

Identification of an effective and robust model of elephant keeping and keeper welfare



Insights based on activity budget of elephants in captivity and mahout-elephant interaction in Karnataka

Surendra Varma, Shiela Rao, Suparna Ganguly and Harish Bhat

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Preface

The budgeting of different activities of elephants kept in captivity within a specified period of time provides an opportunity to compare the behaviours exhibited by wild and captive elephants, to highlight the differences observed, if any and to determine the cause of such differences. In a natural system there is no direct human-force linked to the day-to-day survival of elephants, but in a man-made situation, keepers play a critical role. This analysis tries to associate the connection between elephant activity budget and its influence on identifying welfare status of elephants in captivity. This analysis assumes that the welfare of an elephant cannot be seen in solitary and that understanding the interactions between an elephant and its mahout may offer deeper insights on the elephant's welfare status.

Based on known captive elephant distributions, individual elephant districts were identified in the State of Karnataka to facilitate analysis. Identification of these districts was also based on the locations of colleges and non-governmental organizations (NGOs) who formed the team of data collectors. Initial data collection was carried out with the support of nine teachers from nine districts of the state, who had previously taken part in the first one-day workshop, organized at Sakrebylu Elephant Camp. Initially, identifying interested teachers and students was cumbersome, however, an investigation on people biodiversity register carried out by the Centre for Ecological Science, Indian Institute of Science, Bangalore, helped us identify dedicated teachers and students for carrying out this investigation on captive elephants in Karnataka. The teachers and students were short listed depending on the availability of captive elephants close to their institutions. They were very enthusiastic towards such a program and showed keen interest in the training program. They were more concerned about the data collection process as it involved an interaction with the animal, mahout, owner and the teacher along with the students. Teachers felt that this was the first time that they could see an elephant so close, feel it, and also understand various issues relating to the animal, right from its anatomy to behaviour. They felt that such an exposure would definitely help them know more about animals and also aided teaching biology more effectively.

The need of identifying welfare status of elephants in captivity and the unique opportunity of using teachers, students and members of non-governmental organisations for the investigation did provide exclusive insights on welfare status of elephants in captivity. Some members of the team continued their observation even after the project was over, and this did offer scope for creating effective volunteer force to monitor the status of elephants from these regimes. The observations made by the group have been processed and this document has been developed. More or specific importance has been given to the methodology section, with the assumption that this may act as reference material for future behavioral observations and its influence on welfare aspects of elephants or any wild animals kept in captivity.

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Mr. K.S Abdul Samad,. Honorary Wildlife Warden, Bellary, Mr. H . Ananda Krishnappa, Volunteer, Pavagada, Tumkur District, Mr. G. Basappa, Teacher Govt. High School, Yeramarus Camp, Raichur District, Mr. Chandrappa, Teacher, Chitadurga Science Centre, Kelagote, Chitradurga District, Mr. Daniel Sukumar Das, Managing Trustee, Club for Awareness and Nature Study (CAN) Bangalore, Mr. C.H Deepak, Volunteer, Sagar, Shimoga District, Ms. Deepika L. Prasad, Volunteer, Compassion Unlimited Plus Action (CUPA) Bangalore, Mr. Girish Maharani Junior College, Mysore, Mr. K.S Gopalakrishna, Volunteer, Shimoga District, Ms. -N. Indiramma, Govt. PU College, Chikkanayakanalli, Tumkur, Tumkur District, Mr.. G.K Karthik, ,Nisarga - Bangalore, Mr. Keshav Hegde Korse, S.D.M. College, Ujire, Dakshina Kannada District, Mr. C Krishnegowda,. Govt. P. U. College, Srirangapatna, Mandya District, Mr. G. Madhav,. Volunteer, Shimoga, Mr. Mukunda Volunteer, Shimoga District, Mr. Pramod Nayak Karkala, Udupi District, Mr. Rajendra Hasbhavi, Researcher, CUPA, Bangalore, Mr. Ramakrishnappa, Govt. P. U. College, Venkatapura, Pavagada Taluk, Tumkur District, Mr. Ravi Kumar, Centre for Appropriate Rural Technologies (CART), Mysore, Ms. Shama Karkal, Volunteer, (CUPA) Bangalore , Mr. H.H Venkatesh, Volunteer, -Hassan District, Ms.Vydehi Kadur, Volunteer, CUPA Bangalore and Savitha Nagabhushan, Managing committee member, CUPA, Bangalore, observed the elephants and brought out this significant knowledge on them in captivity from different management regimes.

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Executive Summary

The results are based on an assessment of the captive elephants and their keepers belonging to different management regimes - Forest Department Elephant Camps, Temple Trusts, Ashrams or “Mutts”, State Zoos, Circus and Private ownership.

These results are presented to identify an effective and robust model of elephant keeping and keeper welfare.

The observations are made through three broad categories:

Assessment of the Time Activity Budget of individual elephants kept in different management regimes

Assessment of the Mahout Elephant Interaction through observation of individual mahouts, while he is with or within the area of his elephant

Assessment of profile (age, sex, body measurements), status of space, facilities, manpower and fund provided for each elephant from different management regimes through a detailed survey sheet (referred as Passport) for each animal

The time-activity budget shows, in terms of number of occurrence, total and mean duration spent on different activities, forest camp elephants having advantage over ashram, temple and zoo elephants as they are privileged to spend more time bathing: indulging in dust baths, playing, rubbing their bodies and trumpeting. After forest camps, elephants from zoos also exhibited many positive behaviors and seemed to outdo elephants from other regimes in interactions with other elephants from their natal herd. This group interaction naturally adds an enriched dimension to their captive lives.

Negative behaviors such as constantly blessing people or devotees, stereotypic behaviors, standing for long periods of time and sleeping during the daytime appeared to be major behavior patterns exhibited by elephants kept in temples and ashrams.

If data is pooled for all the positive behaviors, elephants that are kept in zoos appear to be provided with most of the natural conditions followed by elephants from forest camps. However, elephants exhibiting negative behaviors or unnatural traits also appear to be more in zoo elephants.

Forest camps have shown a clear consistency in the pattern of results - their exposure to negative or unnatural behavior is the least; they stand closer to all the positive or natural conditions required for elephant keeping.

The results of mahout-elephant interaction suggest that mahouts spend more time interacting with elephants in zoos and forest camps. Negative interactions were most in temples followed by zoos and forest camp. Positive interactions were most in zoos

followed by temples and forest camps in terms of total number of occurrences and duration.

Elephants in temples are more submissive, obedient (to the mahout's interaction or control) and conditioned. Elephants in forest camps are partially responsive to the mahout's commands. Zoo elephant's responses are more playful and less obedient compared to the other management regimes.

In terms of space, flooring, quality of water available, elephant's exposure to other elephants for interaction, type of work given and food provided, forest camps appear to be the better-managed elephant keeping system.

With reference to the status of reproduction and the veterinary care provided both zoo and forest camps stand to be better managed regimes. Temples appeared to be poorly managed in this aspect too.

The results of the status of elephant keepers, their experience, social status, health care, insurance and other factors give 70% credit to the forest camps for their keeper management in comparison to mahouts from other regimes.

The results presented through this investigation has been instrumental in confirming, in an objective and non-biased manner, that elephant keeping models differ widely in their allocation of space and natural living conditions to the animals.

It has also proved, beyond reasonable doubt, that temples are the worst offenders in terms of welfare and other specified conditions of keeping (according to Sec.42 of the Wildlife Protection Act) namely, housing, upkeep and maintenance. The most acceptable models of captivity, according to this study, would be Forest Camps and Zoos or an optimum combination of the two. However, Forest department camps need to improve their scope for the manifestation of positive behavior and interactions, which are surprisingly lacking among the camp elephants.

Based on this experience, good elephant keeping is defined as a system with dense or sparse forest cover, perennial running water sources, and the animal being exposed to timely and adequate food (without overfeeding or underfeeding). The animal also requires adequate space for movement, exercise and other elephants of different sex and age-class for free and unconditioned interaction. Increasing the elephant-mahout ratio (current 1:1) for minimizing the pressure on both elephant and keeper leads to improved resource availability for both. It may be noted here, that elephants in both zoos and forest camps were always with chains, be they long drag chains for night browsing or shorter chains when on public display or while waiting. This may be the single most important factor that may need to be addressed in the future elephant keeping centers – be they zoos, forest camps or rescue centers.

It is concluded that the Forest Department Elephant Camps (FDEC) and the Zoological Gardens (Zoo) with the above mentioned conditions provided and some modifications (in

terms of providing natural conditions for captive elephants) can play a major role in achieving the goal of satisfactory elephant keeping. FDEC can act as Elephant Care Centers, while both FDEC and innovative Zoos can be considered as a source of knowledge on the species and resource generation.

Introduction

Maintenance of elephants in captivity has been an integral part of India's history, culture and tradition for centuries (Gale, 1974, Krishnamurthy & Wemmer, 1995, Nugegod, 1992, Sukumar et al., 1988). However, the captive elephant population has been exposed to terrible conditions, where the deprivation of their welfare needs and profound suffering characterize the existence of captive elephants today. It is also essential to note that the entire physical and emotional well-being of the captive elephant is dependent on the "mahout" or keeper and/ or owner of the elephant. Mahouts and owners are responsible for every aspect of their elephant's life. Hence, to understand and accurately assess captive elephant welfare, it is necessary to understand the interaction, more particularly, that a mahout shares with his/her captive elephant. Keeping elephants in captivity is a complex process, and identification of their welfare status is even more intricate as the influence of a given behaviour on the welfare status is not clearly understood. However, to derive specific conclusions on behaviour related welfare status, elephants in captivity have to be observed systematically for their activity pattern or activity budget for a long time.

Elephant activity budget (McKay, 1973; Guy, 1976; Easa, 1988; Baskaran, 1998) can be referred as 'different activities an elephant is involved in or exposed to in a given unit of time'. This budgeting of different activities within a specified period of time provides an opportunity to compare the behaviours exhibited by wild and captive elephants, to highlight the differences observed, if any and to determine the cause of such differences. Activities could be defined as behaviour exhibited by a given animal, and behavior could be further defined as what an animal does and how it does it, in terms of responding to a stimulus/ stimuli. Observation on this aspect attempts to understand what triggers the behaviour, the actual mechanisms involved, and how a given behaviour may differ if elephant is exposed to natural or man-made environment. The man-made environment may also include semi-natural conditions provided to elephants. In a natural system there is no direct human force linked to the day to day survival of elephants, but in a man-made situation, keepers play a critical role.

Interaction between elephant and its mahouts could be defined as communication or interface between elephant and mahouts. Interaction is also a mechanism that draws both the elephant and its mahout to come together in performing the different tasks for which they are responsible. Within this environment of human-elephant association, depending on the state of minds of keepers and elephants, a given behaviour expressed by elephant or mahout could be defined as positive or negative interaction. Positive interaction maybe a reflection of a natural environment or natural behaviour, or well-being of the animal kept in captivity. The set of behaviours not observed among wild elephants or observed very rarely, but are of common occurrence in captive situations (stereotypy, infant rejection by mother, infanticide, absence of play in young animals, excessive periods of sleep among adults, not exhibiting any interaction with conspecifics) can be termed negative behaviours. Mahout's welfare may also, directly or indirectly, be linked to his/her positive or negative approach towards the elephant and due to this factor, elephant may be exposed to positive or negative environment or behaviour.

The occurrence of conflict between an elephant and the closest companion it can attain in captivity may indicate the absence of natural behaviour by the animal as a consequence of stressful captivity. This investigation attempts to link the relationship between elephant activity budget and its influence on identifying welfare status of elephants in captivity. It's also assumed that, welfare of elephant cannot be seen in isolation and the understanding of the interaction between elephant and its mahout may also provide some specific insights on elephant welfare status.

Methodology

The present study was part of an on going survey of captive Asian Elephants over entire India. The main purpose of this survey was to collect data on elephant time activity budget (Moranko, 1987), and to assess the interaction between elephant and keeper. Along with this data regarding thier physical living conditions, social and physiological aspects of the animal, personnel availability/ funding deficiency was collected to represent a set of passport data.

Based on known captive elephant distributions, individual elephant districts were identified in the State of Karnataka to facilitate analysis. Identification of these districts was also formed by the locations of colleges and Non Governmental Organizations (NGOs) who formed the team of data collectors. The study was conducted in a spectrum of different management regimes: Forest Department Elephant Camps, Temple Trusts, ashrams or “mutts” and State Zoological Gardens (Zoo) with each having unique characteristics.

The observations have been divided into three broad categories as

- I. Assessment of the time activity budget of individual elephants kept in different management regimes
- II. Assessment of the elephant mahout interaction through observation of individual mahouts, while he is with or within the area of his elephant
- III. Assessment of status of space, facilities, manpower and fund provided for each elephant from different management regimes through a detail survey sheet (referred as passport) for each animal

Each of these steps entailed several sub-tasks

Assessment of time activity budget of Asian elephant

Selection of an individual animal for observation

- Selection of study period. One observation was to be done for 12 hours (3 hours per day) and was to be completed within 4 continuous days of a week (for example for day 1 morning 6 am - 9am, day 2, 9am – 12pm day 3, 12 to 3 pm and day 4, 3pm- 6pm). Observation was to be continued for 8 weeks per animal
- Observation of the animal was done on a selected animal for duration of 10 minutes followed by a break of 5 minutes. Thus, in one hour 40 minutes was set

as the study time. Each set had a 10-minute study time and a 5-minute break, and there were four such sets for an hour.

- Starting time, closing time and duration (in minutes) of each behavior (Altmann, 1974) was noted down along with other relevant information.

Assessment of elephant mahout interaction

Selection of individual mahout and his elephant for observation

- Selection of study period. One observation was to be done for 12 hours (3 hours per day) and was to be completed within 4 days of a week (for example for day 1 morning 6 am - 9am, day 2, 9am – 12pm day 3, 12 to 3 pm and day 4, 3pm- 6pm). Observation was to be continued for 8 weeks per mahout
- Observation of mahout was done for duration of 10 minutes followed by a break of 5 minutes. Thus, in one hour 40 minutes was the study time. Each set had a 10-minute study time and a 5-minute break, and there were four such sets for an hour.
- Individual mahout was observed while he was with and within a specific area of proximity to the animal. The observations were made without the knowledge of the mahout. It is known that if mahouts were aware of the observation of their interaction with elephants, this would result in a very biased interaction. Even if the mahouts were aware of the observation or study, they were given to understand that the study was on elephants, and not on them.

The selection of elephants for each regime was based on the proportion in relation to the total number of captive elephants reported in the state. The results presented here are for one state i.e., Karnataka, wherein 45 animals (Appendix 1) represent about 35% of its captive population of 130. (Today, we find that the numbers have increased to 160, but at the time of analysing the data the information that we had on total number of elephants for the state was 130).

Selection of elephants for both activity budget (26 elephants, 20% of total elephants estimated for the State) and mahout elephant interaction (13 elephants, 10% of total elephants estimated for the State) was based on type of elephant available in the given regime (Appendix 1). For example, temples in Karnataka keep only adult females, and here selection based on specific sex or age-class was not possible. Secondly, the aim of the study was not to compare the system of keeping for different age and/ or sex class of elephants, but for overall elephant keeping in different management regimes.

Initially, a workshop was conducted exclusively for developing the methodology. Classroom sessions for data collection were carried out and these sessions were supplemented by direct observation of elephants in the field. In addition to this, a number of field sessions in different management regimes using elephants of different age and sex classes were also carried out to train the observers.

During the training sessions, each behaviour was defined, and to make the observations uniform, a standard ethogram (Altmann, 1974; Easa, 1988; Baskaran, 1998) was developed (see appendix 2 for more details). Each behaviour was described or defined

using different aspects of body movements and context associated with it. As each behaviour was defined on broad terms, it was possible to collect data of starting, closing and duration of each behaviour.

- For example, feeding was defined as the action or actions associated with eating. This included starting time of taking or breaking of a branch or twig or removing grass or picking up of food material through trunk, and eating.

Both grazing and browsing were treated as a single feeding behaviour, not as distinctly grazing or browsing (as different modes).

It's expected that there may be problems associated with non-independence of behavioural categories. For example an elephant may be doing several behaviours at same time, so the duration of these behaviours may be difficult to accurately log as there simply may be too much going on. For example, while feeding, elephant may move its tail: an example non-independence of behaviour.

However, unlike monkeys and squirrels, recording different behaviours of elephants was not that difficult, as they are known to spend more time in indulging in each behaviour. If we ignore tail flicking in elephants, concentrate only on feeding as it takes place continuously, non-independence may not affect our observations.

While feeding, when the elephant uses its trunk to chase away flies instead of its tail, then feeding stops and observation is also discontinued. The occurrence of using trunk to chase flies can be recorded in the category of "chasing flies" and not under "feeding"; also, ear-flapping and/ or tail movement while feeding will not be recorded in the category "feeding".

Some behaviours not defined prior to observing have been left to the discretion of the observer, as behaviours can be dynamic and context dependent. Depending on the objective of the investigation, an observed additional behaviour was included and specific definitions were developed for the particular behaviour.

Elephant responses to mahout were defined based on specific criteria, if specific commands were given to elephants; the immediate responses to those particular commands by the elephants were noted down and described based on some characterization.

Responses were time-dependent (immediately following a command/ following a time-lag), distinct enough not to be missed. For example, if an elephant was asked to bless people or bend its body (for bathing), if the response was quick and obeyed the command, it was considered as obliging.

If the elephants took some time to respond or the command was repeated and only then the elephant obeyed, it was considered as partially obliging. If the elephant was beaten or

punished, if its reaction was not aggressive towards the mahouts, but obeying, it was considered as submissive.

“Normal” in relation to interaction between elephant-mahout can be defined as non-interactive behavior of the elephant with the presence of mahout. For example: animal continues with its activity without being influenced by presence of mahout.

“Responding” is a behaviour exhibited by elephant when not initiated by the mahout. For example: Elephants stops its activity when mahout enters; even when the mahout is not approaching the animal for any interaction.

Though observers were trained, it would have been difficult to follow the instructions due to the dynamic nature of the behavioural environment or even the learning capacity of the observer. However, we assume this error may not influence the overall result observed due to negligible proportion of such errors. The use of definitions for a set of likely behaviours, relatively longer duration of elephant behaviour and opportunity to add to the repertoire while observing, enabled recording the given behaviour easily. Twenty-one behavioural patterns that were selected for the study were long duration behaviours or defined along with sub sets (for example, feeding was combined with removing grass or other associated actions), this approach also helped the observer to record the occurrence or duration reasonably well.

Assessment through ‘passport’

The observations of activity budget and elephant-mahout interaction were made by a large set of observers for restricted period of time (with out considering seasonality or resource and other factors available). The result may have to be validated for its usability or applicability or acceptability. To validate the results of the time activity budget and mahout elephant interaction, a total of 36 elephants belonging to different management regime (see Appendix 1) were randomly selected for the detailed investigation of space, facilities, manpower and fund. Trained researchers travelled to visit all the elephants, managers, mahouts, veterinarians and others who were associated with the management of captive elephants, to collect the data. The parameters selected for the investigation also includes management aspects such as status and availability of enclosure, water, resting, sleep, opportunity to walk, interaction with other elephant/s, training, behavior, work, food, reproduction, veterinary care, facilities, manpower, and other aspects.

Data processing

Time activity budget

The observations were classified into different behaviors. For each behavior, number of occurrence, total duration and mean duration, standard deviation and standard error associated of respective mean was calculated. The frequency of occurrence of event or total duration may emerge from one or a few animals, but not from all the elephants of given regime. This is due some animal from a given regime may or may not exhibited a given behaviour. Given this, the normalizing the data was based converting number of event or total duration into per animal. This was achieved by dividing number of events or total duration into number of animal observed for each regime. As mentioned earlier,

the selection of number of elephants for each regime was based on number of elephants found in each regime. Calculation of mean duration of occurrence of given behaviour has also provided scope for standardizing the unequal sample of elephant available for observations.

Initially the data was pooled for all elephants belonging to each management regime. Later each behavior was processed for each management regime. In addition the results were also processed for percentage of animals; those exhibited a given behaviour for given regime. For example number of elephants those exhibited the behaviour of blessing in each management regime was divided by total number elephants selected for the regime and the results were multiplied by 100 to arrive the percentage animal exhibit the behavior of blessing. An attempt was also made to calculate mean events and mean duration, for this purpose, all the elephants irrespective of exhibiting or not exhibiting given behaviour from given management regime was considered. However total number of animal observed (or available for sampling) for some of the regimes (zoo and mutt, for example) was very low (as number of animal kept in these management regimes themselves were low for sampling) and no efforts were made to calculate mean of event or duration or statistical significance across the behaviour across the regimes. Given this constraint the data processing was restricted only to obtaining the percentage elephant exhibit given behaviour for given management.

For the pooled data (of all the managements or individual management regimes), the highest or lowest values of number of occurrences, total duration and mean duration of each behaviour of each regime was considered for categorizing a given regime to be a good or bad management regime. Statistical significance of the values were tested using z test, and comparisons were made of the results of forest camps with temple, mutt, and zoos, similar comparisons were made across temple and mutt, temple and zoo, mutt and zoo.

Mahout elephant interaction

Types of interaction, number of occurrence of each interaction, total duration, mean duration (with its standard deviation and error) were calculated. Total number of events of interactions, and the total duration of each interaction (of 13 elephants) were converted into per animal per regime. Interactions were further divided into positive and negative, number of occurrence, total duration and mean (with standard deviation and error); duration of positive and negative interaction per regime was calculated to compare the results across regimes.

Wherever possible, the elephant's response to a given interaction was observed and this information was available for 6 elephants (out of 26 elephants selected for time activity budget observation). This information was further analyzed for different regimes to compare the results across different systems of elephant keeping.

Since the distribution of elephants in each regime (for both activity budget and elephant mahout interaction) is uneven, equal sample size of each regime would not provide a meaningful comparison. However, the results of total occurrence, and duration of each

behaviour for given regime have been converted into results per animal, for comparison of results, so as to address this inequality.

Passports

A total of 77 sub parameters were considered for data processing and these were classified into 3 broad categories such as

1, Sex ratio, relationship between neck girth and shoulder height, space (size & status), floor, water (quality & distance), interaction, work and food (type) provided

2, Reproduction, veterinary care and record keeping

3, Elephant keepers and their experience, social status, health care, insurance and other factors

In each category, number of sub parameters was used for data processing and this includes 15 sub parameters for category 1, 14 for category 2 and 48 for category 3. For some parameters mean (with standard deviation and error) value was calculated (e.g mean of age class of elephant kept in each regime, or mean distance from camp to water etc.) and for some parameters proportion of individuals or occurrence was calculated (e.g. proportion of male and female (of all age class) kept in each regime or proportion of individual elephant exposed to water from river or other sources). Each parameter was rated based on its merit, rating of 10 being the highest and 0 being the lowest. Mean (with standard deviation and error) rating was calculated for each category for each management regime. Mean values (along with Se) were compared across the regime and z test was used to see the statistical significance of the mean arrived for each category and different management regimes.

Results:

Activity budget of individual elephant kept in different management regime

Overall Behavioural patterns exhibited by the Asian elephants kept in Captivity

Pooling all the data and only those elephants that exhibited a given behaviour together, the study identified 20 different behaviors for the animals observed (Appendix 1 for elephants observed for different studies), during the survey period of 203 hours (Table 1). Amongst these behaviors, feeding dominated (29 % of the time) followed by walking 14%, standing 10% and others (including urinating, yawning, defecating and being alert).

The results are compared with studies carried out in the wild and found that in the wild elephants spent about 65% time for feeding, 10 % for walking, 20% resting, mud bathing 2%, drinking 1.4% and other behaviours (communication, signal, rubbing the body against trees or rock, defecation, nursing calves and playing) 2% in Parambikulam National Park in southern India (Easa, 1988). Baskaran (1998) found elephant spending 60% of the total time for feeding, 20% for resting, and moving (without feeding) was 14% and other behaviours (including drinking, salt licking, playing, dust bathing, rubbing, vocalization, vigilance, defecating and urinating) was 6%. These results clearly indicate elephants in captivity spent less time for feeding, and the feeding may be sacrificed due

to performance of other behaviour. Wild elephants observed to be spending more time in resting (Baskaran, 1998), which appears to be contributing about 20% of their total activity, which has been reduced to only 1%, even when sleeping is treated as resting, the increase was only 2%.

Table 1: Type of behaviors, number of occurrences, total and mean durations (with standard error –SE) for all and per individual animal observed for time activity budget

S.No.	Behavior	Number of occurrence	Duration		No of occurrence /animal	Duration/ animal		Mean	SE
			%	(min)		(min)			
1	Bathing	59	2.5	456	3.62	2.36	18.2	7.7	0.45
2	Begging	4	0.2	40	0.32	0.16	1.6	10.0	0.00
3	Blessing	39	1.6	243	1.93	1.56	9.7	6.2	0.72
4	Bobbing	72	3.0	481	3.82	2.88	19.2	6.6	0.69
5	Drinking	39	1.6	230	1.83	1.56	9.2	5.8	0.67
6	Dust bath	29	1.2	142	1.13	1.16	5.7	4.8	0.65
7	Feeding	556	23.3	3627	28.79	22.24	145.1	6.5	0.58
8	Flapping	5	0.2	48	0.38	0.2	1.9	8.6	1.56
9	Interaction	151	6.34	463	3.68	6.04	18.5	3.0	0.18
10	Moving	28	1.18	241	1.91	1.12	9.6	8.6	0.58
11	Others	440	18.47	1873	14.87	17.6	75.0	4.3	0.18
12	Playing	107	4.49	351	2.79	4.28	14.0	3.3	0.19
13	Resting	22	0.92	83	0.66	0.88	3.3	3.7	0.76
14	Rubbing	55	2.31	213	1.69	2.2	8.5	5.0	0.55
15	Scratching	45	1.89	117	0.93	1.8	4.7	2.6	0.49
16	Sleeping	52	2.18	471	3.74	2.08	19.0	9.1	1.57
17	Sparring	7	0.29	26	0.21	0.28	1.0	3.7	0.45
18	Standing	228	9.57	1239	9.84	9.12	50.0	5.4	0.24
19	Trumpeting	8	0.34	23	0.18	0.32	1.0	2.8	1.16
20	Walking	342	14.36	1750	13.89	13.68	70.0	5.1	0.23
21	Working	17	0.71	69	0.54	0.68	2.8	4.1	1.01
Total		2305		12186			487.44		
Hours				203.1			8.124		

The over all results were divided across different regimes. Interestingly, activities not performed in the wild: work (as commanded by the mahout) and such activities as blessing/ begging contributed comparable percentages (5.5% for mean occurrence and 6.6% for mean duration) indicating low contribution to the overall behaviour types. However, this does is no way implying that the captive elephants observed were exhibiting similar behavioural repertoire.

Feeding, which is considered to be important and dominant behaviour for elephants in wild gets reduced to 12% and 13 % in mutt and temple respectively. Forest camp elephants spent 24% and zoo elephant spent 30% of their time for feeding. Elephants in the wild feed variety of natural foods, and they spend a lot time preparing their food. Although elephants in temple and mutt are given cooked food, as they have to perform many unnatural activities (controlled by their mahouts), the time they spend on feeding may be scarified.

Out of 21 different behaviours (Table 1) reported for the investigation, the behaviour ear flapping was included under the categories of others, and behaviours such as begging and blessing were merged under one category as blessing (it was found begging and blessing are interlinked). With this total number of 21 behaviours were brought down to 19. Out of this six behaviours (S.no, 1, 5, 6, 7, 9, and 16 of Table 2) are considered as positive behaviours and four (s.no 2, 3, 13 and 14 of Table 2) were considered as negative behaviour or unnatural behaviour of elephant or as being imposed on the elephant. Some behaviours for example, moving or rubbing or working or others can not be considered as positive or negative behaviours and those are not included in any of these two categories

Table 2: Number of occurrences and total duration (in min) of different behaviors observed from different management regimes

Behavior		Number of occurrence /animal			Duration/animal			Zoo	
		Fc	Mutt	Temple	Zoo	Fc	Mutt		Temple
S.no									
1	Bathing	3.4	0.7	1.7	1	27.4	6.7	11.3	4
2	Blessing	0	4.0	4.7	0.7	0	40.0	22.2	6.7
3	Bobbing	1.2	0.7	0.2	17.7	12.3	16.7	1.7	87.0
4	Drinking	0.6	2.3	1.7	4.7	5.0	23.3	9.2	13.3
5	Dust bath	1.1	0.0	0.0	5.0	7.2	0.0	0.0	16.0
6	Feeding	14.0	4.0	11.5	93.7	128.3	40.0	70.3	1209.0
7	Interaction	0.9	0.0	0.0	46.3	2.5	0.0	0.0	143.3
8	Moving	0.4	2.7	2.5	0.0	1.5	26.7	23.7	0.0
9	Playing	0.3	0.0	2.0	30.6	1.2	0.0	4.7	103.7
10	Resting	0.2	0.0	0.0	6.7	0.2	0.0	0.0	26.7
11	Rubbing	1.4	0.0	5.5	1.0	13.1	0.0	6.0	2.0
12	Scratching	0.3	0.7	4.2	4.7	2.4	6.7	8.0	6.0
13	Sleeping	0.7	1.7	1.3	9.7	4.3	41.7	12.1	57.3
14	Standing	9.5	1.7	10.7	11.3	45.5	16.7	78.5	38.7
15	Trumpeting	0.2	0.0	0.0	1.7	1.0	0.0	0.0	3.0
16	Walking	15.2	0.0	4.8	38.3	89.8	0.0	43.5	97.3
17	Working	1.1	0.0	0.3	0.0	4.4	0.0	0.3	0.0
18	Sparring	0.0	0.0	0.0	2.3	0.0	0.0	0.0	8.7
19	Others	7.6	15.0	35.3	35.3	34.3	191.0	187.4	100.0

As these behaviors were analyzed for different management regimes, an interesting pattern of elephant keeping appeared to emerge. Elephants kept in forest camps (FC), got more bathing opportunities, both as number of occurrences and total duration per animal (Table 2). Elephants that appeared to be allowed more interaction in terms of number of occurrences and total duration with other elephants were in zoos followed by forest camps. The negative behaviors such as constantly blessing people or devotees, stereotypic behaviors (e.g bobbing head vigorously), standing for long periods of time and sleeping during the daytime appeared to be major behavior patterns exhibited by elephants kept in temples and ashrams. Although vigorous stereotypic behavior was

observed from a zoo elephant, the animal in question that exhibited such behavior was earlier kept under temple management, and had recently been confiscated and transferred to the Zoo.

Out of six positive behaviours identified, for five, zoo elephants performed better than all others, and for one forest camp elephants showed dominance, in terms of occurrence and total duration. For mean duration, out of six positive behaviours, forest camps stand first in three of them and one each for zoo, temple and mutt (Table 3). Out of four negative behaviours, for three zoo stands first, and for one behaviour, temple stands first in terms of number of occurrence. The total duration was dominated by zoo, followed by temple and mutt, and for mean duration, all the regime contributed equally.

In terms of mean duration spent on different activities (Table 3), forest camp elephants have advantage over ashram, temple and zoo elephants as they are privileged to spend more time indulging in dust baths, playing, rubbing their bodies and trumpeting. These are natural behaviors, exhibited in the wild.

Table 3: Mean duration spent for different behaviors in different management regimes.

S.no	Behavior	FC		Mutt		Temple		Zoo		Se
		Mean time spent	Se	Mean time spent	Se	Mean time spent	Se	Mean time spent	Se	
1	Bath	8.1	0.5	10.0	0.0	6.8	1.4	4	0.0	
2	Blessing	0	0.0	10.0	0.0	4.8	0.9	10.0	0.0	
3	Bobbing	10.0	0.0	8.3	0.4	10.0	0.0	4.9	0.6	
4	Drinking	8.1	1.3	10.0	0.0	5.5	1.6	2.9	0.7	
5	Dust bath	6.7	1.0	0.0	0.0	0.0	0.0	3.2	0.6	
6	Feeding	9.2	1.7	10.0	0.0	6.1	0.5	4.0	0.2	
7	Interaction	2.4	0.7	0.0	0.0	0.0	0.0	3.1	0.2	
8	Moving	3.8	1.7	10.0	0.0	9.5	0.6	0.0	0.0	
9	Play	3.8	0.8	0.0	0.0	2.3	0.8	3.4	0.3	
10	Resting	2.5	0.7	0.0	0.0	0.0	0.0	4.0	0.8	
11	Rubbing	9.4	0.4	0.0	0.0	3.1	2.1	2.0	0.5	
12	Scratching	7.8	2.6	10.0	0.0	1.9	0.5	1.3	0.2	
13	Sleep	7.3	1.4	10	0	9.1	0.9	5.9	0.6	
14	Standing	4.8	0.3	10.0	0.0	7.4	0.5	3.4	0.3	
15	Trumpeting	4.7	3.3	0.0	0.0	0.0	0.0	1.8	0.7	
16	Walk	5.9	0.3	0.0	0.0	9.0	1.1	2.5	0.2	
17	Work	4.1	1.1	0.0	0.0	1.0	0.0	0.0	0.0	
18	Sparing	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.5	
19	Others	4.5	0.4	10.0	0.0	5.3	0.9	2.8	0.3	

The result leads to a critical question of which is more important – is it number of occurrences or total time spent or mean duration or a combination of all three? If an elephant is exposed to increased frequency of a specific behavior (particularly, the positive or natural behaviors) in terms of occurrence, total time and mean duration spent, this could then be considered as an ideal condition for the animal. This calls for a comparison of the number of occurrences, the total duration and mean duration of each

behavior, which could then provide the actual state of the management of individual elephant/s kept in different management regimes.

Bathing

Bathing aids in temperature regulation (Poole and Taylor, 1999), a fact of importance considering the low surface area-volume ratio (Weissenbock, 2006) of these gigantic animals and the high ambient temperatures they are exposed to. The practice of scrubbing the animal while bathing is said to aid in removing ectoparasites/ fungus (Kurt and Garai, 2007; Ferrier, 1947).

Although mean time spent for bathing (Figure 1a and b) appeared to be more for



Figure: 1a Bathing observed in forest camps; note source of water



Figure: 1b Bathing observed in private institutions, note source of water

elephants from ashrams (Figure 2), number of occurrences and total time duration for bathing by forest camp elephants indicate that these animals are exposed to water more frequently than their counterparts from other management regimes.

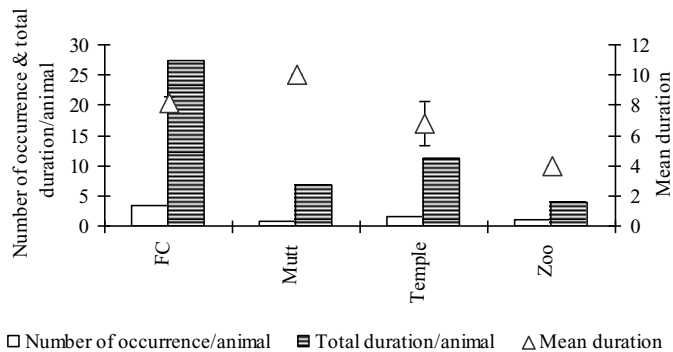


Figure 2: Bathing observed for captive elephants from different regimes

Mud bath

Wild elephants have been observed to spray themselves with mud/ soil, following/ in the absence of bathing with water (McKay, 1973). Skin care for elephants includes along with bathing, activities such as dust-bathing/ wallowing/ rubbing against suitable trees/ rocks (Kurt and Garai, 2007). In cases of mud bath, (Figure 3), number of occurrence and total duration/animal was more in zoos. No mud bathing was reported for temple and mutt.

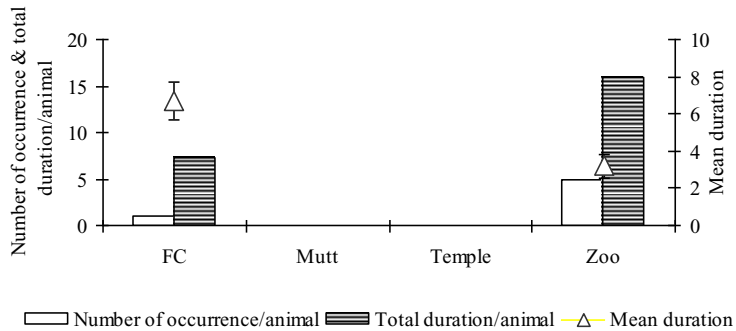


Figure 3: Mud bath observed for elephants from different management regimes

Interaction

Elephant society has been described as a multi-tiered, fluid, fission-fusion society with relationships lasting across generations (Poole and Moss, 2008), family groups of related animals have been observed in the wild (Vidya and Sukumar, 2005), both male and female young are dependent on their family, while pre-pubertal males gradually leave their natal herds to form loose associations of other males (Kurt and Garai, 2007). Learning from group members is important for developing individuals in the context of feeding behaviour (Poole and Taylor, 1999). Given their social nature, presence of companions (Figure 4a and b) in a captive situation is considered to be a source of



Figure 4a: Social interaction observed in temple; note elephant is isolated, chained and the floor is unnatural



Figure 4b: Social interaction observed in zoo; note elephants are exposed for play and other natural interactions

enrichment (Mellen and Keele, 1994). Breaking of established bonds between individual elephants led to expression of aggression/ stereotypy (Clubb and Mason, 2002). In the case of interaction total number of occurrence and total duration (Figure 5) were more in zoo, and the results of mean duration may not be significant, for forest camp and zoo and interaction among the elephant was absent in temple and mutt.

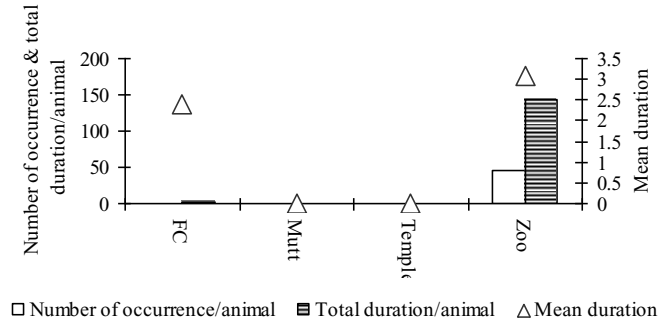


Figure 5: Interaction among the elephants observed from different management regimes

Play:

Kurt and Garai (2007) observed in a wild population of Asian elephants, neonates and infants spent 17% of time in social behaviour and play, juveniles 10%, sub-adult females 3% and 10% in adult females. Also, play was absent in young individuals (Figure 6) showing apathy/poor physical development/ sick elephants, all were orphaned. Growing males need to know the strengths of other independent males, in such situations of developing independence of a young male, playing with non-natal individuals has been observed (Poole and Granli, in press).



Figure 6: Play behaviour observed during the investigation

In the case of play the pattern for number of occurrence and total duration were similar as mud bath and interaction (Figure 7). However the results of mean duration spent interacting among other elephants may not differ across regimes.

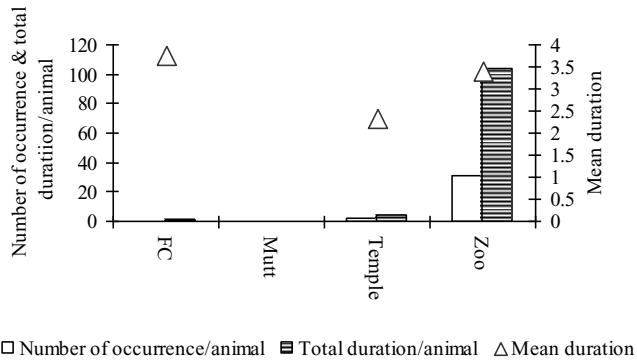


Figure 7: Play observed for captive elephants from different management regimes

Walking

Home range size for wild elephants is reported to vary from 100-300 km² (Sukumar, 1991), being on the move for most parts of a day (Kane et al., 2005). Walking is one of the most important aspects of an elephant's life, as their leg and joints are designed for movement (Poole and Granli, in press). Elephants from forest camps were exposed to more walking (Figure 8) than elephants kept in all other different systems. Number of occurrence and total duration of walk for zoo elephants was more followed by forest camps, mutt contributed very less in this important behaviour.

The results of mean duration of walking may provide very interesting insights as the results may be significantly different for forest camp and temple. Walking is closely associated with feeding, as elephants in mutt and temple spent most of their time standing in one place, provision for walking is needed, and in forest camps its more related to their feeding behaviour, as they move a lot for feeding. After forest camps, elephants from zoos also exhibited many of the positive behaviors, particularly mud bath, play and walk. Zoos also seem to stand first in interaction of elephants with other elephants.

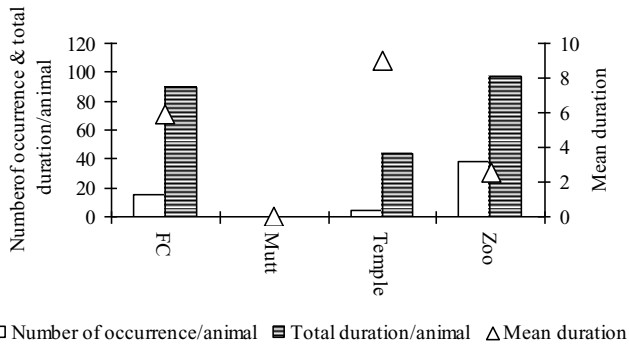


Figure 8: Walk observed for captive elephants from different management regimes

Feeding

Digestibility of dry matter in elephants may vary from 30-45% (Ullrey, et al., 1997) (protein digestion of 22% – Sukumar, 1991) indicating less than half of what is eaten is digested. This entails predominance of foraging (Figure 9a and b) and eating to provide sustenance for their size— with elephants reported to forage and engage in feeding activities for 12-18h a day (Sukumar, 1991). McKay (1973) observed elephants feeding



Figure 9a: Feeding behaviour observed in a forest camp; note elephant has option of natural food and foraging



Figure 9b: Feeding behaviour observed in a temple; note elephant is exposed only to stall feeding

on variety of plants, across several genera and many families. Such a wide variety cannot be provided or is difficult to provide in captive situations of stall feeding. Number of occurrence and total duration of feeding behaviour was observed more for zoo elephants (Figure 10). Mean duration of feeding observed for mutt and forest camp may not differ, but for forest camp and temple, forest camp and zoo, mutt and temple, temple and zoo, and mutt and zoo may be significantly different.

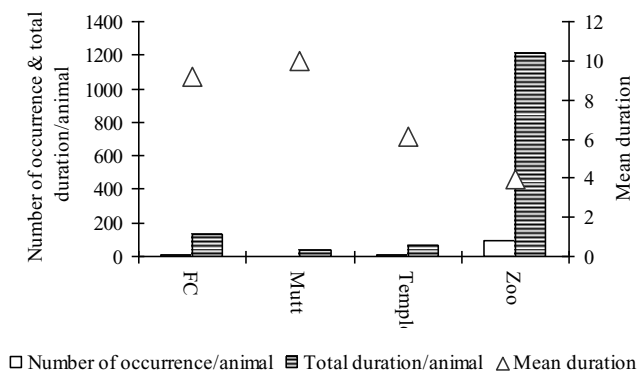


Figure 10: Feeding observed for captive elephants from different management regimes

Sleeping and standing

Kurt and Garai (2007) observed that total sleep duration was negatively correlated with age, with shorter duration being observed among adults (3 - 4.5h in adults). Elephants have been observed to spend 5% of their time in standing (along with comfort activities/ drinking) (Poole and Granli, in press).

Diseased/ wounded elephants, observed by McKay (1973), rested more and fed less. Negative behavior or unnatural conditions, particularly sleeping during the daytime (Figure 11) and standing for long hours (Figure 12) are prominently exhibited in zoo, ashrams and temples in terms of total occurrences and duration. The results of mean duration of sleeping during day time may be different for forest camp and temple and mutt and it may not for forest camp and zoo.

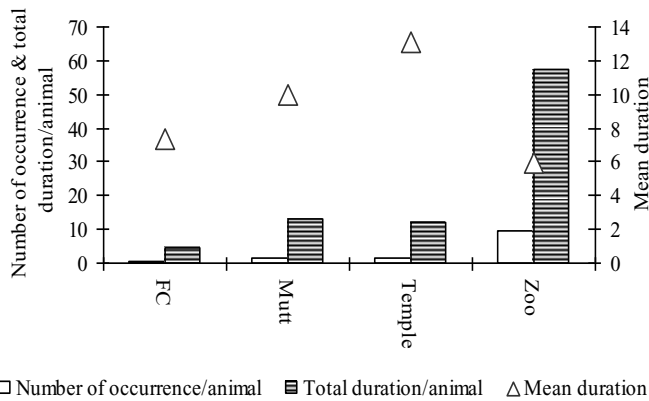


Figure 11: Sleep during day observed for captive elephants in different regimes

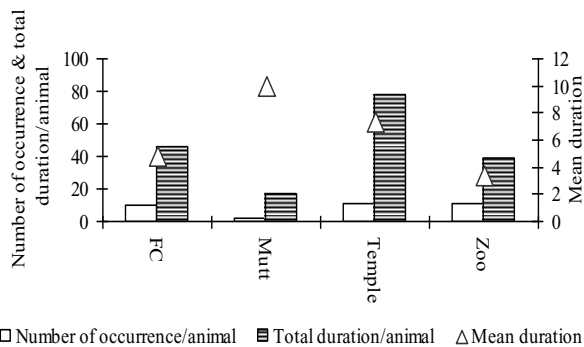


Figure 12: Behaviour of standing by captive elephants observed in different regimes

Blessing:

These observations are further reinforced by the fact that elephants from temple and ashram (mutt) are constantly exposed to the public who pay money to the mahouts for being blessed (Figure 13) by the elephant (some elephants have to go through this process more than 1000 times per day!). Number of occurrence and total duration was high in temple and mutt. The results of mean duration of blessing people was high in temple and mutt (Figure 14), completely absent in forest camp.



Figure 13: Getting trained for blessing people

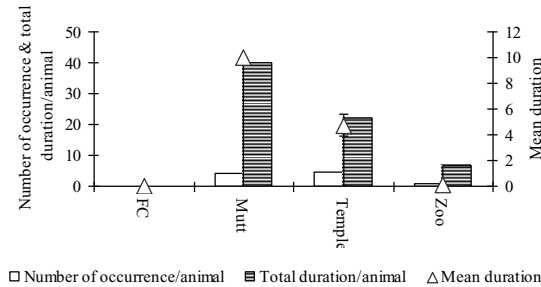


Figure 14: Blessing observed for captive elephants for different regimes

Stereotypy:

Unvarying, repeated and apparently functionless behaviours (stereotypies) have been observed in animals exposed to barren captive conditions/ social stressors/ individuals experiencing pain (Veasey, 2006). While stereotypic animals (Figure 15) maybe viewed as having adapted to a stressful situation (Veasey, 2006), such behaviours are not “reactive/ responsive” in the sense, even when such animals are shifted to captive conditions with better facilities stereotypies continue to be expressed. Most of the animals (irrespective of regime)



Figure 15: Stereotypic behavior (moving the body constantly) exhibited by elephants in Mutt

exhibited severe stereotypic behaviors (Figure 16), in terms of number of occurrence and total duration and the mean duration may also reflected the same pattern. Elephants kept in forest camps and zoos also showed stereotypic behaviors, but the past history of these particular animals revealed that they originated from temples and had been confiscated or handed over.

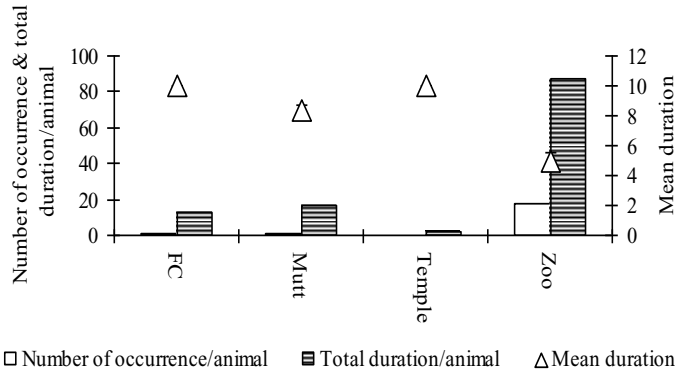


Figure 16: Bobbing observed for captive elephants from different regimes

Patterns of occurrence of positive behaviours

If one pools all the positive behaviors or natural conditions together (in terms of number of occurrence and total duration), elephants that are kept in zoos appear to be given most of the natural conditions followed by elephants from forest camps (Figure 17). Behaviors such as mud bath, play and interaction with other elephants are exhibited more in the zoo environment than in others.

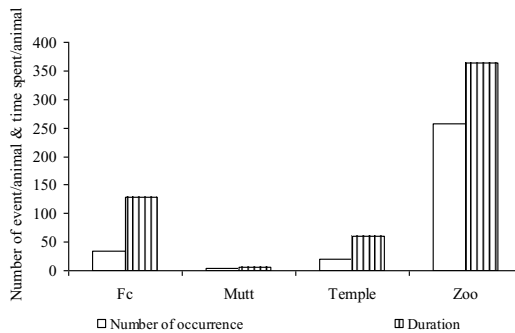


Figure 17: Total number of occurrence and duration of positive behaviours exhibited by captive elephants from different management regimes

Very interestingly, elephants exhibiting negative behaviors or unnatural traits also appear to be more in zoo elephants (Figure 18). Forest camps have shown a clear consistency in the pattern of results - their exposure to negative or unnatural behavior is the least; they stand closer to all the positive or natural conditions required for elephant keeping.

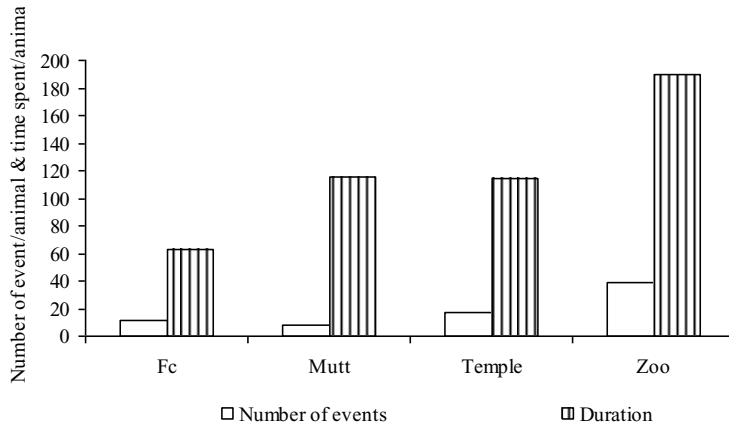


Figure 18: Total number of occurrence and duration of negative behaviours exhibited by captive elephants from different management regimes

Percentage of elephants those exhibited different behaviour in different management regime

It is possible that the percentage of elephants those exhibit given behaviour may vary management regime to another management regime and this may positively or negatively affect overall results. If results are processed for percentage of animal those exhibit given behaviour for given management regimes, the following insights may emerge. The results suggest that the percentage of elephants exhibit blessing was nil for forest camps, (Table 4) and high for mutt and temple.

Mud bathing observed for zoo was high followed by forest camp and this behaviour was nil in temple and mutt. Feeding, and walking was exhibited by all the elephants observed for forest camp and zoo, and only 83% and 33% of animal from temple and mutt respectively exhibit feeding behaviour and walking was exhibited by 50% elephants observed in temple and only 33% elephants observed in mutt exposed to walking. Sleeping during day time also property of temple and followed by mutt and zoo, and percentage animals exhibited this behaviour was very less in forest camp. The pattern for other behaviour is presented in the table 1.

The interesting insights that could be observed from the results are, forest camp elephants are exposed to more bath, this may be related to they are exposed to natural water source, blessing could be a distinct property of mutt and temple, and some elephants from zoo may also made to bless people by mahout for the extra income. Results of standing may

be contradictory as more number of elephants from forest camps show this negative behaviour, and it may be possible that the standing while feeding may not be defined by the observers properly and there could be correlation between feeding and standing. Sleeping during day time again a property of temple and mutt, and the same proportion (as mutt) zoo elephants do exhibit sleeping behaviour during day time. Play and interactions among elephants are exclusive to zoo and forest camp elephants.

Play behaviour may also related to specific age, more towards calves, and a calf in zoo indulged in more play behaviour. Elephants in zoo are always together and interaction among them appears to be stable, while in forest camp, this behaviour is fragmented as the group is split for free ranging. No interaction among temple and mutt elephants was observed and this is the reflection of isolated life temple and mutt elephant exposed to.

Table 4: Percentage of elephants those exhibited different behaviour in different management regime

	Forest camp	Mutt	Temple	Zoo
Bath	69.2	33.3	66.7	33.3
Blessing	0.0	66.7	50	33.3
Mud bath	23.1	0	0	66.7
Feeding	100	33.3	83.3	100
Standing	92.3	66.7	83.3	66.7
Sleeping (during day time)	15.4	33.3	50	33.3
Walking	100	33.3	50	100
Play	23.1	0	33.3	100
Interaction	46.2	0	0	66.7

Mahout-Elephant interactions in different management regimes

Types of interactions observed

Through this study, a total of 44 types of mahout elephant interactions (Appendix 3) have been identified or interpreted from 329 occurrences (mean 7.5, SE = 1.5, N= 44) lasting for 18 hours (mean 0.41, SE = 0.09, N= 44). Of the 44 types of interactions identified, 8 were classified as negative and 13 as positive (Table 5 & 6).

Negative interaction

Kurt and Garai (2007) state that the occurrence of scars (whitish/ discolored patches) on an elephant's body may be the result of persistent chaining/ use of ankush/ knives by handlers, among other causes.

They report higher frequency of stab wounds (ankush/ knife) among bulls than among female elephants (as bulls come into musth). Some of the prominent negative behaviours (Figure 19) were beating, chaining, forcing animal to beg or bless, prodding the animal with pole. Temples and mutt contributed more towards negative behaviours in terms of occurrence and the total duration/animal

Table 5: Negative interaction observed from different management regime

S.No	Negative interactions	Ashram				Ashram			
		FC & Temple		Zoo	All	FC & Temple		Zoo	All
		Occurrence/animal				Total duration/animal			
1	Beating	0.33	1.00	1.50	0.77	0.33	1.20	2.00	0.92
2	Chaining	0.00	0.40	2.00	0.46	0.00	0.80	3.00	0.77
3	Dragging the animal	0.33	0.00	0.00	0.15	3.33	0.00	0.00	1.54
4	Forcing animal to bless	0.00	1.00	0.00	0.38	0.00	1.00	0.00	0.38
5	Forcing animal to beg	0.00	0.60	0.00	0.23	0.00	1.40	0.00	0.54
6	Prodding with ankush	0.00	1.40	0.00	0.54	0.00	2.80	0.00	1.08
7	Prodding with pole	0.00	0.60	0.00	0.23	0.00	0.60	0.00	0.23
8	Walking with hook by head	0.00	0.20	0.00	0.08	0.00	2.00	0.00	0.77
Total		0.67	5.20	3.50	2.85	3.67	9.80	5.00	6.23

Positive interactions

The results of positive interaction (Figure 20) show interesting insights: total occurrence



Figure 19: Elephant plying with mahout; an example of positive interaction



Figure 20: pulling the elephants through its ear; an example of negative interaction

and duration/animal for forest camp was lower than temple and mutt, and only two (15%) of the positive interactions were reported for this regime. Zoo showed 77% of the positive interaction and both occurrence and total duration/animal was more in this regime.

Temple and mutt together showed 62% of the positive interactions investigated and both occurrence and total duration/animal was more then forest camp animals (Table 5). However, for the elephants, duration of time exposed to mahout is an important aspect deciding the number positive interaction reported for any regimes.

Forest camp elephants are allowed to range free and without interacting with their mahouts while they free range. This factor may play a role in deciding the number, events and total duration.

Table 6: Positive behavior observed from different management regime

Positive interaction	Ashram & Temple Zoo All				Ashram & Temple Zoo All			
	FC	Temple	Zoo	All	FC	Temple	Zoo	All
	Occurrence/animal				Total duration/animal			
1 Allowing the animal to play	0.00	0.40	1.00	0.31	0.00	0.40	1.50	0.38
2 Applying oil	0.00	0.40	3.50	0.69	0.00	4.40	7.50	2.85
3 Being friendly	0.00	0.00	0.50	0.08	0.00	0.00	1.00	0.15
4 Calf playing with mahout	0.00	0.00	2.00	0.31	0.00	0.00	4.00	0.62
5 Cleaning	0.00	2.60	0.50	1.08	0.00	5.60	2.50	2.54
6 Giving bath	0.17	0.40	0.50	0.31	1.67	2.20	5.00	2.38
7 Massaging	0.00	0.40	0.00	0.15	0.00	2.20	0.00	0.85
8 Patting	0.00	0.40	2.50	0.54	0.00	0.40	7.00	1.23
9 Playing with the animal	0.00	0.00	3.00	0.46	0.00	0.00	6.00	0.92
10 Rubbing	0.00	0.00	2.50	0.38	0.00	0.00	4.50	0.69
11 Rubs water off from eye	0.00	0.40	0.00	0.15	0.00	0.40	0.00	0.15
12 Scrubbing the animal	0.50	0.00	0.50	0.31	4.00	0.00	0.50	1.92
13 Washing the animal	0.00	0.60	0.00	0.23	0.00	1.20	0.00	0.46
Total	0.67	5.60	16.50	5.00	5.67	16.80	39.50	15.15

The results show that the mean interaction/animal with mahout for zoo was 1.09 (SE = 0.11, N=44), for forest camps it was 0.992 (SE = 0.09, N= 44), and for mutt and temples together it was 0.645 (SE = 0.044, N= 44). The results for all these categories may not differ. However, percentage of negative interaction and number of occurrence of negative occurrence/animal was more in temple and mutt followed by zoo (Figure 21).

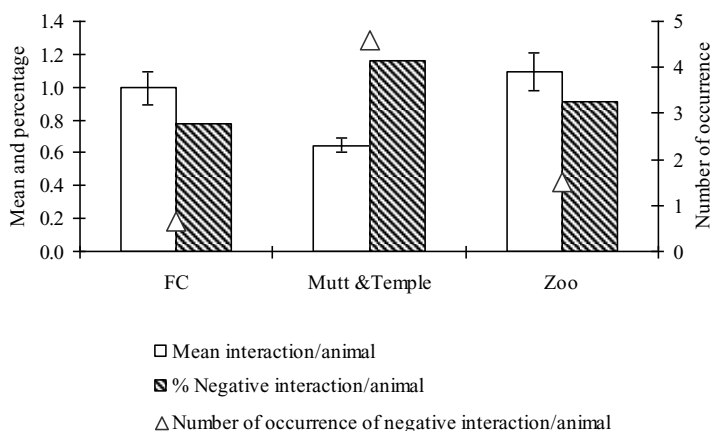


Figure 21: Mean interactions for all interactions, percentage of negative interaction/animal and number of occurrence of negative interaction/animal

Number of occurrence of negative interactions were more in temples followed by zoos and forest camp. Comparison of negative and positive interactions showed that the total number of occurrences (Figure 22) of negative interaction was more in temples followed by zoo.

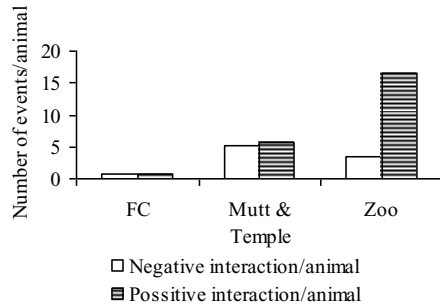


Figure 22: Number of occurrence of negative and positive interactions observed for captive elephants from different management regimes.

The duration of negative interactions (Figure 23) were more in temples followed by zoos and was the least in forest camps. Positive interactions were more in zoos followed by temples and forest camps in terms of total number of occurrences and duration.

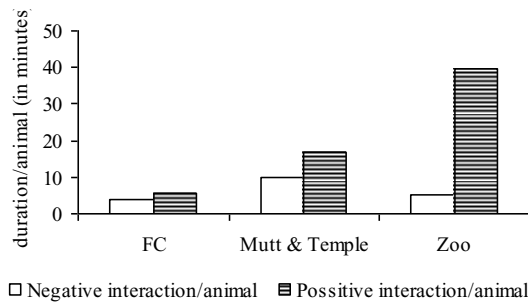


Figure 23: Duration of negative and positive interactions observed for captive elephants from different management regimes.

Comparison of mean negative and positive interactions (of occurrence) may show interesting results and there may not be any difference in positive interaction across the regimes and the result of negative interaction (occurrence and duration) also may follow the same pattern (Figure 24 and 25).

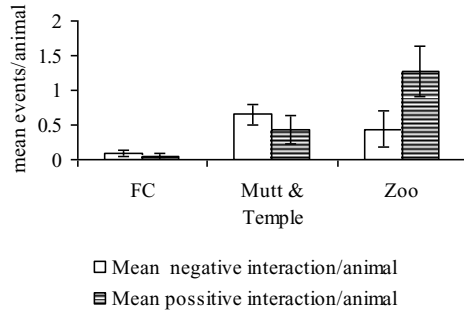


Figure 24: Mean of number of occurrence of negative and positive interactions for different management regimes.

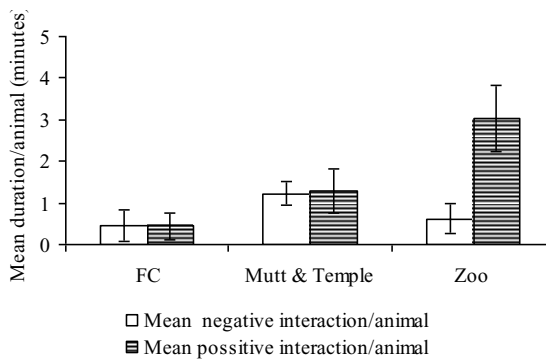


Figure 25: Mean duration of occurrence of negative and positive interactions for different management regimes.

Elephant's response to mahout interaction

The results of the elephant's response (Figure 26) to mahout's control or commands show that elephants in forest camps and temple/ashrams are very disciplined (i.e. do not show aggression or reaction) to the interaction or control of mahouts. They appear to be conditioned to fear and therefore submissive. In the zoos, elephants are not very submissive nor do they respond automatically to the mahout's approach or command.

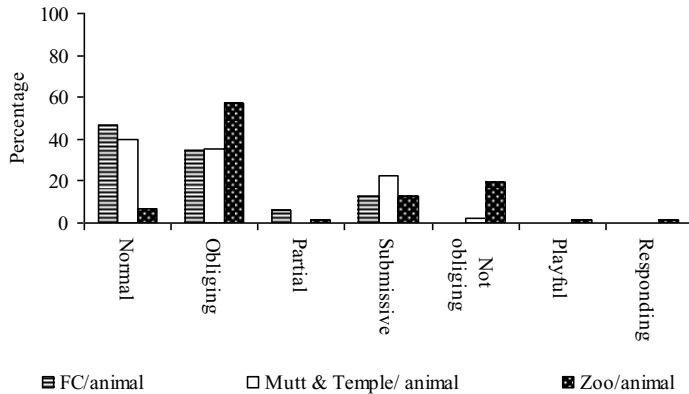


Figure 26: Elephant's response to mahout's commands observed across different management regimes

In the case of "response" as individual behavior, elephants in temples are more submissive, obedient (to the mahout's interaction or control) and conditioned. Elephants in forest camps are partially responsive to the mahout's commands. Zoo elephant's responses are more playful (Table 7) and less obedient compared to the other management regimes.

Table 7: Elephants response from different management regime

S.no	Animal response	FC/animal (%)	Ashram & Temple/ animal (%)	Zoo/animal (%)
1	Normal	38.5	48.7	12.8
2	Obliging	15.3	23.6	61.1
3	Partial	66.7	0.0	33.3
4	Submissive	16.0	44.0	40.0
5	Not obliging	0.0	6.35	93.8
6	Playful	0.0	0.0	100
7	Responding	0.0	0.0	100

Assessment through passport

Validation of findings of time activity budget and mahout-elephants interaction can be obtained through the assessment of welfare parameters. The results of this exercise confirm the findings of elephant time activity budget and mahout-elephant interaction.

Status of space and other welfare aspects

In terms of space, flooring, quality of water availability, elephant's exposure to other elephants for interaction, type of work given and food provided to elephants, forest camps stand to be the better-managed elephant keeping system (Figure 27), followed by zoo, temples score very poorly.

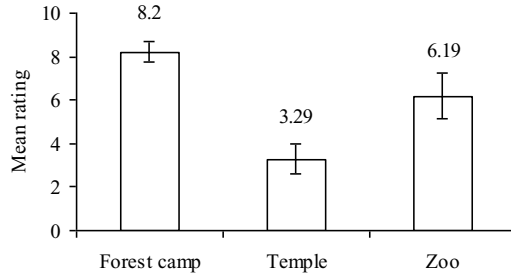


Figure 27: Results of the assessment of welfare parameters of space, floor, quality water provided and other aspects under category 1 for different management regimes

If each parameter was rated based on its merit, rating of 10 being the highest and 0 being the lowest, or under bad (0 to 2.4) poor (2.5 to 4.9), moderate (5.0 to 7.4) and satisfactory (7.5 to 10) categories (Varma et al 2008), forest camps qualify to be in satisfactory condition, zoo falls under moderate condition and temples under poor welfare status for the category 1. The level of variations around the mean (%CV) for forest camp was only 6%, but for temple it was 21% and for zoo it was 17%.

Status of reproduction and veterinary care

With reference to the status of reproduction and the veterinary care provided to them, both zoo and forest camps stand to be the best management regimes as there may not be any difference in the results for forest camps and zoo. In this case also, temples appeared to be poorly managed (Figure 28). The level of fluctuation around the mean for zoo was very low (3%) for forest camp 7% and for temple it was 31.2%.

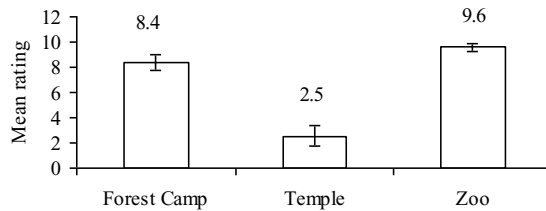


Figure 28: Results of the assessment of welfare parameters of reproduction and veterinary care provided under category 2 for different management regimes

Status of elephant keepers

The results of the status of elephant keepers, their experience, social status, health care, insurance and other factors give 70% credit to the forest camps (Figure 29) for their keeper management in comparison to mahouts from other regimes. However, there may not be any difference in the management of all the regimes. All the three regimes come under only moderate welfare status in this category, and level of variation around the mean welfare value was low (less than 15%) for all the regimes.

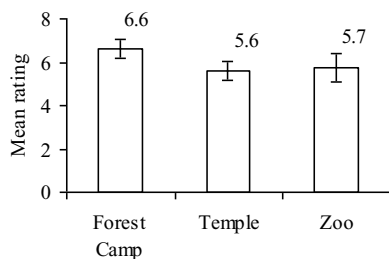


Figure 29: Results of the assessment of welfare parameters of mahout and cawadi social status under category 3 for different management regimes

Discussions

The current study aimed at identifying a robust model of captive elephant management in Karnataka state. Based on the results from activity budget and elephant-mahout interaction it appears that captive elephants in forest camp have advantage over mutt (also referred to ashram), temple and zoo elephants, in terms of number of occurrence, total and mean duration spent on different activities. This is due to the fact that they are privileged to spend more time bathing, indulging in dust baths, playing, rubbing their bodies and trumpeting. After forest camps, elephants from zoos also exhibited many of the positive behaviors and seem to stand first in interaction with other elephants from their natal herd. This group interaction naturally adds an enriched dimension to their captive lives.

The negative behaviors, constantly blessing people or devotees, stereotypic behaviors, standing for long periods of time and sleeping during the daytime appeared to be major behavior patterns exhibited by elephants kept in temples and ashrams. If data is pooled for all the positive behaviors, elephants that are kept in zoos appear to be given most of the natural conditions followed by elephants from forest camps. Elephants exhibiting negative behaviors or unnatural traits also appear to be more in zoo elephants.

Forest camps have shown a clear consistency in the pattern of results - their exposure to negative or unnatural behavior is the least; they stand closer to all the positive or natural conditions required for elephant keeping. The results of mahout-elephant interaction suggest that mahouts spend more time interacting with elephants in zoos and forest camps. Negative interactions were more in temples followed by zoos and forest camp. Positive interactions were more in zoos followed by temples and forest camps in terms of total number of occurrences and duration.

Elephants in temples are more submissive, obedient (to the mahout's interaction or control) and conditioned. Elephants in forest camps are partially responsive to the mahout's commands. Zoo elephant's responses are more playful and less obedient compared to the other management regimes. In terms of space, flooring, quality of water availability, elephant's exposure to other elephants for interaction, type of work given and food provided, forest camps stand to be the better-managed elephant keeping system. With reference to the status of reproduction and the veterinary care provided, both zoo

and forest camps stand to be better managed regimes. In this case also, temples appeared to be poorly managed. The results of the status of elephant keepers, their experience, social status, health care, insurance and other factors give 70% credit to the forest camps for their keeper management in comparison to mahouts from other regimes.

The survey reveals that management of most of the captive elephants in the private sector (i.e, temple and ashrams or mutts) is not acceptable. In most cases, the animals are over fed or under fed and chained under concrete roof with concrete/stone floor during day and night time. A diet chart is not provided; the authorities conform to their own norms and feed the animal with all possible foods. The animals also lack essential physical activity: walking, exercise, ability to move in unrestrained manner, etc. Some of the elephants do not even have the chains changed or removed for long duration of (20 to 22 hrs/day) time, resulting in bruises. Proper well-trained veterinary doctors are not available sufficiently or even for routine check-ups. This negligence results in serious health problems.

Conclusion

The results presented through this study have been helpful in corroborating, in an objective and non-biased manner, that elephant keeping models differ widely in their allocation of space and other resources to the animals. It has also proved, beyond reasonable doubt, that temples are the worst offenders in terms of welfare and other specified conditions of keeping (according to Sec.42 of the Wildlife Production Act) namely, housing, upkeep and maintenance. The most acceptable models of captivity, according to this study, would be Forest Camps and Zoos or an optimum combination of the two.

Management of most captive elephants in the Government sector i.e. belonging to the Forest Department appear to be relatively better as they have free ranging opportunities to a feed on variety of food, interact with other elephants, along with very good running water facilities (Krishnamurthy, & Wemmer 1995). In the camps, elephants are fed based on the diet chart provided by the departmental veterinary doctors. However, Forest department camps need to improve their scope for the manifestation of positive behavior and interactions, which are surprisingly lacking among the camp elephants. Zoos, particularly in Karnataka State can be rated equal to the forest camps in many aspects—in other words for poor conditions also. It may be necessary to mention here that the elephants observed in the two State-run zoos are some of the best managed and kept, compared to the other Indian zoos. This is primarily because in both the zoos, the elephants live in stable family herds, have plenty of interactions and in one set-up, at Bannerghatta Biological park elephants are allowed daily access into the forest for foraging and browsing at night. When results and records emerge from zoos in other states of India, this may change in terms of the average elephant keeping standards in Indian zoos.

Based on this experience, good elephant keeping is defined as a system with dense or sparse forest cover, perennial running water sources, and the animal being exposed to timely and adequate food (without overfeeding or underfeeding). The animal also requires adequate space for movement, exercise and exposure to other elephants of

different sex and age class for free and unconditioned interaction. Increasing the elephant mahout ratio (current 1:1) for minimizing the pressure on both elephant and keeper leads to improved resource availability for both. It may be noted here, that elephants in both zoos and forest camps were never without chains, be they long drag chains for night browsing or shorter chains when on public display or waiting. This may be the single most important factor that may need to be addressed in the future elephant keeping centers – be they zoos, forest camps or rescue centers.

It is concluded that the Forest Department Elephant Camps (FDEC) and the Zoological Gardens (Zoo) with the above mentioned conditions provided and some modifications can play a major role in achieving the goal of satisfactory elephant keeping. FDEC can act as Elephant Care Centers, while both FDEC and innovative Zoos can be considered as a source of knowledge on the species and resource generation.

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Appendix 1: elephants observed for various studies

S.No	Regime	Elephant name	Sex	Age	Study			
1	Forest camp	Bhanumathi	Female		TAB	MEI	ER	Passport
2		Chaithra	Female		TAB	MEI		Passport
3		Durga						
3		Parameshwari	Female	46	TAB	MEI	ER	Passport
4		Ganesh	Male	6	TAB	MEI	ER	Passport
5		Gopi	Male	30	TAB	MEI		Passport
6		Harsha	Male	35	TAB			Passport
7		Indra	Male	28	TAB			Passport
8		Jayaprakash	Male		TAB	MEI		Passport
9		Maithili	Female	40	TAB			Passport
10		Netra	Female	6.9	TAB			Passport
11		Prashanth	Male	45	TAB			Passport
12		Thirtarama	Male	14	TAB			Passport
13	Ganga	Female	50	TAB				
1	Mutt	Gauri	Female		TAB	MEI	ER	Passport
2		Gauri	Female	30	TAB			
3		Laxmish	Female	20		MEI		
4		Srilakshmi	Female	11	TAB	MEI	ER	Passport
5			Male		TAB			
1	Temple	Bharathi-arundathi	Female	10				Passport
2		Gajalakshmi-Menaka	Female	19	TAB			Passport
3		Ganga	Female	50	TAB			Passport
4		Indira	Female	40	TAB			Passport
5		Indumati	Female	51				Passport
6		Kalpana	Female			MEI		
7		Kalpana - Gowri	Female	38	TAB			Passport
8		Lakshmi	Female	30				Passport
9		Lakshmi	Female	20				Passport
10		Lakshmisha	Male					Passport
11		Lata	Female		TAB			
12		Laxmi	Female	35				Passport
13		Laxmi	Female	9	TAB			Passport
14		Manjunath	Male			MEI		
15		Neela	Female	27				Passport

		Padma-Rajni						
16		Bhai	Female	11				Passport
17		Raja	Male	11				Passport
								Passport
18		Usharani	Female	35				
		Abimanyu -						
1	Zoo	Ganesh	Male	1				Passport
2		Airavathi	Female	2				Passport
3		Aishwarya	Female	2				Passport
4		Kollegala	Female	32				Passport
5		Gajalaxmi	Female	26				Passport
6		Padmavathi	Female	51	TAB	MEI	ER	Passport
7		Rama	Male	12				Passport
8		Suvarna	Female	28	TAB			Passport
9		Manikandan	Male	17	TAB	MEI	ER	

TAB: Time activity budget, MEI= Mahout Elephant Interaction, ER Elephant's Response

Appendix 2: Ethogram

S.No	Behaviour	Definition
1	Bath	(SOA*) Mahout/cawadi splashes water on elephant while scrubbing it; (EOA*) mahout stops scrubbing, elephant gets up/ moves away of water source
2	Begging	Elephant with handler, (SOA) raises trunk at approaching human, extends trunk towards human, passes money to handler, passes food into its mouth (SOA) Elephant with handler, (SOA) raises trunk on command from handler, irrespective of approach of people, to attract potential donors; drops trunk to normal position (EOA)
3	Blessing	Elephant with handler, (SOA) raises trunk on command from handler, touches head of stranger; (EOA) drops trunk to normal position
4	Bobbing	Repeated (SOA) up/ down/ sideways movement of head (stereotypy); (EOA) cessation of movements
5	Drinking	(SOA)Elephant takes water through trunk, passes water into its mouth; (EOA) not performing above movements/ performing other activity
6	Dust Bath	(SOA) Elephant takes mud/ loose earth in its trunk, sprays it on its body; (EOA) not performing above movements/ performing other activity
7	Feeding	(SOA) Elephant lies down on sides, rubs itself with wet mud (wallow); (EOA) not performing above movements/ performing other activity
8	Ear-flapping	(SOA) Elephant uses trunk to pick up food, puts food in mouth and moves in relation to feeding; (EOA) not performing above movements/ performing other activity
9	Interaction	(SOA) To and fro movement of ears; (EOA) cessation of movement (SOA) Extends trunk towards conspecific Ear spread out, tail raised, trunk raised, moves towards conspecifics Moves away from conspecific Rubbing each other Feeling with trunk Looking at the other animal/s (EOA) not performing above movements/ performing other activity
10	Moving (it is a short duration activity)	(SOA) Animal moves exclusively, without interacting/ feeding/ being made to walk; (EOA) not performing above movements/ performing other activity
11	Play	Behaviors performed, by growing individuals, without any visible purpose involved, either with other individuals/ other objects/ on its own For example: (SOA) rubbing against mother, running on its own, sparring with another; (EOA) not performing above movements/ performing other activity
12	Rest	Different from sleep, (SOA) standing/ sitting, not involving any activity, not dozing, not closing its eyes, only ear-flapping/ tail flicking continues; (EOA) performing other activity

13	Rubbing	Scratching body against object/ other animal, excluding those associated with “Play” behaviour. Example: (SOA) Elephant rubbing against tree; (EOA) cessation of this activity
14	Scratching	(SOA) Elephant holds an external object, stick/ branch, in its trunk and scratches its body; (EOA) cessation of this activity
15	Sleep	(SOA) Elephant closing its eyes, standing/ sitting/ lying down, no ear-flapping/ tail flicking, no activity; (EOA) performance of other activity
16	Sparring	(SOA) Two elephants, pushing each other, ears right angle to head, tail raised Two elephants moving towards each other, ears right angle to head, tail raised, trunk raised (EOA) cessation of above movements/ performing other activity
17	Standing	(SOA) Elephant standing on its feet, not moving, (may flick tail/ flap ears, trunk moving/ still); (EOA) performing other activity
18	Trumpeting	(SOA) Elephants with raised trunk, makes vocal calls; (EOA) Trunk drops down, stops calling.
19	Walk	On command from mahout, (SOA) elephants moves; (EOA) stops moving On command from mahout, (SOA) Lifting logs/ cut fodder in trunk, carrying it, raising a leg (to allow mahout/ others to climb), (on command from mahout) raising trunk and ringing bells, raising trunk and splashing water on temple idol; (EOA) cessation of these activities/ performance of
20	Work	other activities

SOA*: Starting of activit, EOA*: Ending of activity

Appendix 3: Type of interactions observed from different management regime

S.no	Name of the interaction	Number of events/animal				Duration of the event/animal			
		FC	Mutt & Temple	Zoo	All	FC	Mutt & Temple	Zoo	All
1	Adjusting chain	0.33	0.40	0.00	0.31	0.67	0.60	0.00	0.54
2	Allowing the animal to play	0.00	0.40	1.00	0.31	0.00	0.40	1.50	0.38
3	Applying oil	0.00	0.40	3.50	0.69	0.00	4.40	7.50	2.85
4	Beating	0.33	1.00	1.50	0.77	0.33	1.20	2.00	0.92
5	Being friendly	0.00	0.00	0.50	0.08	0.00	0.00	1.00	0.15
6	Bringing grass	0.00	0.00	0.50	0.08	0.00	0.00	0.50	0.08
7	Bringing water	0.00	0.20	0.00	0.08	0.00	0.20	0.00	0.08
8	Calf playing with mahout	0.00	0.00	2.00	0.31	0.00	0.00	4.00	0.62
9	Chaining	0.00	0.40	2.00	0.46	0.00	0.80	3.00	0.77
10	Chasing the calf away	0.00	0.00	7.00	1.08	0.00	0.00	8.00	1.23
11	Cleaning	0.00	2.60	0.50	1.08	0.00	5.60	2.50	2.54
12	Commanding	1.33	1.20	10.50	2.69	6.17	3.20	24.00	7.77
13	Dragging the animal	0.33	0.00	0.00	0.15	3.33	0.00	0.00	1.54
14	Feeding	1.33	2.80	4.50	2.38	12.17	3.20	18.00	9.62
15	Giving bath	0.17	0.40	0.50	0.31	1.67	2.20	5.00	2.38
16	Giving medicine	0.00	0.00	0.50	0.08	0.00	0.00	2.00	0.31
17	Giving water	0.00	1.00	0.00	0.38	0.00	2.00	0.00	0.77
18	Interaction with other mahout	0.17	1.60	0.00	0.69	1.17	7.00	0.00	3.23
19	Keeping hook next to the animal	0.00	0.20	0.00	0.08	0.00	0.20	0.00	0.08
20	Making animal blessing	0.00	1.00	0.00	0.38	0.00	1.00	0.00	0.38
21	Making animal ready for work	0.17	0.40	0.00	0.23	1.67	0.80	0.00	1.08
22	Making animal to beg	0.00	0.60	0.00	0.23	0.00	1.40	0.00	0.54
23	Massaging	0.00	0.40	0.00	0.15	0.00	2.20	0.00	0.85
24	No interaction with the animal	0.00	4.20	0.00	1.62	0.00	21.20	0.00	8.15
25	Others	0.33	8.00	3.50	3.77	3.33	28.80	9.00	14.00
26	Patting	0.00	0.40	2.50	0.54	0.00	0.40	7.00	1.23
27	Playing with the animal	0.00	0.00	3.00	0.46	0.00	0.00	6.00	0.92
28	Posing for photo	0.00	0.20	0.00	0.08	0.00	0.00	0.50	0.08
29	Pouring water	0.00	0.40	0.00	0.15	0.00	0.60	0.00	0.23
30	Preparing food	0.17	0.00	0.00	0.08	1.17	0.00	0.00	0.54
31	Prod with ankus	0.00	1.40	0.00	0.54	0.00	2.80	0.00	1.08
32	Prod with pole	0.00	0.60	0.00	0.23	0.00	0.60	0.00	0.23
33	Removing the chain	0.17	1.20	1.00	0.69	0.83	2.00	1.50	1.38

34	Rubbing	0.00	0.00	2.50	0.38	0.00	0.00	4.50	0.69
	Rubs water off from								
35	eye	0.00	0.40	0.00	0.15	0.00	0.40	0.00	0.15
36	Scrubbing the animal	0.50	0.00	0.50	0.31	4.00	0.00	0.50	1.92
	Standing close to the								
37	animal	0.83	3.00	0.00	1.54	2.00	15.60	0.00	6.92
	Taking offering from								
38	people	0.00	0.20	0.00	0.08	0.00	0.20	0.00	0.08
	Taking photos with the								
39	visitors	0.17	0.00	0.00	0.08	1.67	0.00	0.00	0.77
40	Walking	1.33	0.00	0.50	0.69	7.83	0.00	1.00	3.77
	Walking towards to the								
41	animal	0.17	0.00	1.50	0.31	0.17	0.00	2.00	0.38
42	Walking with animal	0.00	0.80	0.00	0.31	0.00	2.60	0.00	1.00
	Walking with hook by								
43	head	0.00	0.20	0.00	0.08	0.00	2.00	0.00	0.77
44	Washing the animal	0.00	0.60	0.00	0.23	0.00	1.20	0.00	0.46
		7.83	36.60	49.50	25.31	48.17	114.80	111.00	83.46

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 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.

Wildlife Rescue & Rehabilitation Centre (WRRC) is a registered public charitable trust for the welfare of wild animals and birds that often find themselves trapped in an urban environment. The Trust is a sister in concern of CUPA and both organisations compliment each other in their services. WRRC was established as a separate Trust in 1999.

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 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 fora.

Asima Pratishthana, is a non-governmental organization, established in 2004. The main activities of the organization are: wildlife awareness programmes, inventory of the biodiversity, nature education, conducting bird watching and nature trails, survey and monitoring of lakes and other threatened ecosystems and policy advocacy. It has published a book – Pakshi Prapancha (Birds of Karnataka in Kannada) and has received the best book of the year, 2006 award from Kannada Pusthaka Pradhikara, Govt. of Karnataka, Kannada Sahitya Academy Award for the year 2006 towards best book in science literature. The organization has also collaborated actively in several conservation related projects with Karnataka Forest Department, Karnataka Biodiversity Board, Centre for Ecological Science (CES), Indian Institute of Science, Bangalore, Eco-watch, KRVP, Agasthya International Foundation and undertaken many conservation and awareness oriented projects.

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.

Photo credits: Front cover, Fig. 4a, 9b and 19: Rajendra Hasbhavi; Fig 1b, 13: Harish Bhat; Fig 15: Shama Karkal; Fig. 1a, 4b, 6, 9a, 20 and back cover: Surendra Varma.

The budgeting of different activities of elephants kept in captivity provides an opportunity to compare the behaviours exhibited by wild and captive elephants. The results based on this approach may also offer a scope for understanding the welfare status of elephants kept in captivity.

This analysis tries to associate the connection between elephant activity budget and its reflection on the welfare status of elephants in captivity. In addition, the understanding of the interaction between elephant and its mahout may also offer some detailed insights on elephant welfare status.

The data collection was carried out with the support of school/college teachers/ students, and personals from NGO from 9 districts of Karnataka. The team of researchers - from the combination of students, teachers and others - were very enthusiastic towards such a programme and felt that this was the first time that they could see an elephant so close, feel it, and also understand various issues relating to the animal, right from its anatomy to behaviour. This process provided two distinct benefits, the welfare status of elephants observed was known, and helped the observers to know more about animals and also aided teaching biology more effectively in schools and colleges.



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