups were used. It should be noted that many groups and individual males could have been classified repeatedly to derive sex ratios over the sampling period and therefore this total of 1355 elephants should not be taken as a population count.
Sexing of elephants in Juvenile and calf age class was difficult even when reviewing video/photo data and therefore we've only presented them as an age class in the tables (Table 1-7).

Table 1 *The age-sex structure of the elephants classified (N = 5305)1 in Rajaji National Park (West of River Ganges), January 2002 - December 2007*

Age-Class	Percentage	
	Males	Females
Adults	14.38	38.17
Sub - Adults	9.84	6.94
Juveniles	14.12	
Calves	16.21	

[1] *Note: Since our method assumed sampling with replacement, many of the elephant groups and bulls would have been classified repeatedly over the last 5 years. Therefore the total elephants classified (N = 5305) should not be confused with the population size. Please see methods for more details.*

Table 2 *The age-sex structure of the elephants classified (N = 235) in Rajaji National Park (West of River Ganges), January 2002 - December 2002.*

Age-Class	Percentage	
	Males	Females
Adults	16.60	35.32
Sub - Adults	14.04	5.11
Juveniles	13.19	
Calves	13.19	

Table 3 *The age-sex structure of the elephants classified (N = 713) in Rajaji National Park (West of River Ganges), January 2003 - December 2003.*

Age-Class	Percentage	
	Males	Females
Adults	20.37	31.56
Sub - Adults	14.31	7.57
Juveniles	18.09	
Calves	7.29	

Table 4 *The age-sex structure of the elephants classified (N = 1073) in Rajaji National Park (West of River Ganges), January 2004 - December 2004.*

Age-Class	Percentage	
	Males	Females
Adults	13.23	37.28
Sub - Adults	8.20	7.92
Juveniles	14.73	
Calves	19.10	

Table 5 *The age-sex structure of the elephants classified (N = 1014) in Rajaji National Park (West of River Ganges), January 2005 - December 2005.*

Age-Class	Percentage	
	Males	Females
Adults	10.26	38.56
Sub - Adults	9.66	7.99
Juveniles	13.41	
Calves	19.72	

Table 6 ***The age-sex structure of the elephants classified (N = 1387) in Rajaji National Park (West of River Ganges), January 2006 - December 2006***

Age-Class	Percentage	
	Males	Females
Adults	15.14	40.09
Sub - Adults	10.67	3.97
Juveniles	12.62	
Calves	17.09	

Table 7 *The age-sex structure of the elephants classified (N = 883) in Rajaji National Park (West of River Ganges), January 2007 - December 2007.*

Age-Class	Percentage	
	Males	Females
Adults	13.93	38.17
Sub - Adults	9.84	6.94
Juveniles	13.59	
Calves	15.29	

Table 8. *Proportion of Adult females accompanied by a young one (< 5 years old; calf or Juvenile age-class) in Rajaji NP*

Time Period/Year	% adult females with young
Overall (2002-2007)	79.46
2002	74.70
2003	80.44
2004	90.75
2005	85.93
2006	74.10
2007	68.92

Table 9. *Number of adult females per adult male in Rajaji NP*

Time Period/Year	Number of Adult Females/Adult Male
Overall (2002-2007)	2.65
2002	2.13
2003	1.55
2004	2.82
2005	3.76
2006	2.65
2007	3.00

From the analysis of the data over the last 5 years from the western part of Rajaji NP, it appears that the elephant population is still maintaining a very healthy adult sex ratio of 1 male: 2.65 females (Table 9). This is, from all records, still among the best sex ratios in South Asia, where elephant population age-sex structures have been studied intensively. This compares very well with the data obtained from a previous study conducted by the PI between 1996-1999 (Williams et. al. in press) where the adult male:female ratio was 1:1.87 (Appendix 1-Table 10). The adult sex ratio was the least skewed among the populations studied so far in India. In fact the adult sex ratios were comparable to those reported from Sri Lanka (1 male: 1.9 females) where >90% of the males are tuskless (Katugaha et al.1999) and hence poaching is not an issue in Sri Lanka. The northwest Indian population (Corbett and Rajaji NPs) is the only Asian elephant population in India where the adult sex ratio is comparable to those of the Sri Lankan populations. The proportion of adult males (16.5%) in the population is the highest when compared to other

studies in mainland India where the adult male:female ratios range from 1:15 to 1:100 (Daniel et al.1987, Chandran 1990, Sukumar 1991). The reason for this is the lack of poaching in the study area during the study period.

While there is a difference, partly expected due to the poaching incidents that happened in 2001, it has been difficult to figure out exactly what proportion of the expressed sex ratios were due to an artefact of sampling, and what proportion actually reflects the poaching of a few bulls in 2001. Since elephants are long-lived animals (sometimes living as long as 60-70 years), actual measurement of skewing of sex ratios can only be found through continuous tracking of the sex ratios over many years something that this study is attempting.
More than just adult sex ratios, it is important to look at other population parameters like no. of calves:100 females or the percentage of females accompanied by an young one less than 5 years old. The population is relatively healthy and about 80% of the adult females (n=2025) classified were accompanied

by a young one less than 5 years. Williams et. al. (in press) found that >95% of the adult females were accompanied by an young one in an earlier study conducted between 1996-1999. This shows that while the reproduction in Rajaji population is good (compared against table 10), there seems to be an drop in the number of young elephants (calves and Juveniles). In certain populations like in Periyar Tiger Reserve in Kerala (Chandran 1990) lack of adult males due to poaching has caused a drop in calving rates due to the inability of females to find a male which has resulted in only 30% of adult females being accompanied by a calf less than 5 years old. Since elephants are polygamous and a few males can service many females, Table 7 indicates that the adult sex ratios are very healthy in Rajaji NP and the availability of males is definitely not the reason for this estimated drop in the number of juveniles and calves per 100 females. We believe that habitat factors, influenced by rainfall and human factors, can be a reason for this drop and would strongly reccomend future research into this aspect.

Conclusion

This is one of the few long term studies of elephant population parameters of Asian elephants. We now have data for over 12 years now. The Rajaji Elephant population is looking demographically very healthy from an assessment of their age-sex ratios. We believe with the current levels of protection and management that this population will continue to grow. However the decline in percentage of adult females accompanied by a young elephant (< 5 years) has dropped when compared with data from 10 years ago and therefore should be a cause for concern. The detection of such changes in the percentage of adult females accompanied by a young elephant would not have been possible with a single time period study and therefore it is important to continue this long term study of their age-sex parameters. We need to start researching the impact of habitat quality on elephant reproduction and calf survival in Rajaji NP to figure out whether it is a factor in the measured decline in calves and juveniles

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Appendix 1

Table 10. *The age-sex structure of elephants classified (N=756) in Rajaji National Park, India 1996-1999.*

Age-Class	Percentage	
	Males	Females
Adults	16.5	30.9
Sub - Adults	14.4	8.0
Juveniles	8.8	8.7
Calves	12.8	

Some Identified Males & Their Distinguishing Characteristics in Rajaji National Park

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This is a confidential document submitted only to the Park Director, Rajaji National Park and Chief Conservator of Forests (WL), Uttaranchal. It is also submitted to Scientists at the Wildlife Institute of India, Dehra Dun, Uttaranchal. It is requested that this document or copies of it are not circulated to anyone else due to the sensitive nature of the information.

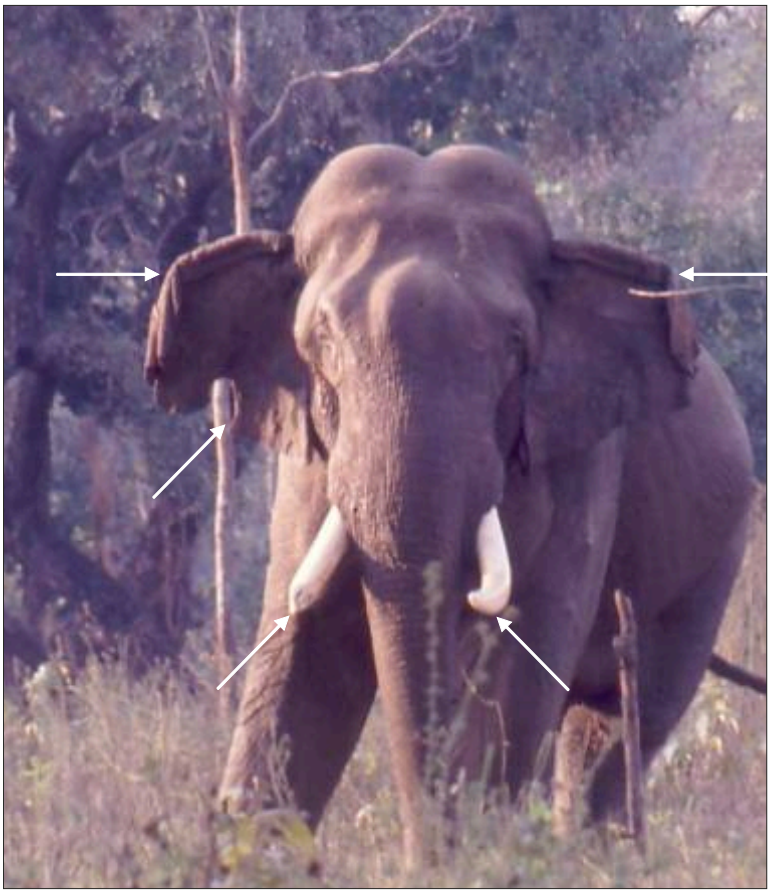
Male No. 1 Tipu (50+ years old)

Identification marks

Tusk: Slightly divergent upwardly curving left tusk and chipped end right tusk

Ears: Top of the ears completely folded over, with upturned U-shaped large notch on right ear

Tracks: Hind right feet track has a quarter moon shaped cresent mark clearly visible



Male 2 Named Shahrukh (30-35 years old)

Identification marks Single right tusked male.

Tusk: Upwardly curving if seen from the side straightening at the end

Ears: Top of the ears completely folded over, bottom edge of left ear notched and tattered, bottom of right year has u-shaped (tiny) notches

Male 3 Vasant (30 years old) unmistakably long tusks

Tusk: Long thin tusks pointing downwards & divergent & slightly upwardly curving at the ends. Left tusk curved more and upwards than right tusk

Ears: Top of the ears completely 1-1.5″ with no noticeable notches or holes

Male 4 25+ < 30 years old)

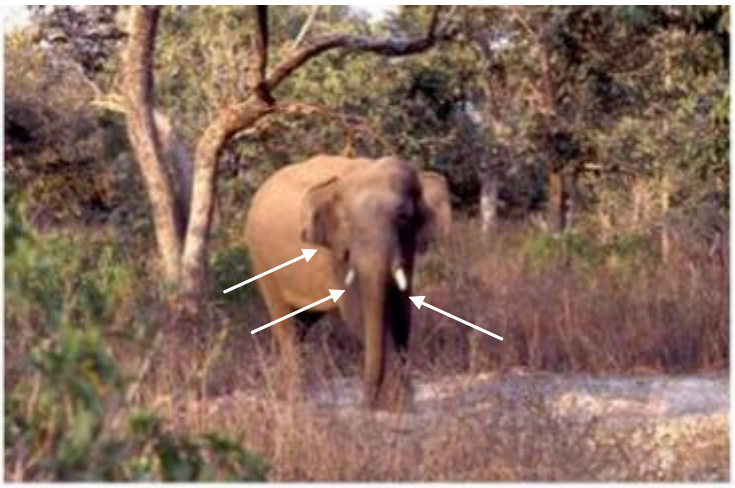
Tusk: Medium long symmetrical tusks, divergent and looks parallel to the ground if seen from the side

Ears: Ear folding just starting. Shallow notch with a hole just above on right ear. Square shaped notch where the ear folds back on the left year.

Male 5 Chewn Chewn (20-22 years old)

Tusk: Very short tusks, right smaller and shorter than left tusk.

Ears: Ear folding just starting. Square notch on the right ear where the ear folds back. Another U-shaped smaller notch on the bottom of the right ear. One deep and one shallow U-shaped notches on the left ear as well.



Male 6 Young Right Tusker (= 15 years old)

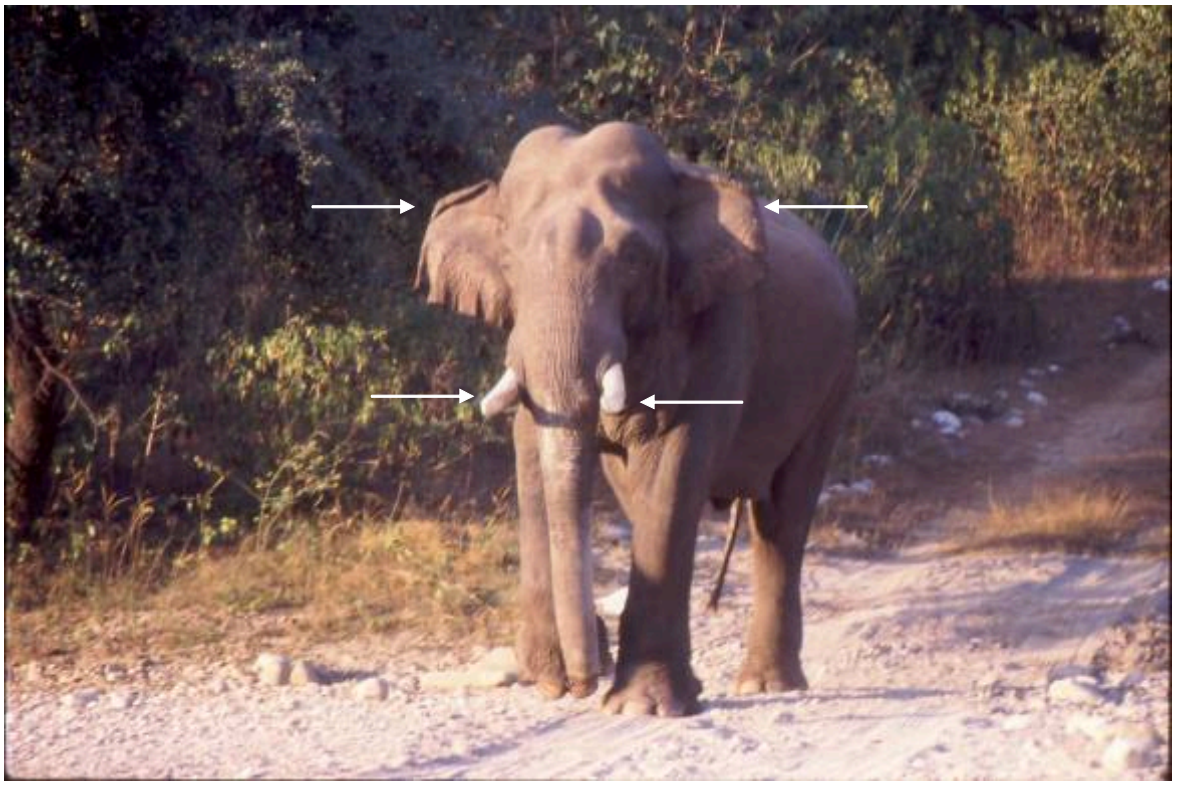
Tusk: Straight downward pointing right tusk

Ears: Ear folding yet to start, showing indications of starting. No other visible cuts, notches or holes in the year. But easily identifiable as there is only one older adult male with right tusk male 1.

Male 7 Anand (35-40 years old)

Tusk: Straight, symmetrical and slightly curving upwards, but almost straight to the ground

Ears: Ear folding about 2" over. No other visible cuts, notches or holes in the year. A pin head sized hole visible on right ear if seen closely with binoculars



Male 8 Amrit (15 years old)

Tusk: Straight, small curving inwards

Ears: Ear folding just beginning. Upturned V-shaped notch on the bottom of the right ear where it folds back. Easily identifiable due to aggressive behaviour when encountered

Male 9 Sunil (25+ years old)

Tusk: Straight medium sized tusks.

Ears: Ear folding about 2″ and no other visible mark

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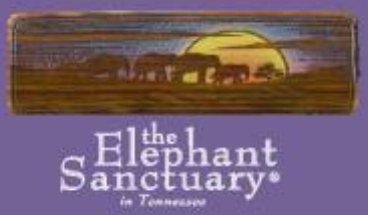

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