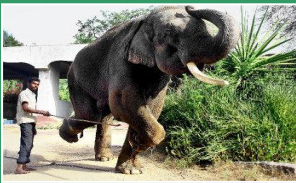# Captive Elephants in Zoos

An Investigation into the Welfare and Management of Captive Elephants in Zoos of India

Surendra Varma, S.R. Sujata, Kushal Konwar Sarma, Nilesh Bhanage, Mahesh Agarwal and Snehal Bhavsar

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Preface

The captive environment provided to elephants determines the state of well-being of the animals. The zoos in India are home to many diverse species of animals including elephants. We sampled 49 elephants from 11 zoos covering seven States in India.

The investigation and resultant document are the first detailed report dealing with population status, management and welfare of elephants in captivity in zoos sampled across India. The welfare of elephants kept in these zoos has been assessed through a number of parameters which have been rated on a scale identified by a team of experts. These parameters include features encountered on the ground in addition to those identified by the experts. Mean rating for each parameter was arrived at based on the ground survey and the same has been compared with the expert's rating to indicate the extent of deviation. This deviation represents the extent of difference between what the experts consider to be the norm and what actually exists in the zoos of India.

The report has eight sections and the section 1 deals with overall population status, management and welfare of captive elephants from 11 zoos sampled from seven States of India. This section along with the executive summary also provides recommendations for each State. Sections 2 to 8 provide details of each individual zoo; these sections may appear to be redundant while details and welfare status of elephants kept in zoos are presented in section 1 itself. However, these sections aim to provide insights on exclusive welfare status of each zoo that is surveyed.

Section 3 is aimed at providing insights on the status of captive elephants kept in a zoo in Gujarat, but, the management regimes of the forest department and the zoo are combined under one category as they come under one management unit of the state government. Section 4 is divided into two sub-sections, the sub-divisions provide the patterns of difference in managing elephants within the specific sections; for example, Bannerghatta Biological Park and Mysore Zoo could be brought under one unit of zoos of Karnataka; however, the management in terms of space provided to elephants in these two zoos is different.

The data was processed by two approaches; the rating scale developed by the experts based on their concept of the importance of a particular parameter to an elephant, was used in section one and in some sections the welfare features or parameters have been rated on a zero to ten scale with zero representing the worst possible situation and ten implying a satisfactory state, closer to what an animal experiences in the wild. This can be further divided into the 0 to 2.4 reflecting, bad welfare conditions, 2.5 to 4.9 for poor, 5.0 to 7.4 as moderate and the values 7.5 to 10 satisfactory conditions.

Each chapter has a detailed report on the population status, management and welfare conditions in addition to its executive summary. The detailed report is presented in the following sequence: introduction, objective, methodology, results, discussion and references. Depending on the needs and interests of the readers, either the executive summary or the detailed report can be referred to.

Keeping elephants in captivity will always be difficult as it would not match its natural environment. Many zoos have difficulties in meeting their financial needs. Funding limits compromise the ability of zoos to keep up and to maintain the highest animal care and safety standards, which often evolve and become more demanding as we learn more about the animal species and their needs. Hence, keeping elephants in captivity should be phased out or all such elephants should be moved to locations with suitable natural environments.

Another way of attaining good welfare would be to provide them natural conditions in the wild. This could be done by sheltering the existing population in suitable wild, forest areas. It is important to note that elephant's ecological and behavioural needs cannot be met in captivity. Zoos in India are government owned and if they come forward to move elephants in their custody to the natural environment, then it would give a message that the government is keen on keeping elephants out of captivity and this would motivate other elephant facilities to follow the foot-steps of the government.

Acknowledgements

Section 1:
Captive Elephants in Zoos

Executive Summary

Elephants cannot be considered to be domesticated even in captivity. Their ecological and biological needs are shaped by conditions experienced by their wild counterparts. Asian elephants form a part of the diverse animals housed and maintained within zoos, spread across different states of the country.

This investigation aims to examine captive conditions of elephants across zoos in India through assessing the existing physical, social, psychological, physiological and health conditions of them and the professional experience and socio-economic status of handlers as they form an integral part of a captive elephant situation.

Rating for different parameters of importance to the welfare of captive elephants suggested by experts was used. A mean rating for each parameter, across all the participating experts, has been used as the Experts' Rating (E-R) which represents the importance attached to a parameter. This was compared with the Mean Rating (M-R) which was arrived from the ground data of the status of given welfare parameter.

A total of 49 elephants were maintained across 11 zoos in seven states of India. Among these elephants there were 32 females and 17 males. Only one of the observed zoos maintained two African elephants and the remaining zoos housed Asian elephants.

All of Andhra's zoo elephants had been received as an exchange or purchase, Assam's zoo elephants were all rescued from the wild, Gujarat's zoo elephants were either rescued or purchased, 50% of elephants for Karnataka's zoos were either rescues or captures from the wild, while the elephant from Kerala's zoo was captured from the wild and all of Mahrashtra's zoo elephants were either received as exchange between zoos or as a gift from other institutions (circus).

Elephants in Andhra's zoo had a mix of semi-natural day enclosure and a man-made concrete night enclosure. All elephants of Assam and Gujarat's zoo had a semi-natural enclosure with earthen flooring, while Karnataka's zoo elephants had a combination of semi-natural night/day enclosure and man-made structures with concrete/ stone flooring, Kerala's zoo had a combination of a semi-natural day enclosure with earthen flooring and a concrete night enclosure. Maharashtra's zoo had a combination of natural/concrete enclosures or only concrete enclosures and the day enclosure was a semi-natural forested area. The night enclosure was semi-open with cement floor for Tamil Nadu's zoo elephants.

All elephants had access to tap water in the Andhra zoo, where water was consumed three times each day and elephants were bathed in an open enclosure. Tap and pond water was the source for Assam's elephants, river or pond was the water source for Gujarat's elephants, tap and pond water was the source for Karnataka, Kerala and Tamil Nadu zoo elephants and tap water, water from tankers and ponds were available for Maharashtra zoo elephants. Comparably low rating was observed for all zoos except Gujarat, although it showed variability in existing conditions for this parameter.

Andhra zoo elephants were walked on tar roads, Assam elephants were walked in the morning and evening in the zoo premises, Gujarat zoo elephants were walked for a restricted duration in the nearby forest. Karnataka zoo elephants were allowed to range-free in their day enclosure or left to forage in the nearby forest at night, Kerala zoo elephant was walked once a week on tar roads, Maharashtra zoo elephants were walked in the day, while Tamil Nadu zoo elephants were allowed to free range in the adjacent forest during the day. Higher deviations from E-R were noticed for Assam and Kerala zoos.

There were two males, five females in Andhra zoo, with interaction restricted to the day time, Assam zoo elephants consisted of primarily young individuals and interaction duration was 2 to 2.5 h. Gujarat elephants consisted of two individuals and duration of interaction among them was 24 h. Karnataka zoo elephants were allowed to interact either in the day or at night, Maharashtra zoo elephants were allowed varying durations of interaction (8-12 h), group size was 1-2 individuals, and Tamil Nadu elephants were allowed to interact during the day and chained at night. Deviation from E-R was minimum for this parameter of interaction for Tamil Nadu zoo.

All Andhra zoo elephants were chained by a foreleg and a hind leg for at least 15 h each day, Assam elephants were chained when not being walked or left to free range in the enclosure. All Gujarat zoo elephants were chained at night. Most of Karnataka's zoo elephants were chained, except for the calves. Free ranging was allowed in the enclosure during the day or in the forest at night. Drag chain was used

while free-ranging in forest; hobbles were used at times to control the elephants. The Kerala elephant was chained for nearly 20 h per day, either by its leg or by a hobble. All elephants were chained, wherein a spiked chain was used for four of the seven Maharashtra zoo elephants, duration of chaining ranged from 9 -20 h a day and Tamil Nadu zoo elephants were chained at night in the enclosure. Low rating was observed for all zoos for the parameter of chaining and the maximum dispersion was seen for Assam elephants followed by that of Kerala.

Andhra zoo elephants were used to provide tourist rides or otherwise left in the enclosure for display to the public and to seek donations. Provision of rides for tourists and carrying food was the work for three of the Assam zoo elephants, while there was no work for the other elephants. Not much work was given for the Gujarat zoo elephants except for three elephants who were used for providing rides for tourists. Elephants were not used for work in Karnataka's zoo. No work was given for the Kerala zoo elephant. Most of Maharashtra's zoo elephants were not made to work, except for two elephants who were used for trips around the zoo. Two elephants were used for providing rides for tourists in the Tamil Nadu zoo. Greater deviation from Expert-Rating (E-R) was seen for Andhra Pradesh and Assam zoo.

All elephants in all the zoos observed were given stall feed. Andhra zoo elephants were allowed to browse/ graze in their morning enclosure. Occasional grazing/ browsing opportunity was given for Assam zoo elephants, two elephants were allowed limited opportunity to free range in Gujarat zoo and in Karnataka zoos, opportunity to forage was provided for five elephants in the nearby forest at night. All Tamil Nadu zoo elephants were allowed to forage and given stall feed. Relatively more variation was seen for Karnataka, Kerala and Maharashtra zoos and these zoos also showed greater deviation from E-R.

Andhra zoo elephants were observed to be reproductively active although there were no reports of calves being born. There were no reports of calf birth in Gujarat's zoo. Adult females of Karnataka zoo were reproductively active and calf-births were reported. Most elephants were females in Maharashtra's zoo, wherein one female had given birth. Two of the adult Tamil Nadu zoo elephants had mated, but no calves were born. Minimum variation was observed for Karnataka zoo elephants, showing lesser deviation from E-R and greater variation for Maharashtra zoo elephants shows absence of uniformity in the parameters observed.

Foot rot, fissures, respiratory problems were seen in Andhra zoo elephants, abscesses and fracture were observed among Assam elephants and foot problem and other wounds were noticed for Gujarat elephants. Maharashtra zoo elephants were reported to have stomach and foot related problems. All the zoos showed variation in the observed parameters implying differences within zoos from the prescribed norms.

Minimum to no variation was observed for Andhra Pradesh and Karnataka zoos for veterinary care, relatively low rating was observed for Gujarat zoos and low and comparable deviations were observed for all zoos except Gujarat.

Mean years of experience of handling elephants by handlers was 23 yrs in Andhra zoo, mean experience for handlers in Gujarat zoo varied between 10 to 15 yrs and Karnataka zoo handlers had a mean experience of 13 yrs in the profession. For Maharashtra zoo handlers, experience ranged from 3 to 35 yrs. Mean experience in the profession for Tamil Nadu handlers was 8 yrs. Relatively lower deviation from E-R was seen for Tamil Nadu handlers.

Mean rating and deviation from E-R for socio-economic condition of the handlers was comparable across different zoos for the handlers that exhibited the existence of similar conditions for the parameters observed.

Considering all the elephants in the zoos observed as a single unit, the overall M-R across all observed parameters was 4.7 implying a deviation of 41% from the average E-R. Least deviation (25% or less) was observed for Karnataka followed by Tamil Nadu zoos.

Recommendations

If elephants are kept in zoos, it is essential that they are provided with natural living conditions in order to attain and maintain good welfare conditions. The need for Captive elephants in zoos pose a question as to what should be done with them— should they be kept in captivity with limited resources of space and funding or should they be left free to adapt to a free-living wild state?

One way of attaining good welfare would be to provide them natural conditions as in the wild. This could be done by moving the existing population to suitable forested areas. But if zoo elephants are to be shifted to camps with access to forests, the following factors must be kept in mind

1. Zoo elephants are primarily stall fed, with most elephants also being habituated to unnatural foods. Such animals lose the experience of browsing/ grazing/ chewing of food as they are unexposed to such feed as uncut fodder/ branches/ tree bark. In this context, learning to graze/ browse is integral to their survival, as they cannot survive only on forest based foods. In contrast, Forest Camp elephants are allowed to graze/ browse in surrounding forests with stall feed being a supplement to the predominantly free-ranging feeding of such animals. Lack of nutrition may be the consequence of the inability to adapt to grazing/ browsing especially among Zoo elephants. The resultant health problems, will burden the parks further.

2. Introduction of new elephants into an already established social order among Forest Camp elephants may cause problems for the new member/s. The new animals have to be accepted by the camp elephants/ other wild elephants. There are instances of such elephants being attacked severely by wild/ forest camp elephants. Injuries from such attacks may take a long time to heal or could even be fatal   It could also cause severe psychological damage to the animal.

3. Among zoo elephants, wherever there are family (related/ otherwise) herds, they need to be moved together and not separated from each other. Zoos (like Bannerghatta Biological Park) which have a national park backdrop and the elephants spend close to 18 hours inside the forest, feeding and foraging, then these could be re-considered as an exception and be allowed to continue in the same location with gradually lesser human control.

4. Relocating zoo elephants to forest camp or semi-natural condition could have its own effects. The damage to the forest from cut fodder collection, loss of plant diversity, loss of food species for other animals, wastage of fodder when the relocated elephants are not able to eat it, are some of the effects.

5. Introduction of elephants to new areas exposes them to new mahouts resulting in a new set of daily schedules which needs to be learnt with the handler. This could be a source of stress to the elephants. The mahouts of zoo elephants need to be retained by the Parks/protected forests till the animals adjust to the new environment and even thereafter if possible.

6. With all these issues, forest camps also may not be alternative relocation sites for zoo elephants; however, these issues should not be an excuse not to expose them to natural environment and providing opportunity to exhibit their natural behaviours. Alternatively, specifically designed care centers need to be considered; these forested but free from wild elephants, we assume can be identified and created

7. In addition to care centres, rescue centres should come up soon for the care and management of some zoo elephants. An existing case would be Menaka, a 19 yr old female Asian elephant currently within the Bannerghatta Biological Park, supported by Wildlife Rescue and Rehabilitation centre, Bangalore. Her health issues involve the need for quarantine, which can be provided in her present location.

8. Medical check-up of the zoo elephants that are planned to be shifted to a more natural environment should be mandatory.

9. African elephants in Indian zoos are few in number (3-4). These should be kept together in some forested locations or, maybe, even sent back to a rescue centre in Africa, contingent upon age and health.

Introduction

Elephants cannot be considered to be domesticated (Lair, 1997). Even in captivity their ecological and biological needs are shaped by conditions experienced by their wild counterparts. Bradshaw (2009) mentions studies which incorporate the difference in living conditions (physical/ biological) in captivity to those observed in the wild as a way of assessing the well-being of captive elephants. Indian zoos, like their western counterparts, were initially established as a place to display various animals, have now begun working towards conservation and creating public awareness on wildlife issues. Asian elephants form a part of the diverse animals housed and maintained within zoos, spread across different states of the country. The captive conditions provided to elephants among these institutions vary, depending on a number of inter-related factors, least of all being the need to provide a species based environment for elephants.

Objective

This report aims to examine captive conditions across zoos to:

- assess the welfare status of captive elephants by assessing the existing physical, social, psychological, physiological and health conditions
- assess the professional experience and socio-economic status of handlers as they form an integral part of the captive elephant situation

Method

Data was collected through observations of elephants (Figure 1a and b)/and interviews with relevant personnel. The welfare of captive elephants kept in Indian zoos was assessed by comparing a range of features─ physical space, social opportunity, expression of species-typical behaviours, reproductive functioning— with those observed for wild elephants. Deviations from wild conditions have been subjected to a rating process developed by a team of experts. The underlying principal for the rating is that the greater the deviation from the wild, the poorer is the welfare.

Figure 1a: Data collection through body measurements of elephant
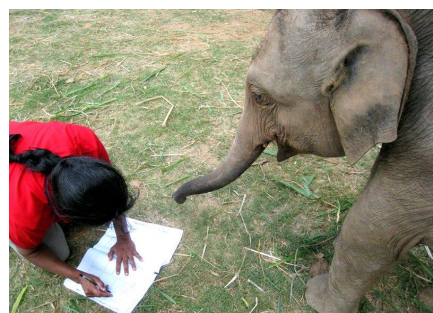
Figure 1b: Data collection through direct observation of the elephant

Data Processing
The Rating Method

A team of 31 experts including elephant biologists, veterinary doctors (studying wildlife disease and captive elephant disease), welfare personnel (working on wildlife conservation and welfare issues), wildlife managers (managing wild, captive elephants) and elephant mahouts rated different parameters of importance to the welfare of captive elephants (Varma, 2008; Varma, et al., 2008; Varma and Prasad, 2008). This rating was then used to assess the welfare status of elephants and elephant keepers:

- Experts rated a total of 114 welfare parameters covering all the major aspects of captivity
- The rating scale was from zero (unsuitable conditions) to ten (suitable conditions). With this logic, experts used maxima based on their concept of the importance of a particular parameter to an elephant. For example mean expert rating of 8.0 (SE= 0.5, N=29) for a parameter 'floor' and 9.0 (SE=0.4, N=31) for 'source of water' was arrived at from the ratings suggested by each expert
- A mean rating for each parameter, across all the participating experts, has been used as the Experts' Rating (E-R) which represents the importance attached to a parameter.
- For example, if an elephant is exposed only to natural flooring, the animal receives a rating of 8 and for entirely unnatural flooring the value is 0; if animal is exposed to both natural and unnatural flooring, the value is 4 (as 8+0/2= 8/2= 4). If an elephant is exposed to a natural water source, such as a river, it receives a value of 9; if the source of water is large lakes or reservoirs, it gets 4.5. A

value of 3.5 is assigned for small water bodies like tanks and ponds. Tap water (running) gets 2.5 and if only buckets, pots, and tankers are in use, then the allocated value is 0.5.

- Data for an elephant or a group of animals in a given zoo (for example Bannerghatta Biological Park–BBP), given State (for example, Karnataka) was collected. With this data Mean Rating (M-R) was calculated for a given parameter, along with its sub-parameters. Thus the Mean Rating (M-R) denotes welfare status of existing conditions on the ground for the particular parameter.

- In this investigation, variables which represent a common feature of the captive condition have been grouped to form a parameter. The variables have been termed sub-parameters. For example, the variables shelter type, shelter size, floor type in the shelter; all represent different aspects of the physical space provided to the elephant. Hence, they are grouped together to form the parameter "Shelter" and each constituent variable is a sub-parameter. In this investigation, the E-R for a parameter (say, shelter) represents the mean of E-Rs across all related sub-parameters. M-R is also based on similar lines.

- E-R and M-R for each of the zoos here represent the average across related parameters observed for that zoo. For instance, E-R / M-R for a parameter "shelter" represent the average of related parameters (termed sub-parameters) such as type, flooring, size, and shade availability. Not all related parameters will be rated for each of the zoos. The number of such related parameters varies for each zoo.

- Results have been presented comparing E-R and M-R as a means of comparing the extent of deviation present in the parameters observed. The difference between E-R and M-R (expressed as percentage) indicates deviation from the prescribed norm.

- For handlers, the difference between the maxima provided by experts (E-R) and existing status (M-R) has been used to indicate the professional/ socio-economic status of value to the handler and his elephant.

- N refers to number of sub-parameters for an observed parameter.

Result
A total of 49 elephants were maintained across eleven zoos in seven states of India (Table 1)

Table-1: Distribution of elephants across zoos in different states

S.No	State	Number of zoos	Total number of elephants
1	Andhra Pradesh (Ap)	1	7
2	Assam (As)	1	9
3	Gujarat (Gj)	2	4
4	Karnataka (Krn)	2	16
5	Kerala (Kl)	1	1
6	Maharashtra (Mh)	3	7
7	Tamil Nadu (Tn)	1	6

Among these elephants there were 32 females and 17 males. Figure -2 gives the overall age distribution of elephants, considering all the zoos together. Female age ranged from 0.1- 51 yrs and age of males ranged from 1.1- 70 yrs.
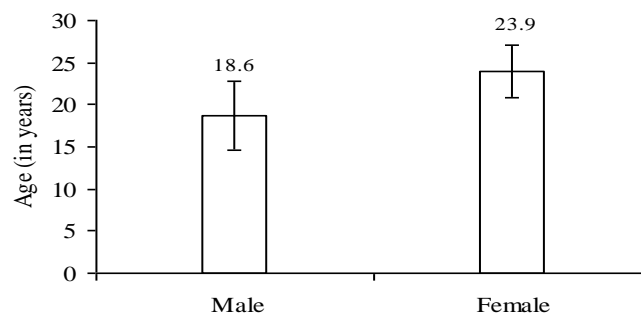
Figure 2: Overall age distribution of elephants
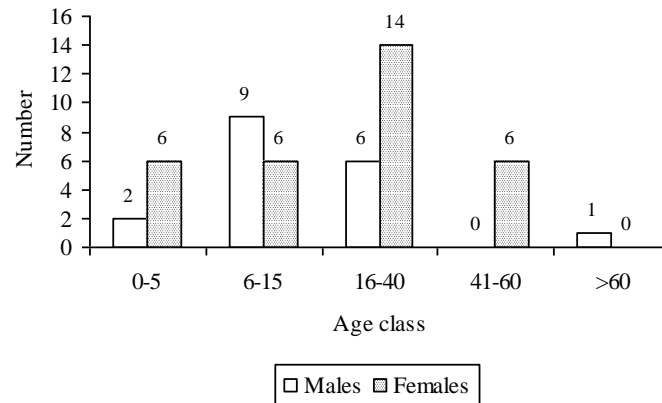
Figure 3: Age class distribution of elephants

Only one of the observed zoos, the Chamarajendra zoological gardens, Mysore, Karnataka maintained two African elephants (both males- Figure 4). The remaining zoos housed Asian elephants.

Figure 4: African Elephants in Mysore Zoo

Source

Exposure to alien conditions in captivity coming from a free-ranging wild background can be traumatic for elephants. Transfer across zoo facilities may expose the animals to different daily schedules and management, a potential cause for stress (Clubb and Mason, 2002).

- All Andhra zoo elephants had been received either as an exchange or a purchase
- Elephants in Assam zoo were all rescued from the wild
- Gujarat zoo elephants were rescued/ purchased
- 50% of elephants for Karnataka zoos were either rescues or captured from wild
- The elephant from Kerala zoo was caught in the wild
- All Mahrashtra zoo elephants were received as an exchange between zoos or as a gift from other institutions (circus)

All the zoos, except Karnataka, showed a deviation of 50% or more from E-R. Figures 5a and 5b give relative rating and percent deviation from E-R respectively. Low rating is indicative of sourcing elephants involving greater change in living conditions.
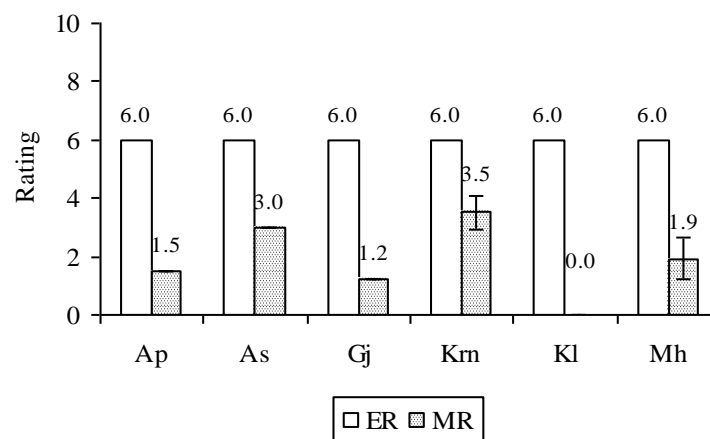
Figure 5a: Comparison of E-R and M-R for source
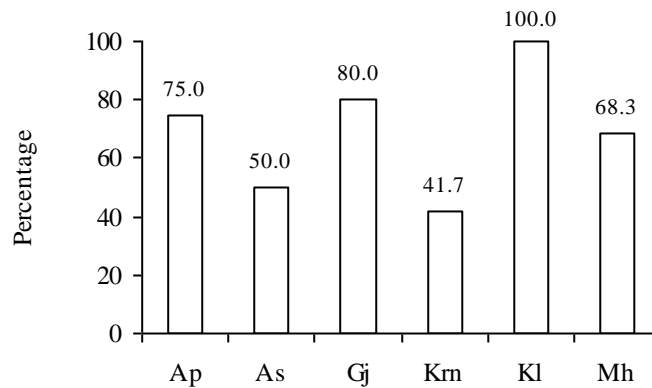
Figure 5b: Percent deviation from E-R for source

Shelter

Traversing kilometres across varied landscape is a characteristic of wild elephants (Sukumar, 1989; Poole and Granli, 2009). Some zoos provide semi-natural condition (Figure 6a, b and c) and man-made enclosures with hard floors (Figure 6d) and restrictions on movement occur in some.

- Elephants in Andhra zoo had a mix of a semi-natural day enclosure and a man-made concrete night enclosure (Figure 7a)

Figure 6a, b, c, d and e: Type of shelter provided; shelter with natural floor (6a, b).

- All elephants of Assam and Gujarat zoos had a semi-natural enclosure with earthen flooring
- Karnataka elephants had a combination of semi-natural day and partially closed night (Figure 7b) enclosure and man-made structures with concrete/ stone flooring
- Kerala zoo had a combination of a semi-natural day enclosure with earthen flooring and a concrete night enclosure

Figure 6c: Shelter with natural floor

- Maharashtra zoo had a combination of natural/ concrete enclosures or only concrete enclosures
- Day enclosure was a semi-natural forested area, night enclosure (Figure 7c) with cement floor for Tamil Nadu zoo

Figure 6d and e: Shelter with concert floor (6d and e)

Figure 7a and b: Night enclosures provided for elephants in two different zoos

Figure 7c: Type of Night shelter provided in another zoo

Figure-8a shows the variability seen in the shelter conditions across all zoos showing non-uniformity in existing conditions for shelter parameters; comparable deviations from E-R being noticed for all zoos (Figure-8b).
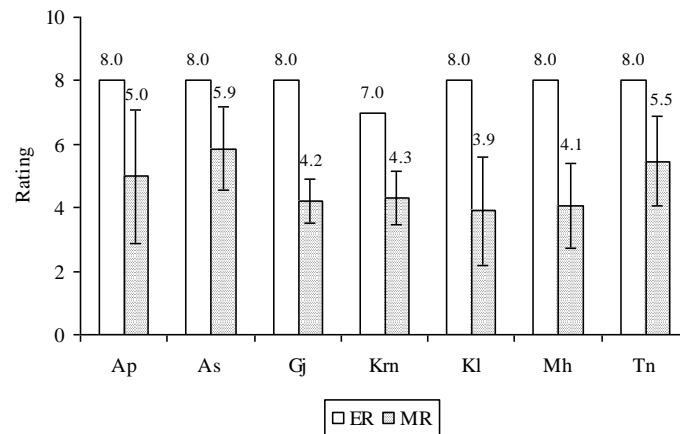
Figure 8a: Comparison of E-R and M-R for shelter
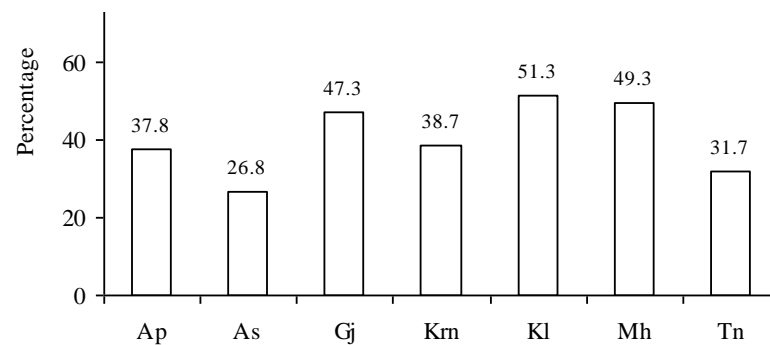
Figure 8b: Percent deviation from E-R for shelter

Water

Presence of water sources in captivity does not ensure its accessibility to the elephant due to the occurrence of sources such as tap water/ restriction on movement of elephants. Provision for dust bathing/ wallowing and other species-typical activities may also be absent. In captivity, handlers usually bathe the elephants; hence this aspect is also rated.

Figure 9a: Source of water; tap water supplied through hose pipe

- All elephants had access to tap water, supplied through hose pipe (Figure 9a) in Andhra zoo. They consumed water three times per day, and were bathed in the open.
- Pond water was the source for Assam elephants. They consumed water 2-4 times each day.
- River/ pond was the water source for Gujarat elephants. They consumed water 3-4times each day
- Tap and pond water was the source for Karnataka, Kerala and Tamil Nadu zoo elephants (Figure 9b)
- Tap water, water from tankers and ponds were available for Maharashtra zoo elephants

Variation was seen for the parameters related to water in all the zoos (Figure 10a) with comparable deviations from E-R for all zoos except

Figure 9b: Bath given at the shelter itself for elephant at Andhra Zoo

Figure 9c: Pond as the source of water for elephants in Tamil Nadu zoo

Gujarat which showed minimum deviation (Figure 10b). Comparably low rating was observed for all zoos except Gujarat, which too showed variability in existing conditions for this parameter.
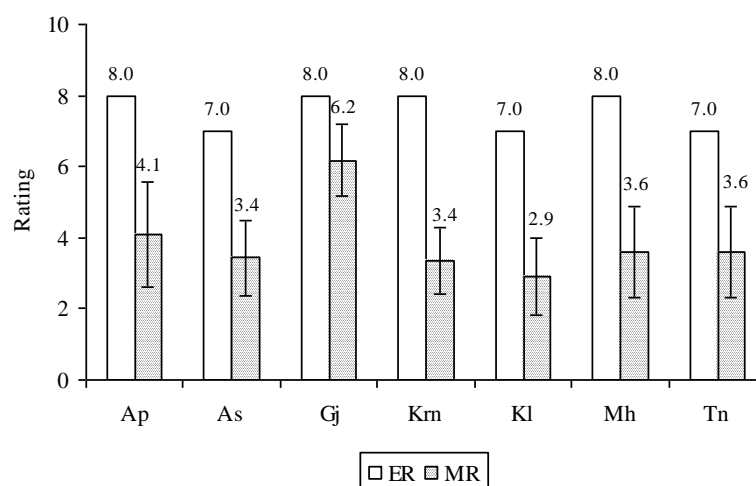
Figure 10a: Comparison of E-R and M-R for water
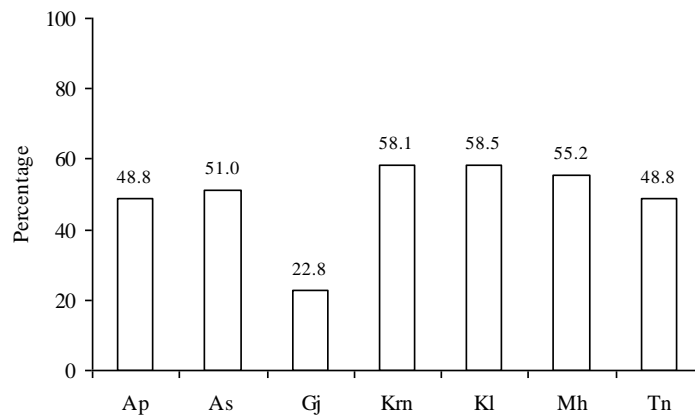
Figure 10b: Percent deviation from E-R for water

Sleep

Elephants have been observed to sleep for 3-4 h (Kurt and Garai, 2007). Choice of sleeping place and size may be restricted for captive elephants. Duration of sleep maybe in excess of those observed for wild elephants.

- The enclosure was also the sleeping place for Andhra elephants, mean sleep duration was 7 h
- Zoo premises was the sleeping place for Assam elephants, enclosure was open type with natural vegetation
- Gujarat zoo elephants were tied with a 5m chain while sleeping, sleep duration was 4 h
- Variation was observed for Karnataka zoo elephants, with one zoo chaining them on concrete enclosures at night and the other leaving the elephants to free range in the adjacent forest
- Kerala elephant was tied within a concrete enclosure at night
- The shelter was also the sleeping place for Maharashtra elephants, duration of sleep varied from 3-7 h
- Tamil Nadu zoo elephants were tied in their night time enclosure, duration of sleep was 4 h

M-R was low for most zoos (Figure 11a) indicating deviations from features observed in the wild; only Gujarat zoo showed relatively low deviation from E-R (Figure 10), but variation was observed in the suitability of this parameter.

Figure 11a: Comparison of E-R and M-R for sleep

13

*: rating based on one parameter only   **: rating based on two related parameters only
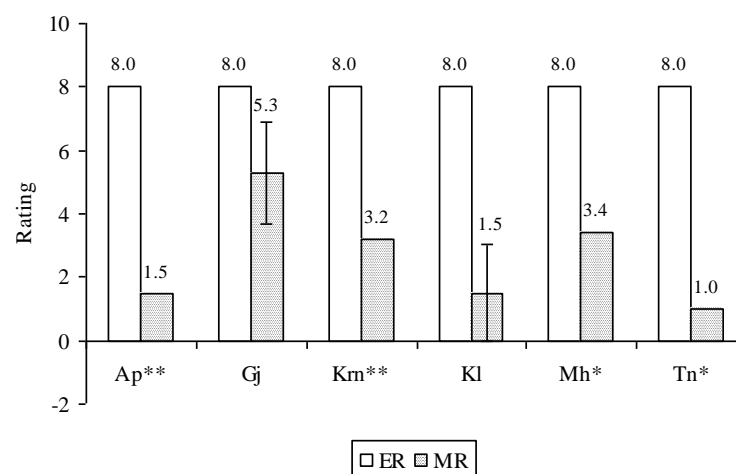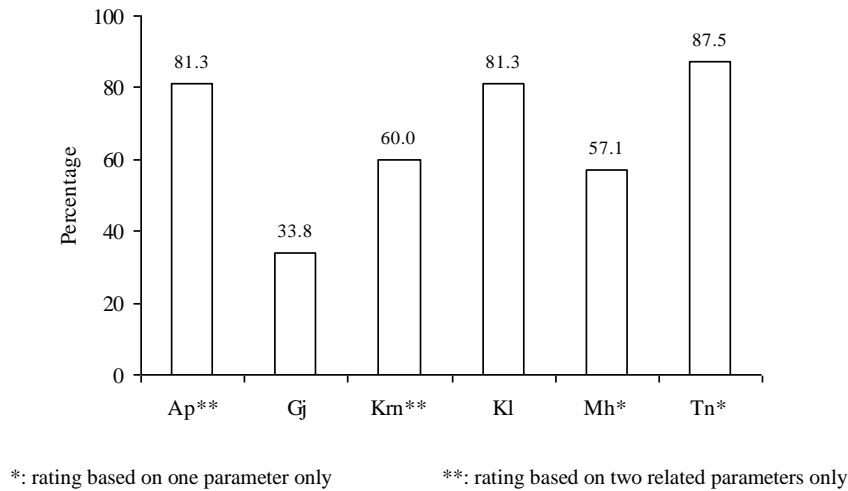
Figure 11b: Percent deviation from E-R for sleep

Walk

Walking for foraging or searching for mates forms a major activity of elephants, occupying nearly 80% of their activity (Poole and Granli, 2009; Sukumar, 1991). In captivity, confinement within circumscribed areas, especially in zoos, is seen. This leads to a change in the activity performed by elephants in most zoos, a factor of significance when they are also chained.

- Andhra zoo elephants were walked for 2-2.5 km for a duration of 1-2 h on tar roads
- Assam elephants were walked in the morning/ evening in the zoo premises for 1.5- 2.5 h/ day
- Gujarat zoo elephants were walked for varying durations, with some allowed to forage for restricted duration in the nearby forest
- Karnataka zoo elephants were allowed to free range in their day enclosure or left to forage in the nearby forest at night
- Kerala elephant was walked once a week on tar roads for a distance of 4 km
- Maharashtra elephants were walked in the day for a mean duration of 2 h
- Tamil Nadu zoo elephants were allowed to free range in the adjacent forest during the day for 2 h

For the zoos in which more than one related parameter for walk was rated, variation was observed in the existing conditions (Figure 12a). Higher deviations (from E-R) were noticed for Assam and Kerala zoos (Figure 12b). This deviation was greater for Kerala zoo considering its higher E-R for this parameter showing relatively poor conditions when compared to all other zoos.
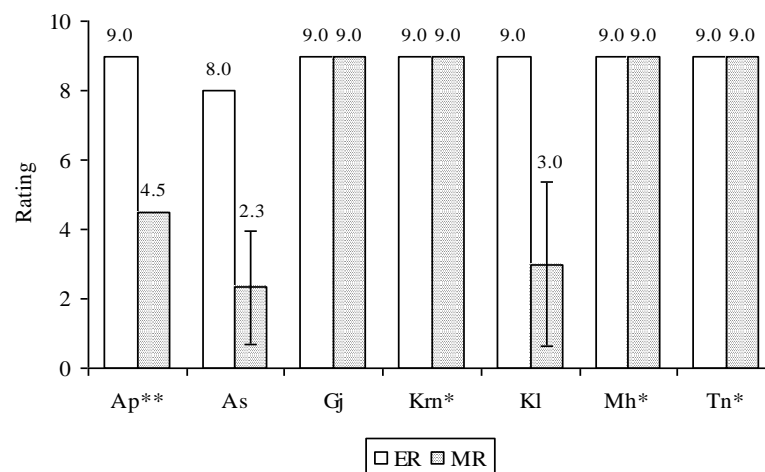
Figure 12a: Comparison of E-R and M-R for walk

14
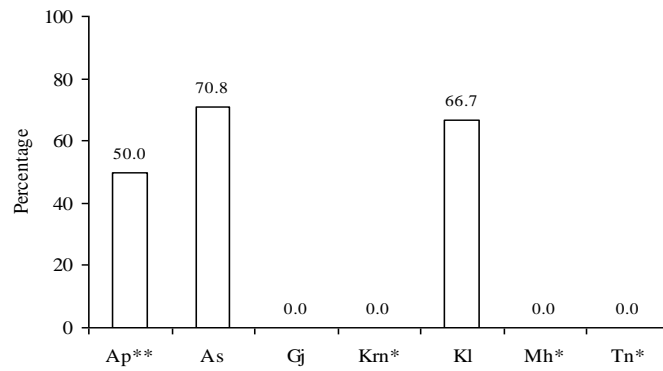
*: rating based on one parameter only   **: rating based on two related parameters only

Figure 12b: Percent deviation from E-R for walk

Social interaction

Elephant society is known for its lasting relationships across generations (Sukumar, 2006), males too have been observed without any aggressive interactions (McKay, 1973). Captivity imposes controls on this aspect of elephant biology by maintaining solitary or a few unrelated individuals. Interaction (Figure 13a, b, c and d) duration may also be limited depending on whether the elephants are allowed to be in close proximity.

a

b

c

d

Figure 13 a, b, c and d: Types and scopes for social interactions observed from four different zoos

- There were two males, five females in Andhra zoo, with interaction restricted to the day time
- Assam zoo elephants consisted of primarily young individuals, interaction duration was 2- 2.5 h
- Gujarat elephants consisted of two individuals (one member of each sex), duration was 24 h
- Karnataka zoo elephants were allowed to interact either in the day or at night
- Kerala zoo kept a single elephant
- Maharashtra zoo elephants were allowed varying durations of interaction (8-12 h), group size was 1-2 individuals
- Tamil Nadu elephants were allowed to interact during the day and chained at night

15

Least rating and greatest deviation was seen for Kerala zoo which kept a single elephant. There was no uniformity in the provisions made for elephants for this parameter in other zoos (Figure 14a), with the lone exception being elephants of the Tamil Nadu zoo. Deviation from E-R was also minimum for this parameter for Tamil Nadu zoo (Figure 14b).
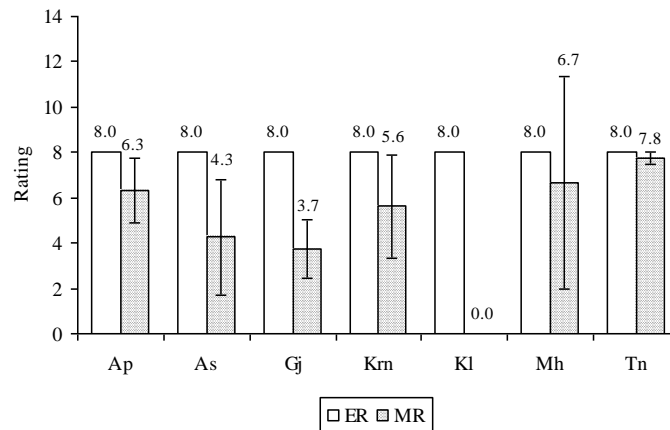
Figure 14a: Comparison of E-R and M-R for interaction
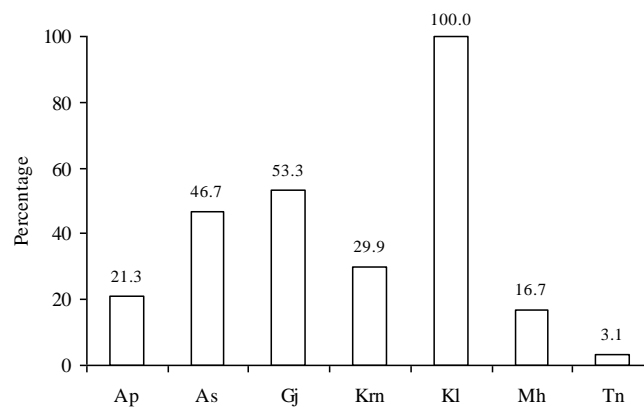
Figure 14b: Percent deviation from E-R for interaction

Chaining

An almost universal feature for captive elephants is the use of chains as a tool to manage the animals. This not only restricts movement but also may result in injuries (Kurt and Garai, 2007). Increased frequency of stereotypy was associated with elephants which were chained (Figure 15a, b and c) rather than penned (Gruber, et al., 2000).
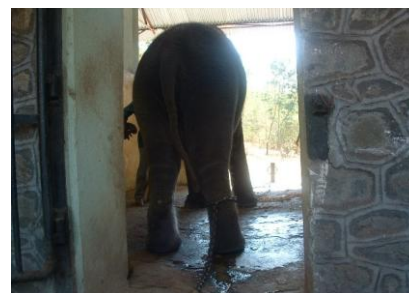
a   b

Figure 15a, b, c and d: Chaining of elephants; elephants being chained out side (15a and c) and insides (15b and d) of the enclosure

16

- All Andhra zoo elephants were chained by a foreleg and a hind leg for at least 15 h
- Assam elephants were chained when not being walked or left to free range in the enclosure. When left in the enclosure, they were hobbled by their forefeet
- All Gujarat zoo elephants were chained at night
- Most Karnataka zoo elephants were chained, except for the calves. Free ranging was allowed in the enclosure during day or in the forest at night. Drag chain was used while free-ranging in forest; hobbles were used at times to control the elephants
- The Kerala elephant was chained for nearly 20 h per day, either by its leg or by hobbling

Figure 15c: Elephant chained outside the enclosure

Figure 15d: Facility for chaining elephants in night enclosure

- All elephants were chained, spiked chain was used for four of the seven Maharashtra zoo elephants, duration of chaining ranged from 9 -20 h
- Tamil Nadu zoo elephants were chained at night in the enclosure

Low rating was observed for all zoos for this parameter implying unsuitability for elephants. Variation occurred for this parameter across most zoos, except Assam which was uniformly poor (Figure 16a). Maximum deviation was seen for Assam elephants followed by Kerala. Comparable deviations were observed for the other zoos (Figure 16b).
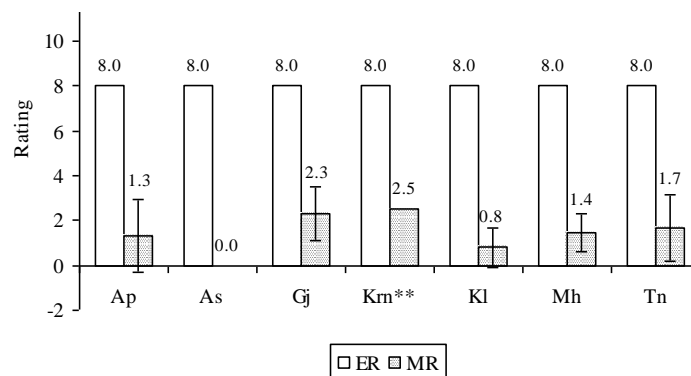
Figure 16a: Comparison of E-R and M-R for chaining
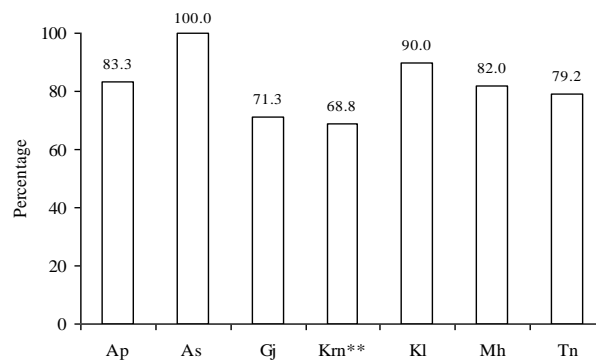
**: rating based on two related parameters only

Figure 16b: Percent deviation from E-R for chaining

Observed behaviour

Elephants which are rough/ aggressive maybe subjected to greater control in the form of chaining. Incidents of stereotype are considered to be indicative of poor welfare.

- Andhra zoo elephants were described as reliable, with two elephants being aggressive
- Elephants in Assam zoo were described as quiet, with no incidents of aggression
- All Gujarat zoo elephants were said to be quiet, with one male having injured a person and exhibiting stereotypy
- Most Karnataka elephants were described as quiet/ calm. Two elephants, an Asian female and an African male had injured people, no stereotypic signs were seen
- The Kerala zoo elephant was calm, but was aggressive towards strangers or new mahouts
- All Maharashtra elephants were quiet/ calm, with one male having injured a person; stereotypy was seen in four of the elephants
- Four of the five elephants were said to be aggressive towards people/ other elephants; one female had injured two persons. Two of the elephants exhibited stereotypy

Among the zoos in which more than two sub-parameters for behaviour were rated, variation was observed indicating occurrence of unsuitable features (Figure 17a). Most deviations from E-R were less than 20% (Figure 17b).
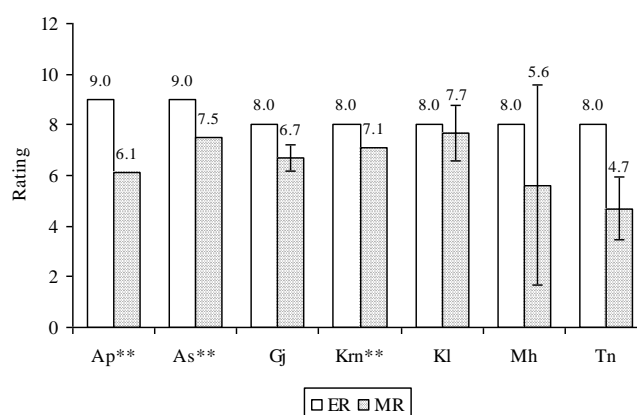
Figure 17a: Comparison of E-R and M-R for behaviour
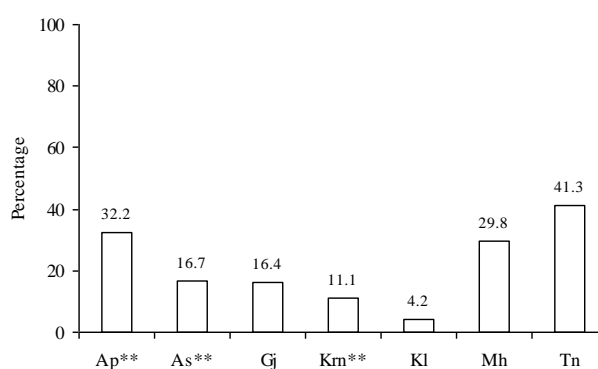
**: rating based on two related parameters only

Figure 17b: Percent deviation from E-R for behaviour

Work

Performance of alien behaviours such as standing in one place for long durations, blessing people with the elephant's trunk in return for money, etc may not be representative of the elephant's behavioural repertoire. Absence of work and no physical/ psychological stimulation is also not conducive to the elephant's health/ well-being.

- Providing rides for tourists (Figure 18a and b) appears to be a common work protocol for elephants kept in most of the zoos

a

b

Figure 18a and b: Elephants used for tourist rides in two different zoos

- Andhra zoo elephants were used to provide tourist rides, or left in the enclosure for display to the public, made to seek donations from public
- Providing rides for tourists (Figure 15a and b) and bringing food was the work for three of the Assam elephants, no work for other elephants
- No work was given for Gujarat zoo elephants
- Except for three elephants who were used for providing rides for tourists, the other elephants were not used for work in Karnataka zoo
- No work was given for the Kerala zoo elephant

Figure 18c: A calf being prepared for training for work related activities

- Most Maharashtra zoo elephants were not made to work, except for two elephants which were taken for trips around the zoo
- Two elephants were used for providing rides for tourists in the Tamil Nadu zoo

Absence of work was the feature in four zoos (Figure 19a) and greater deviation from E-R was seen for Andhra Pradesh and Assam zoo (Figure 19b).
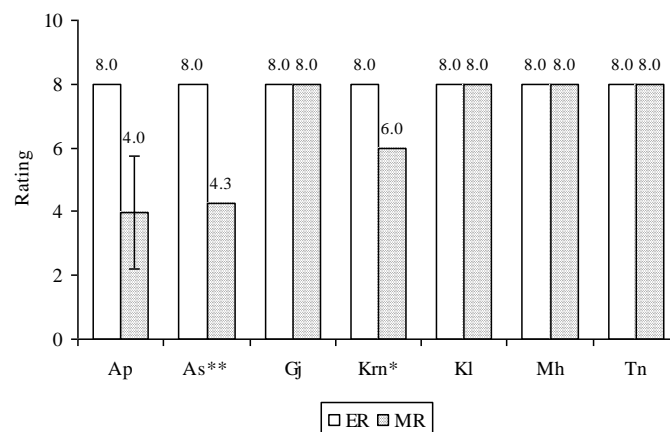
Figure 19a: Comparison of E-R and M-R for work

19

100 ┬

80 ┤

60 ┤

40 ┤

20 ┤

0 ┴

Percentage

50.3   46.9   25.0
Ap   As**   Gj   Krn*   Kl   Mh   Tn
                0.0   0.0   0.0   0.0
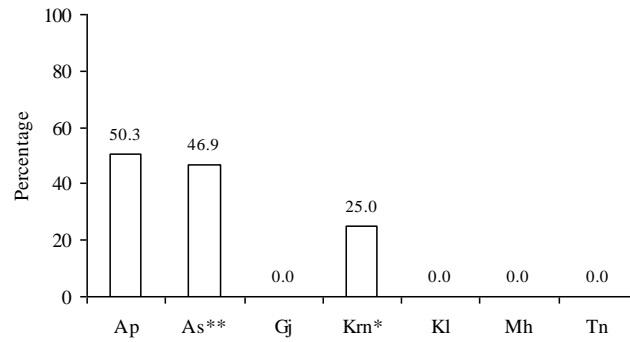
*: rating based on one parameter only   **: rating based on two related parameters only

Figure 19b: Percent deviation from E-R for work

Food

Foraging occupies a major portion of an elephant's activity in the wild (Sukumar, 1991), spending 12-18 h traversing across its habitat. Elephants are known to feed on diverse species and numbers of plants (Shoshani and Eisenberg, 1982), an activity that involves manipulation of food before eating. In a social context, younger individuals learn various behaviours of manipulation (Kurt and Garai, 2007). The species-typical activities of elephants are generally absent in captivity as they are stall fed with a limited range of vegetation.

- All elephants in all the zoos observed were given stall feed (Figures 20a, b, c and d)

Figure 20a: Stall fed; carrot, coconut and millet mix as sources

Figure 20b: Stall fed; grass as one of the sources

Figure 20c: Stall fed; carrot, sugarcane and others as sources

Figure 20d: Stall fed; millet as a source

Figure 20e: Free ranging as source for some zoo elephants

20

- Andhra zoo elephants were allowed to browse/ graze in their morning enclosure, with two elephants given only stall feed
- Occasional grazing/ browsing opportunity was given for Assam zoo elephants, but two elephants were primarily given stall feed
- Two elephants were allowed limited opportunity to free range while the remaining were given only stall feed in Gujarat zoo
- In Karnataka zoos, opportunity to forage was provided for five elephants in the nearby forest at night. The remaining elephants had to graze/ browse within their enclosure or provided only stall feed.
- No opportunity to forage was given for the Kerala elephant
- All Maharashtra zoo elephants were given only stall feed
- Tamil Nadu zoo elephants were allowed to forage (Figure 20e) and given stall feed

There was no uniformity in the parameters related to food provisioning for all the zoos (Figure 21a). Relatively more variation was seen for Karnataka, Kerala and Maharashtra zoos. These zoos also showed greater deviation from E-R (Figure 21b).
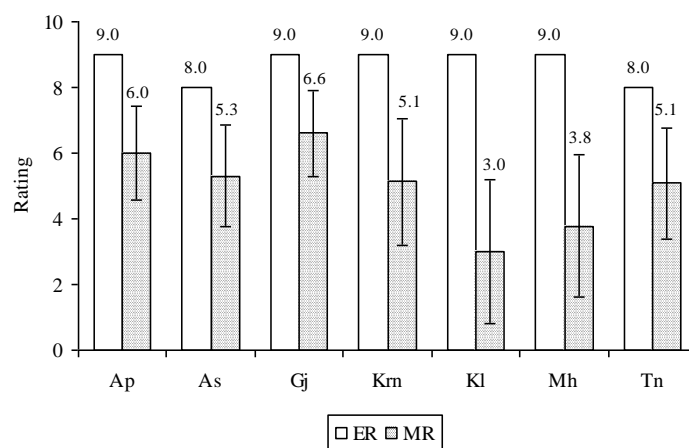
Figure 21a: Comparison of E-R and M-R for food
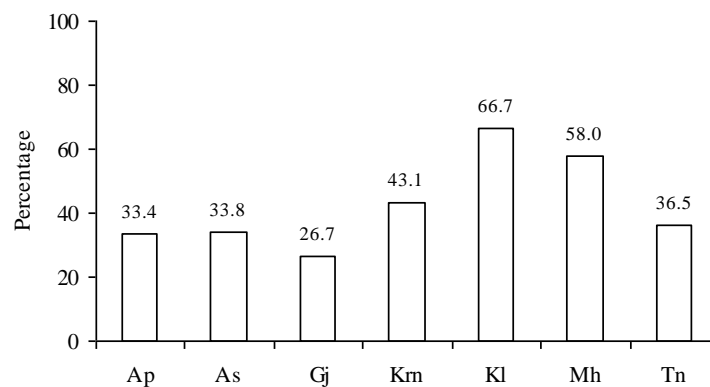
Figure 21b: Percent deviation from E-R for food

Reproductive status

Normal reproductive functioning among adult captive elephants (Figure 18) maybe absent as a consequence of absence of mates or absence of normal reproductive functioning (Clubb and Mason, 2002).

- Andhra zoo elephants were observed to be reproductively active— oestrus among females and musth in males— occurred. There were no reports of calves being born
- Reproductive status of Assam zoo elephants was not known

21

Figure 22: Reproductively active male of one of the zoos

- Occurrence of oestrus among females was not known, males were said to experience musth in Gujarat zoo, no reports of calf birth
- Adult females of Karnataka zoo were reproductively active, male source was both captive and wild, calf-births were reported. Males were said to experience musth/ were reproductively active
- The Kerala elephant was maintained singly, but had been exposed to a male several years ago, no information is available on calf birth
- Most female elephants in Maharashtra zoo were not given opportunity to breed, one female, however, had given birth. Male experienced musth
- Two of the adult Tamil Nadu zoo elephants had mated, no calves were born

Minimum variation was observed for Karnataka zoo elephants (Figure 23a) showing lesser deviation from E-R (Figure 23b) implying occurrence of suitable conditions as compared to other zoos. Greater variation for Maharashtra zoo elephants shows the absence of uniformity in the parameters observed.
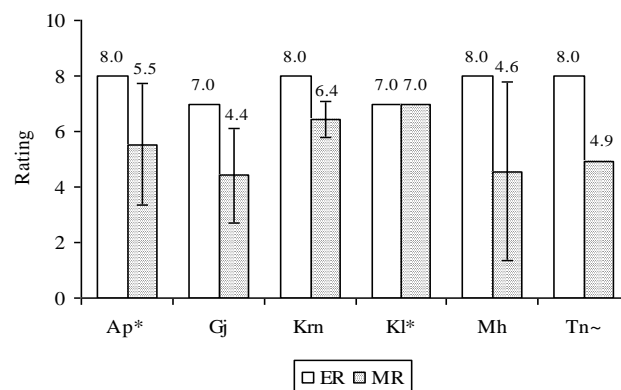
Figure 23a: Comparison of E-R and M-R for reproductive status
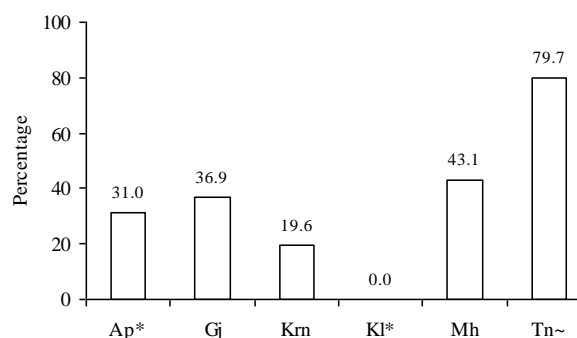
*: rating based on one parameter only   ~ rating averaged across all observed individuals across parameters

Figure 23b: Percent deviation from E-R for reproductive status

Health and veterinary routines

The occurrence of diseases such as tuberculosis, foot problems, nutritional disorders are seen among captive elephants either due to exposure to new environments (humans) or due to husbandry practices (Kaufmann and Martin, 2009).

- Foot rot, fissures, respiratory problems were seen in Andhra zoo elephants. Deworming/ sample (dung) testing was practiced. No immunisation/ oiling/ taking body measurements was done

- Abscesses and fracture was observed among Assam elephants, deworming, immunisation and sample testing (feacal, urine, blood) was practiced
- Foot problems and wounds were noticed for Gujarat elephants; deworming was practiced. Immunisation/ oiling/ sample testing/ taking body measurements were not practiced
- Deworming, immunisation, oiling, sample testing (dung/ urine/ blood) was practiced for Karnataka elephants
- Deworming was practiced, but immunisation and oiling was not done, samples of blood/dung/urine were tested once, body measurements were not taken for Kerala zoo elephant
- Maharashtra zoo elephants were reported to have stomach related disease, head injury (Figure 24a) and foot problems (Figure 24b). Deworming was practiced. Oiling and sample testing was not followed uniformly for all, immunisation was not done

a   b
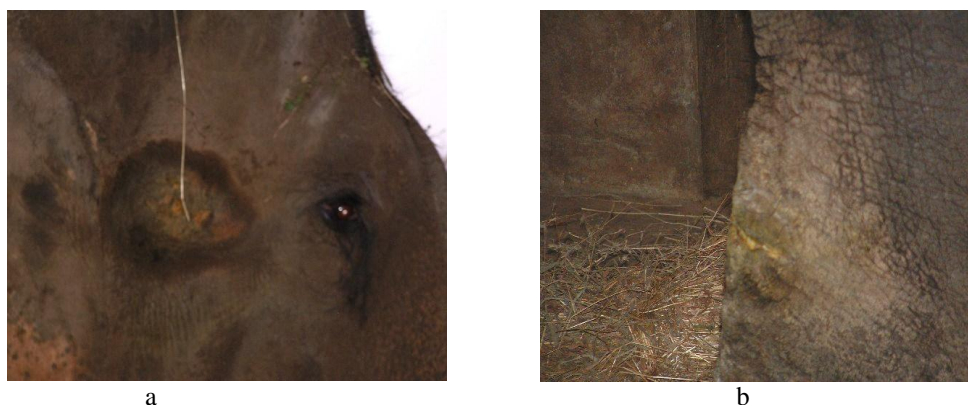
Figure 24a and b: Injuries in head and foot of elephant from Maharastra zoo

- Deworming, immunisation, oiling, sample testing (dung/ urine/ blood), and taking body measurements was practiced for Tamil Nadu zoo elephants

All the zoos showed variation in the observed parameters (Figure 25a) implying differences within zoos from the prescribed norms. Comparable deviations were observed (Figure 25b) for Gujarat and Kerala zoos, followed by Maharashtra.
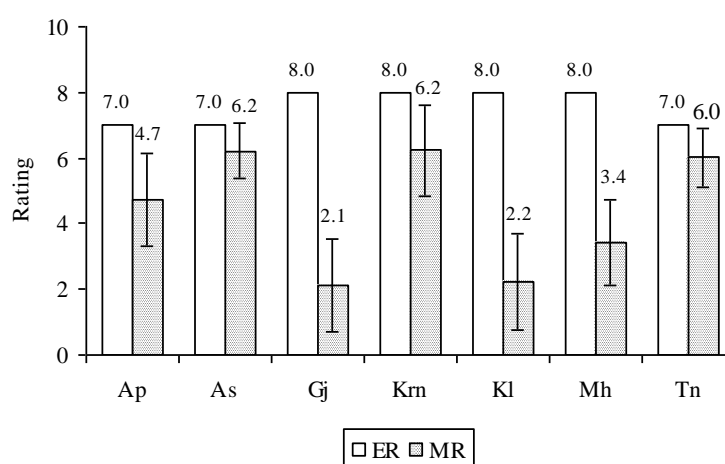
Figure 25a: Comparison of E-R and M-R for health and veterinary routine
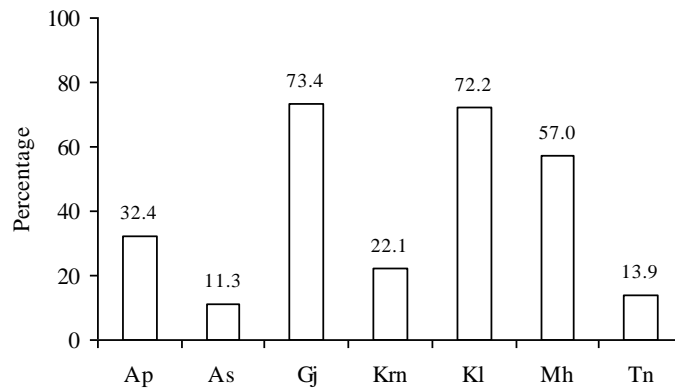
Figure 25b: Percent deviation from E-R for health and veterinary routine

Veterinary care and facilities

Presence of veterinary personnel with relevant experience is important in maintaining health of captive elephants. Absence of infrastructural facilities may hinder efficient management and husbandry of the elephants.

- Veterinary doctor with experience in treating elephants and a veterinary assistant were available for Andhra, Assam, Karnataka and Tamil Nadu zoos with daily visits to the zoo; veterinary clinic facility was also available
- Gujarat zoo had veterinary doctors with varied experiences in treating elephants, visit frequency also varied and records were maintained
- Veterinary doctor was available for the Kerala elephant, visiting the zoo daily, zoo had a laboratory with out-patient facility
- Veterinary doctor with experience in treating elephants was available for Maharashtra zoos, visit frequency was atleast once every day, veterinary assistant was not available for one zoo, while clinic facility was available for all

Minimum to no variation was observed for Andhra Pradesh and Karnataka zoos for this parameter (Figure 26a); relatively low rating was observed for Gujarat zoos. Low and comparable deviations were observed for all zoos except in Gujarat (Figure 26b).
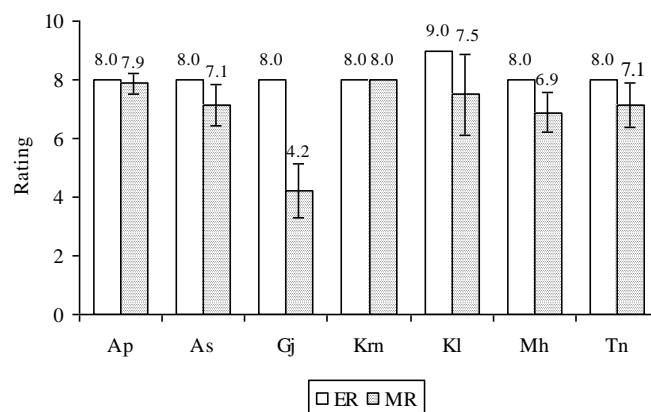
Figure 26a: Comparison of E-R and M-R veterinary personnel and facilities

24
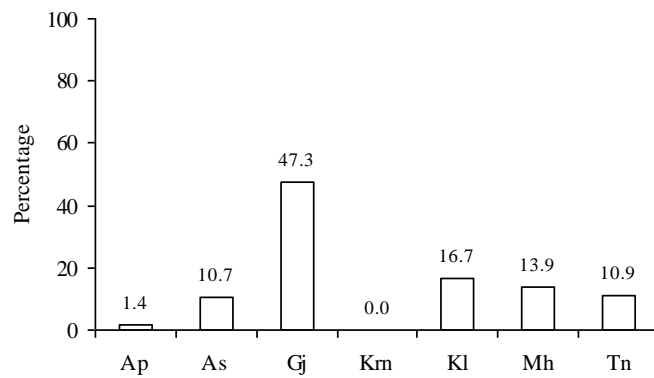
Figure 26b: Percent deviation from E-R for veterinary personnel and facilities

Mahout/cawadi status

Mean age of the handlers (Figure 27 a, b, c and c), across all zoos was 38.7 yrs (SE= 1.7, N=29) ranging from 24 to 58 yrs.

a

b

c

d
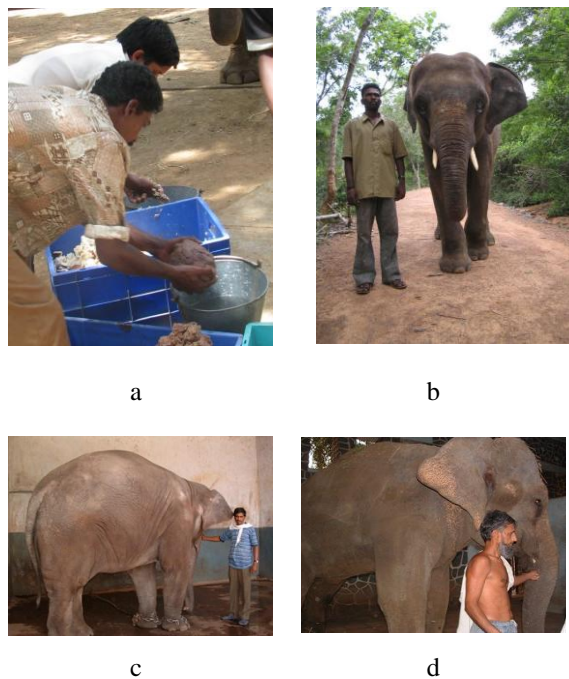
Figure 27a, b, c and d: Profile of handlers from different zoos

Professional experience

Insufficient training in this profession and lack of knowledge about elephants can be dangerous for both the elephant and its handler.

- Mean years of experience was 23 yrs, experience with a specific Andhra zoo elephant was 19 yrs
- Mean experience for handlers in Gujarat zoo varied between 10 and 15 yrs
- Karnataka zoo handlers had a mean experience of 13 yrs in the profession, with a mean of 4 yrs experience with a specific zoo elephant; most chose this profession as it was a traditional occupation
- For Maharashtra zoo handlers, experience in this profession ranged from 3 to 35 yrs, with experience of handling specific elephants ranging from 3 to 20 yrs. Most had joined out of interest.
- Mean experience in the profession for Tamil Nadu handlers was 8 yrs and experience with a specific zoo elephant was 2 yrs.

All handlers expressed comparable ratings with variation observed for each (Figure 28a) with lower variation noticed for Tamil Nadu. Relatively lower deviation from E-R was seen for Tamil Nadu handlers (Figure 28b).
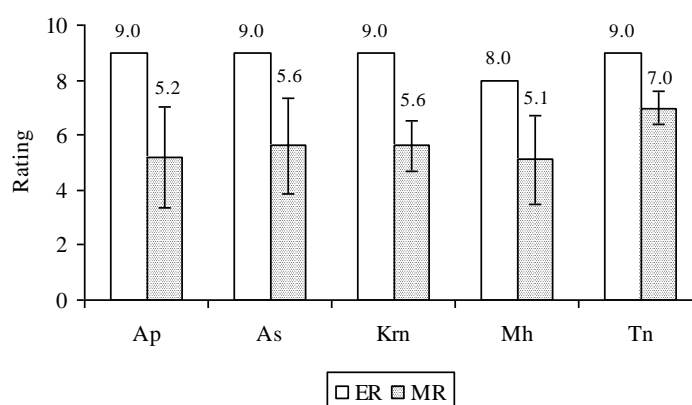
Figure 28a: Comparison of E-R and M-R for handlers' professional experience
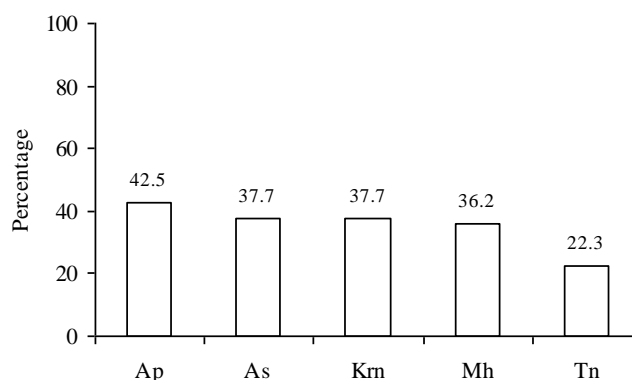
Figure 28b: Percent deviation from E-R for handlers' professional experience

Socio-economic status

Social conditions such as having relatives in the same profession, a minimum level of education and a restricted family size in terms of number of children; a good economic environment such as sufficient remuneration to support a family, and provision of insurance are the factors that play a role in determining the efficiency of performance by the handlers.

- All Andhra zoo handlers were literate, number of children per family varied from 1 to 11, mean annual salary was Rs. 95,950/- (1 US$=Rs.48.00) , insurance cover was available, and most handlers consumed alcohol
- Mean annual salary for Gujarat handlers was Rs. 64,000/-, number of children per family was 2-3, no insurance cover was available, all consumed alcohol
- Most mahouts (66%) working in Karnataka zoos had a background in handling elephants. All the handlers were educated. The wages of only 8% could be considered satisfactory. Majority of the handlers were covered by insurance (83%) while 90% abstained from drinking.
- All Maharashtra zoo handlers were educated, earning a salary of Rs. 60,000 to   Rs. 1,14,000/- annually, supporting a family of 2-6 children, all had insurance cover
- Education ranged from 1st to 9th standard for Tamil Nadu handlers, mean annual salary was Rs. 40,560/- with number of children ranging from 2 to 3 per family, no insurance cover was available

Mean rating and deviation from E-R was comparable across zoos for the handlers (Figure 29a and 29b) implying existence of similar conditions for the parameters observed.
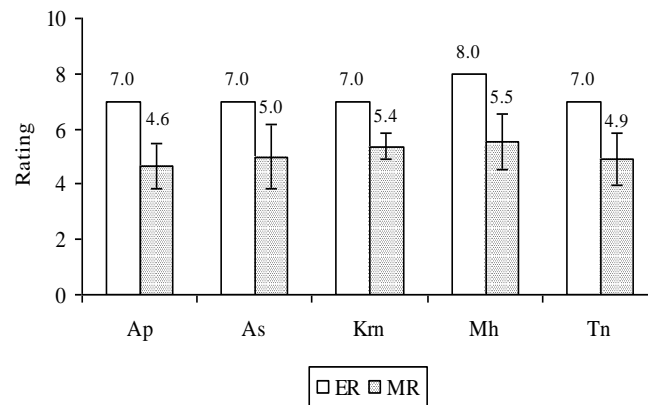
Figure 29a: Comparison of E-R and M-R for handlers' socio-economic status
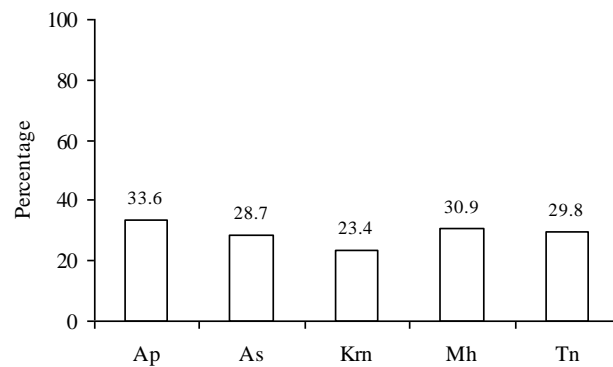
Figure 29b: Percent deviation from E-R handlers' socio-economic status

Overall ratings

Considering all the elephants in the zoos observed as a single unit, the overall M-R across all observed parameters was 4.7 (SE= 0.2, N= 88) implying a deviation of 41% from E-R on an average. Figure 30 gives the relative occurrence of deviation-classes across the zoos. It can be seen that maximum occurrence of minimum deviation (25% or less) was observed for Karnataka followed by Tamil Nadu zoos. The same zoos also showed maximum occurrence of greatest deviation from E-R (> 75%) implying non-uniformity in the standards of available parameters. Most zoos however, showed deviations in the range of 25 -75%.
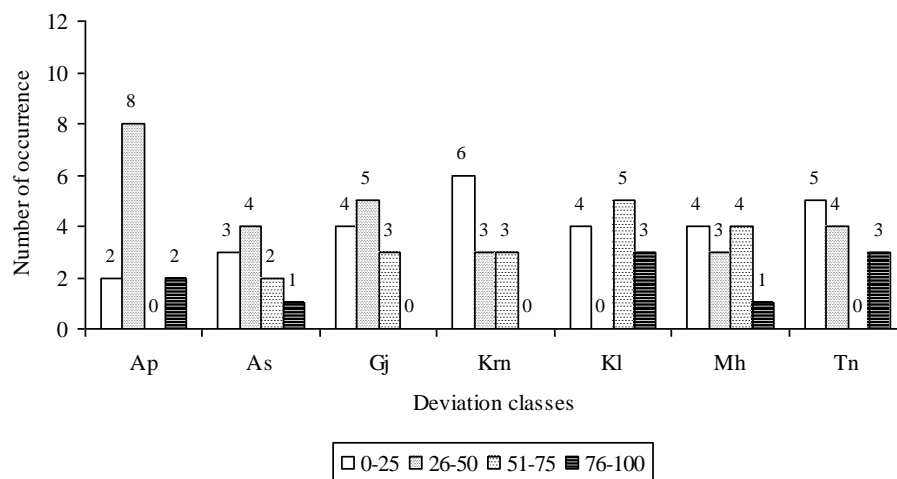
Figure 30: Number of occurrence of deviations from E-R across observed parameters

Discussion

Meeting the needs of elephants in captivity given their behavioural and ecological needs can be challenging (Veasey, 2006). From the knowledge available on wild elephants and the issues faced in dealing with elephants in captivity, the essential features of wild elephants' biology and ecology can be used as a benchmark to assess welfare status of their counterparts in captivity. The rating method adopted in this report depends on the difference seen between captive and wild elephants' living conditions.

Among the deviations observed:

- Less than 20% deviation was seen for veterinary care for six of the seven zoos, the exception was Gujarat zoos, all of which implying the occurrence of better veterinary care among zoos
- Deviation of 50% or more for chaining for all zoos indicates its universal prevalence
- Deviation of 55% or more for sleep for five of the six zoos excepting Gujarat zoos was a consequence of chaining the elephants at night and providing hard floors in night enclosures

Variable deviations indicating non-uniformity in standards across zoos:

- 25 - 67% deviation was observed for food for all zoos
- 25 - 55% for shelter for all zoos
- 20 -60% for water for all zoos
- 20-100% for interaction for all zoos
- 5-40% for behaviour for all zoos

Source of elephants in zoos:

- Deviations for this parameter ranged from 50-100% for all zoos, except of Karnataka. This indicates greater change in the overall living environment experienced by the elephants when sourced
- Karnataka zoos showed relatively less deviation (41%) as a consequence of captive births which was however, not common

Handler status

Non-uniformity in professional experience was noticed for handlers at all zoos, a characteristic feature being relatively lesser experience with a specific zoo elephant.

While the deviation for socio-economic status was in the range of 20-30%, there was no uniformity in the conditions. Features that were deficient in some of the zoos were insurance coverage and a difference in the salary paid across states. A common feature that seemed to occur across zoos was the practice of alcohol consumption.

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Section 2:
Zoo Elephants in Andhra

Executive Summary

The maintenance of elephants in zoos entails the provision of conditions that replicate the ecological, behavioural and psychological state of its wild counterparts to the greatest possible extent. Hence, there is a need for a critical appraisal of the captive conditions existing in zoos.

This investigation assesses the welfare status of elephants maintained in Nehru Zoological Park, Hyderabad through a study of the physical environment as well as the provision of a suitable living environment for expression of species-specific behaviours. This also provides some insight on the socio-economic status of handlers who take care of these elephants.

Welfare status of elephants has been measured in terms of the deviation experienced by the captive animals when compared with wild, free ranging conditions. The deviation was measured through a rating logic and ratings were graded in the following manner:

- 0 – 2.4: Bad conditions
- 2.5 – 4.9: poor
- 5.0 – 7.4: moderate
- 7.5 – 10.0: satisfactory

The Zoological Park has seven adult elephants with ages ranging from 23 to 44 yrs. Mean age of the elephants was 38.3 yrs, ranging from 35 to 41 yrs for females and 23 to 36 yrs for males.

All the elephants had been received or gifted (3 animals), purchased (2 animals), transferred or exchanged (2 animals) where the period of such transactions fall in between 1963 and 2005. Mean rating was 2.5 that implies the predominance of transfer across facilities for all the observed animals.

All the elephants were said to be maintained as zoo exhibits. Maintenance of animals in semi-natural conditions along with use for commercial purposes has been given a lower rating value. Mean rating was 2.7.

Daytime shelter was an open area of 4 acres with Neem (*Azadirachta indica*) and Rain trees (*Samanea saman*), night time shelter was an RCC shed of size 561.7 sq ft, with concrete flooring. Mean rating was 6.2 showing occurrence of moderate conditions.

All the elephants had access to tap water. Occurrence of water is considered important for wild elephants and the mean rating was 5.1 with 48 % of all the rating values getting a score less than four.

All the elephants were said to be allowed to interact in the open area for 9 h. This parameter was rated using four sub-parameters. Mean rating was 8.0 and about 50% of the values fall under 10.

All elephants were chained at night for 15 hours in the shelter, the mean rating was 1.7 showing occurrence of bad conditions.

Work type was either zoo exhibitions, rides, tourism, minor lumber, or commissions of festivals; mean rating for this parameter was 5.0 with 52% of all rating values getting a score less than six.

All except the two males were provided both stall feed and allowed to free range for browsing/ grazing within their zoo enclosures. The stall food include grass, fodder, rice (*Oryza* sp.), jaggery, ragi (*Panicum* sp.), salt, sugarcane (*Sacharum* sp.), banana (*Musa* sp.), and tender coconut. Mean rating was 7.2 and 50% of the values fall under 10.

Four female elephants' exhibit oestrus cycles, both males are reproductively active and all animals were exposed to the opposite sex. Mean rating for female reproductive status was 6.4 with 35% of all the rating values getting a score less than four.

Foot rot, oral cavity problem, parasites, obesity, fissures, toe nail cracks, respiratory problems, abnormal respiratory sounds and lacerated wounds (in left foreleg and hind leg) are some of the health problems reported for the animals. Overall mean for this parameter was 6.4 with 36% values getting a rating less than four.

The zoo has one veterinary doctor with 21 years experience with elephants, who makes daily visits. Mean rating was 9 and 86% of the values are under 10.

Eight handlers take care of the elephants, mean age of handlers was 44.6 yrs, mean number of years of experience of working as handler was 22.5 yrs ranging from 12 to 35 yrs and mean number of years of experience with any particular elephant was 18.7 yrs. Except for one mahout, all the handlers were said to consume alcohol. Overall mean rating for handler welfare was 6.1 with 50 % values getting scores between 8 and 10.

Overall mean rating for the elephants in the zoo was 6.2. Ignoring availability of veterinary care, and considering only physical, social and physiological status, overall mean rating was 5.7 with rating values less than five, contributing 42 % of all the scores.

Introduction

The maintenance of wild animals such as elephants in zoos entails provision of conditions that replicate to the greatest extent possible the ecological, behavioural and psychological state of its wild counterparts. Hence, there is a need for a critical appraisal of the captive conditions existing in zoos. The Nehru zoological park in Hyderabad, in the state of Andhra Pradesh was established in 1959. It covers an area of 380 acres within which diverse fauna are maintained for the dual purpose of conservation and education. Among the animals housed, the zoo has seven Asian elephants maintained in a separate enclosure.

Objective

Conditions experienced by animals in zoos, highlighted by a number of limiting factors, may not be the same as those prevalent in the wild.

- To assess the welfare status of elephants maintained in Nehru Zoological park, Hyderabad, through a study of the physical environment as well as provision of a suitable living environment for expression of species-specific behaviours
- To assess the veterinary care and infrastructure provided for these elephants

The welfare of animal handlers (mahouts) needs to be considered, as poor welfare of a handler may be negatively associated with the way an elephant is treated/ handled.

- To assess the socio-economic status of mahouts as well as his relationship with the animal in terms of experience, methods of animal control, etc.

Method

Elephants have evolved over several millennia, its biology and natural life history pattern being shaped by the complex interaction of different selective forces. Captive conditions need to provide the right environment for expression of species-specific behavioural repertoire and social well-being using the knowledge gained from field research on wild, free-ranging elephants (Stroud, in press). Welfare status of elephants has been measured in terms of the deviation experienced by the captive animals in the social, behavioural and physical environment when compared with wild, free ranging conditions.

The captive environment has been studied using physical aspects such as provision of shelter, floor type, etc., behavioural features such as the animal's temperament, incidents of aggression, social characteristics such as opportunity for interaction with other elephants, etc. Each of these features has been rated on a zero to ten scale with zero representing the worst possible situation and ten implying a satisfactory state, closer to what an animal experiences in the wild.

Rating values were graded in the following manner:

- 0 – 2.4: Bad conditions
- 2.5 – 4.9: poor
- 5.0 – 7.4: moderate
- 7.5 – 10.0: satisfactory

Some of these features have been grouped together to form a parameter. For example: shelter includes sub-parameters such as: shelter type, flooring type, maintenance of hygiene and shade availability. The rating values of sub-parameters have been used to calculate a mean rating for the parameter. The same rating scale has been used for assessing conditions exclusive to captivity such as availability of veterinary care, veterinary practices followed and facilities provided. Graphs depicting percentage occurrence of rating values, from zero to ten, for a parameter have been presented. The rating value for each sub-parameter has also been presented through graphs. The welfare status of the mahout has been rated on the same scale. Mahout's socio-economic conditions as well as his relationship with elephants have been assessed.

Result
Population status

The Zoological Park has seven adult elephants (two males and three females) with age ranging from 23 to 44 years. Mean age of the elephants was 38.3 yrs (SE= 3.2, N = 7) ranging from 35 to 41 yrs for females and 23 to 36 yrs for males.

Source of elephant

All the elephants had been received or gifted (3 animals), purchased (2 animals), transferred or exchanged (2 animals) with the respective period of such transactions falling between 1963 and 2005. Source of the

captive elephant: whether captive born/ wild caught or transferred across facilities is an indicator of the change in living conditions experienced by the animal. Movement across facilities entails breakage of established social bonds and/ or introduction of unfamiliar and new animals into an established group with potential as a source of stress (Clubb and Mason, 2002). Animals which have been transferred across institutions have been given a low rating value.

Mean rating value was 2.5 (SE =0.0, N =7) implying transfer across facilities for all the observed animals. Mean age at transfer, calculated based on the year of transfer and elephant age, was 13.6 yrs. (SE = 4.6, N = 7).

Purpose of keeping
    All the elephants were said to be maintained as zoo exhibits.

Maintenance of animals in semi-natural conditions along with use for commercial purpose has been given a lower rating value. Mean rating was 2.7 (SE = 0.8, N = 7).

Shelter
- Daytime shelter was an open area of 4 acres with Neem (*Azadirachta indica*) and Rain tree (*Samanea saman*)
- Night time shelter was an RCC shed of size 561.7 sq ft with concrete floor
- The shelter was cleaned once in a day with water spray and spade

Shelter is an important feature of a captive animal's life as it is compelled to spend its life within it. This was rated using five sub-parameters. Mean rating was 6.2 (SE = 2.3, N= 5), showing the occurrence of moderate conditions (Figure 1).
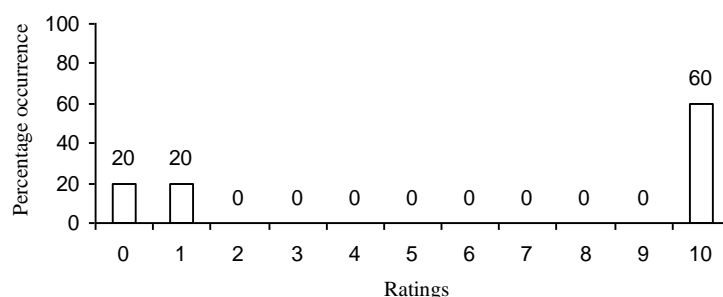
Figure 1: Percentage occurrence of ratings for shelter

Provision of natural conditions, including allowing the animals to free range, was given high rating values. Mean rating was 1.1 (SE = 0.0, N =7) showing existence of bad conditions. Use of natural substrates has been given high rating values while hard substrates are rated low. Mean rating was 0.0 (SE= 0.0, N =7) indicating use of unsuitable substrates at night.

Keeping animals confined within a circumscribed area requires regular cleaning to prevent accumulation of animal excreta. Mean rating (Figure 2) was 10.0 (SE =0.0, N =7).

Sh-t: Shelter type   Fl-d: Floor type (day)
Fl-n: Floor type (night)   Sd: Shade availability
Hy: Hygiene maintenance
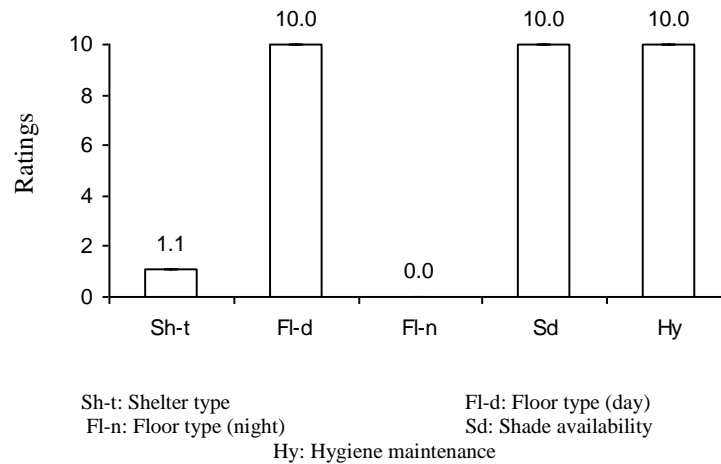
Figure 2: Ratings for shelter related parameters

Water availability and use

- All the elephants had access to tap water
- Number of times drinking/ day = 3
- Average quantity of drinking was 128.9 l (SE = 6.9, N =7)
- Water quality tests were done
- Bathing place was open ground
- Duration of bath (hrs): Mean 0.6 h (SE = 0.1, N = 7)
- Summer bath time: Mean 1.4 h (SE = 0.1, N =7)
- Seasonal variation in bathing: Summer– 3 times, Winter– once
- Materials used for bath: Plastic and Scrubber

Occurrence of water is considered important for wild elephants (Mckay, 1973). Availability and use of water for drinking and bathing was rated considering occurrence and ease of accessibility, quantity and/ or duration of the activity, and use of appropriate materials. Mean rating was 5.1 (SE = 1.7, N= 6) with 48 % of all the rating values getting a score less than four (Figure 3).
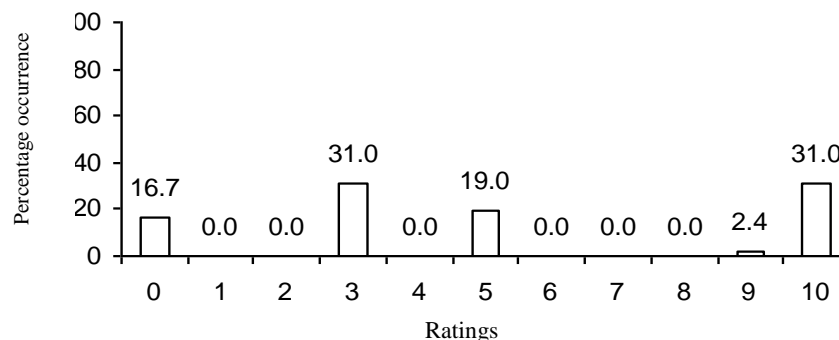
Figure 3: Percentage occurrence of ratings

Running water sources are less prone to contamination when compared to stagnant sources. Mean rating was 3.0 (SE = 0.0, N= 7) showing use of tap water for all the observed animals. High rating value was given when duration accounted for 1to 2 % of a day. Mean rating was 2.9 (SE = 0.4, N = 7).

The location of the zoo in a region with relatively high ambient summer temperature necessitates measures to maintain body temperature of the elephants. Mean rating for summer bath duration (Figure 5) was 5.0 (SE = 0.0, N = 7). Use of hard, abrasive scrubs has been given low rating value. Mean rating was 0.0 (SE =0.0, N = 7).

Pr-w: Availability of perennial water source   Qn: Quantity of water provided for drinking
W-t: Water quality tests   Bt-du: Bath duration
Bt-duS: Bath duration summer   Bt-m: Bathing materials used
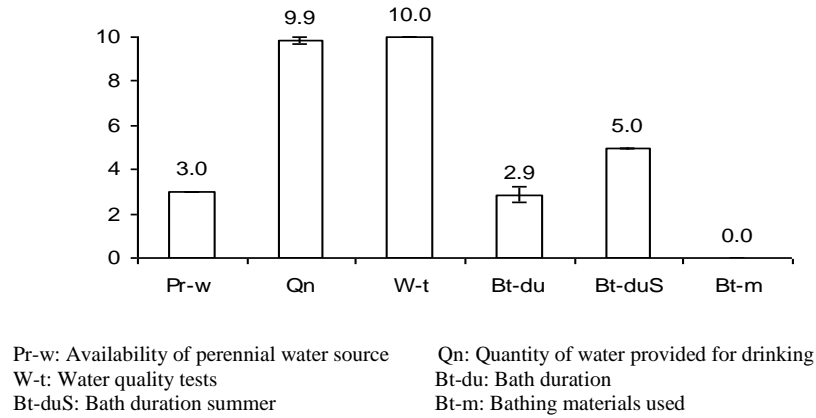
Figure 4: Ratings for water related parameters

Rest and sleep
- All the elephants were allowed to rest
- Resting place was the shelter/ enclosure
- Type of shade during day/night: Day− trees, Night− enclosures
- Mean sleep duration was 6.9 h (SE = 0.7, N =7)

Wild elephants are known to rest during hot periods of the day and also they sleep during the night (Kurt and Garai, 2007). This parameter was rated considering factors such as opportunity for rest/ sleep, duration and place. Mean rating value was 4.9 (SE = 2.1, N= 5) with 51% of all the rating values getting a score less than two (Figure 6).
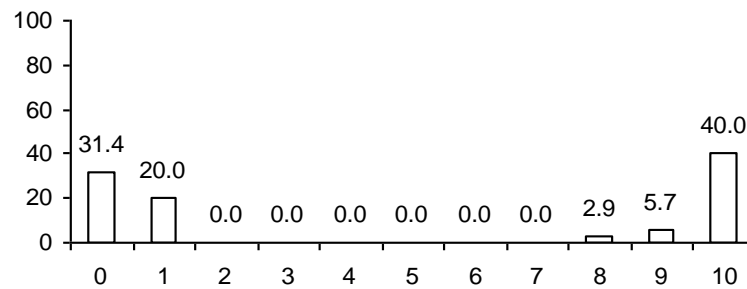
Figure 5: Percentage occurrence of ratings

All the observed elephants were given opportunity for rest and sleep. Hence, rating for both sub-parameters was 10.0 (SE =0.0, N =7). The elephants were said to be kept within enclosures at night. Hence, rating for sleeping place (Figure 7) was 0.0 (SE =0.0, N=7).
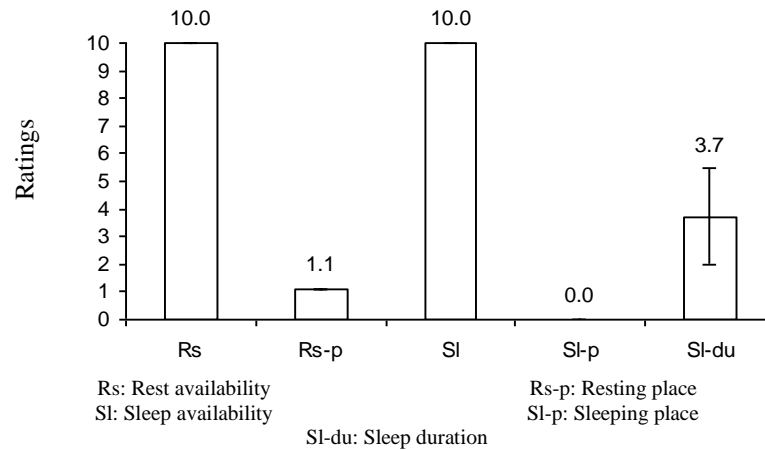
Figure 6: Ratings for rest and sleep related parameters

Opportunity to walk
- The elephants were walked for 2 to 2.5 kms over a duration of 1 to 2 h.

Elephants are known to be active for most part of a day (Kane,et al., 2005). Confining elephants within restricted spaces may involve reduced opportunity to walk / be active. This parameter was rated by taking into account the opportunity provided to the animals to walk and the nature of terrain used for walking. Mean rating for walk was 10.0 (SE = 0.0, N= 4) whereas the mean rating for nature of terrain was 0.0 (SE = 0.0, N =4).

Social interaction
- All the elephants were said to be allowed to interact in the open area for 9 h.
- Location of interaction was feeding site and bathing area
- Type of interaction: Cajoling, trunk interaction, greetings etc.

Provision for social interaction among members of the same species is of paramount importance to animals such as elephants which are known for maintaining long lasting relationships within family units (Vidya and Sukumar, 2005). This parameter was rated using four sub-parameters. Mean rating was 8.0 (SE = 1.4, N= 4) and about 50% of the values fall under 10 (Figure 8).
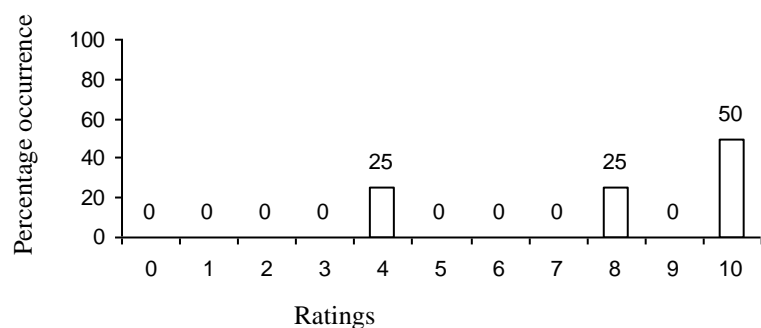
Figure 7: Percentage occurrence of ratings

All the observed elephants were said to be allowed to interact. Hence, rating was 10.0 (SE =0.0, N=7). Duration for which interaction was allowed was rated (Figure 9). Mean rating was 4.0 (SE = 0.0, N =7).

In: Opportunity for interaction   In-hr: Interaction hours
Gr-sz: Group size   In-ds: Distance between animals
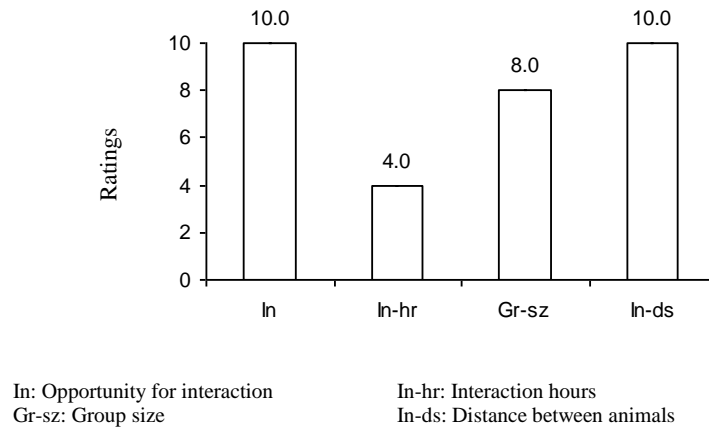
Figure 8: Ratings for social interaction related parameters

Chaining

- All elephants were chained at night for 15 h in the shelter
- Region of chaining: one front and one back leg
- Chain weight: 66 Kg
- Chain length: 14 m
- Not allowed to free range.

Management of captive elephants using chains is a widespread practice. This parameter was rated considering the region of chaining and whether allowed to free range or not. Mean rating value was 1.7 (SE = 1.7, N=3) showing occurrence of bad conditions (Figure 10).
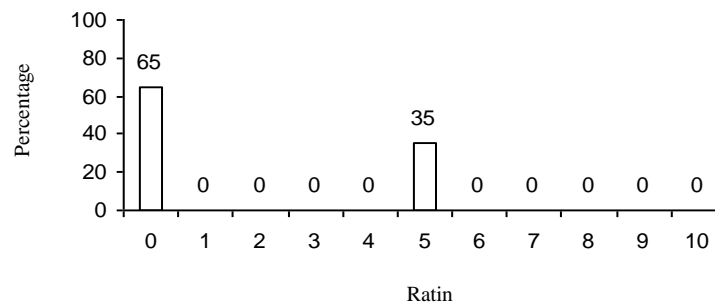
Figure 9: Percentage occurrence of ratings

The sub-parameter of free ranging provides an indication of the chained or free ranging status of the elephants. Low rating values reflect greater proportion of chaining duration. Mean rating was 5.0 (SE = 0.0, N=7). It is a common practice to allow working elephants to free range at night. Mean rating value was 0.0 (SE =0.0, N=7).

Fr/Ch: Free-ranging or chained   Ch-r: Chaining region
Fr-n: Free-ranging at night

Figure 10: Ratings for chaining related parameters

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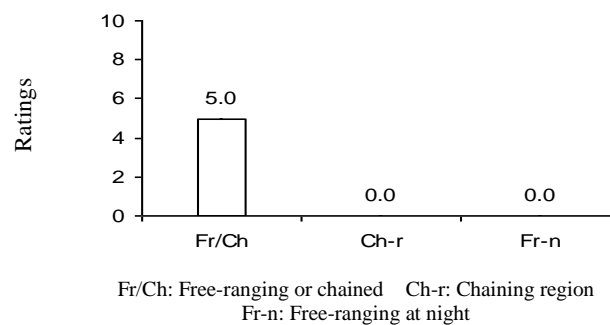
Observed behaviour
- Vijay (male, 23 yrs) described as agitated, nervous and aggressive towards strangers
- Asha (female, 35 yrs.) described as nervous, aggressive at times towards mahout
- Remaining elephants: reliable/ quiet

This parameter was rated based on the temperament of the animal and incidence of aggression. Mean rating value for observed temperament of the elephant was 7.1 (SE = 1.8, N= 7) with two elephants (Vijay, male, 23yrs. and Asha, female, 35 yrs.) said to be nervous/ agitated. Mean rating for aggressive behaviour was the same as for observed temperament.

Work
- Work type was either zoo exhibition, rides, Tourism, Minor lumber, or commission for festivals
- As zoo exhibit: work duration was from 8 a.m. to 5 p.m.
- Rides: 3 to 5 p.m.
- Mean age when elephant began working was 19.6 yrs (SE = 2.9, N = 5)
- Rajani/Vanaja (female, 41 yrs) were also used in festivals to take part in processions
- Vijay, Jamuna, Anarkali and Rani: made to beg from zoo visitors for mahout
- Jamuna and Rajani-Vanaja worked 1 extra hour during summer
- Number of people carried on rides: 6 adults or 8 children
- Howdah weight: 50 Kg; type: wooden, padded with grass
- Mean number of trips/day: 14 (SE = 1.9, N = 4)
- Shade availability during work: no shade for two working elephants that were available as part of zoo exhibits
- Water was available for four animals and not available for one elephant, namely, Jayan
- Food was available for all the observed elephants (N = 5) during work
- Food type: Provided by visitors: banana, fruits etc. Provided by zoo: grass

Rating values were designed to reflect the work conditions which promoted natural behaviour. Mean rating value for this parameter was 5.0 (SE =1.9, N = 5) with 52% of all rating values getting a score less than six (Figure 12).
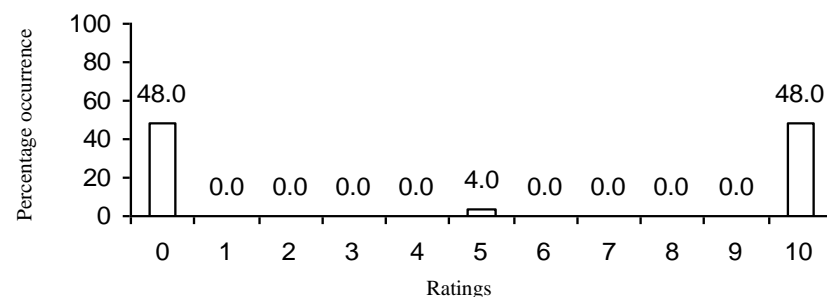
Figure 11: Percentage occurrence of ratings

Low rating values were designed to show the use of elephants for unnatural work types. Mean rating was 0.8 (SE =0.8, N= 6) as the animals were said to be used for tourist rides. Some elephants were also said to be made to seek money from zoo visitors. Working elephants are made to bear weights of varying heaviness. However, the animals have to bear this weight repeatedly during the course of work. Mean rating (Figure 13) was 0.0 (SE = 0.0, N=4).

Provision of shade for animals exposed to high ambient temperatures during work is important in maintaining its well-being. Mean rating value was 6.0 (SE = 2.4, N =5) with two elephants, Jayan (male, 36 yrs) and Rajani / Vanaja (female, 41 yrs) not having access to shade.

W: Work type   Wgt: Average weight carried
Sh: Shade availability   Wt: Water availability during work
Fd: Food availability during work
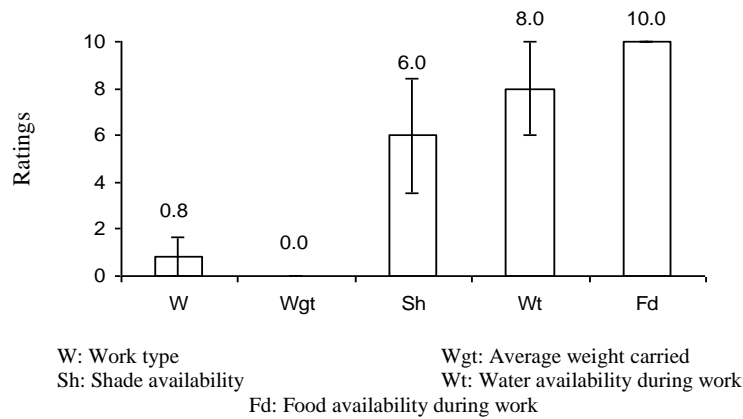
Figure 12: Ratings for work related parameters

Food provisioning

- All except the two males (Vijay and Jayan) were provided both stall feed and allowed to free range to browse/ graze within their zoo enclosures
- Stall food: Grass, Fodder, Rice (*Oryza* sp.), Jaggery, Ragi (*Panicum* sp.), Salt, Sugarcane (*Sacharum* sp.), Banana (*Musa* sp.), Tender coconut
- Food source: Zoo owned farm, Ragi and salt from kitchen, Sugarcane and banana from the market
- Quantity: Grass-30 katta (bundles), Fodder-30kg, Rice-Jaggery, Ragi, Salt-2/3 kg each, Sugarcane− 4 pieces, Banana-4 each, coconut−2
- Sugarcane, banana not given daily for Vijay, Anarkali, Rani, Rajani-Vanaja
- Type of mineral mixture given: Agri-min daily
- Ration chart used for all elephants
- Straw provided: Sorghum/Napier, once a day
- Same food provided throughout the year

Wild elephants have been observed to feed on a variety of plants as they forage (Mckay, 1973). Food provisioning in captive conditions might not be able to replicate the variety seen in the wild, considering the restrictions imposed on space. Rating values were designed to reflect this phenomenon; management practice of maintaining diet charts was also included with this parameter. Mean rating was 7.2 (SE = 1.7, N = 4) and 50% of the values fall under 10 (Figure 14).
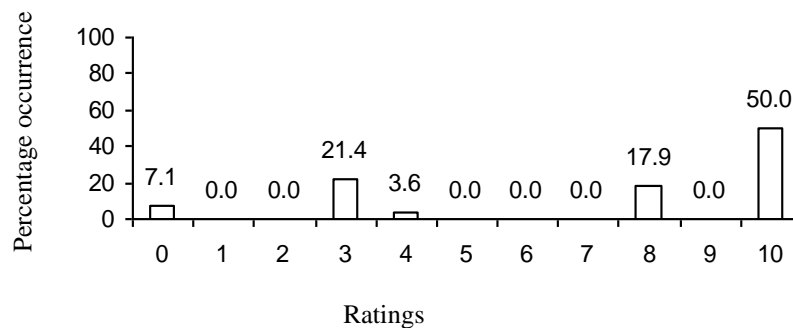
Figure 13: Percentage occurrence of ratings

High rating values show opportunity to free range for foraging as well as provision of stall feed. Mean rating was 5.7 (SE = 1.5, N =7) with both male elephants (Vijay, 23 yrs and Jayan, 36 yrs) being provided only stall feed. The number of items provided during stall feed is an indication of the variety. However, this variety cannot replicate the range of food observed in the wild. Hence the number of items is divided by two and rated. Mean rating (Figure 15) was 3.1 (SE = 0.1, N =7).

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Fd: Food provisioning type   Fd-n: Number of food items
Mn: Mineral mix given   Rt: Ration chart usage
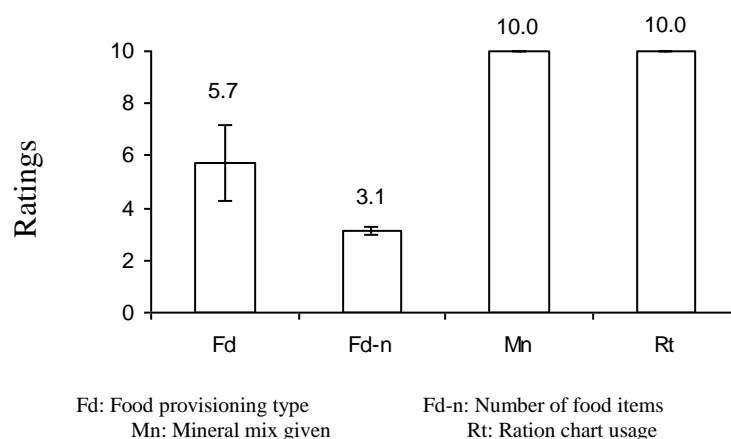
Figure 14: Ratings for food related parameters

Reproductive status

- Four female elephants were said to exhibit oestrus cycles; Both males were said to be reproductively active
- All animals were exposed to the opposite sex
- Anarkali: no observation of mating; Asha: Mating failure; Jamuna and Asha: mated with captive male; Rajani-Vanaja: mated with wild male, one calf born, age at first birth was 21 yrs.
- Both males: no offspring sired
- Musth reported for the elephant Vijay

The expression of reproductive activity among adult animals is considered to be an indicator of health (Kurt and Garai, 2007). This parameter was rated using features such as whether reproductively active/ not, exposure to opposite sex, calves born, etc. Mean rating for female reproductive status was 6.4 (SE = 1.0, N = 20) with 35% of all the rating values getting a score less than four (Figure 16).
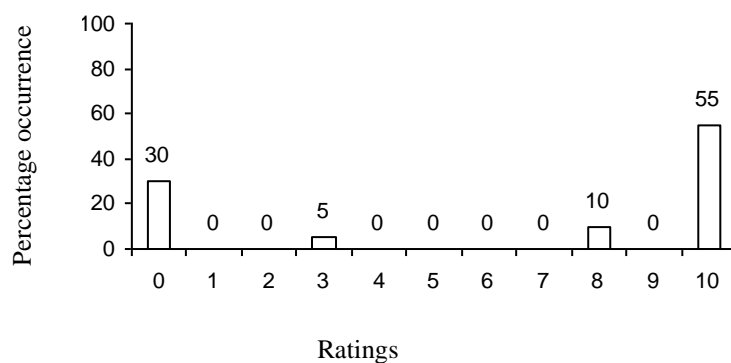
Figure 15: Percentage occurrence of ratings for females

Mean rating for male reproductive status was 6.7 (SE = 2.1, N= 6), and about 67% of the ratings fall under 10 (Figure 17).

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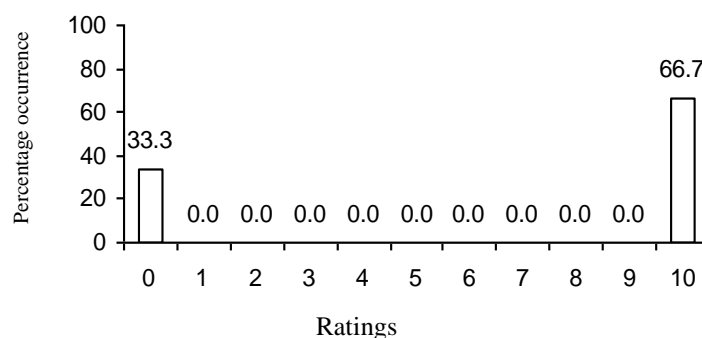
Figure 16: Percentage occurrence of ratings for males

Health status and veterinary care protocol
- Disease/ injury:
  Vijay: Foot rot, Oral cavity problem, Parasites
  Jamuna: Obesity
  Jayan: Foot rot, Fissures, Toe nail cracks, Parasites, Sneezing
  Asha: Foot rot, Fissures in sole, oral cavity problem, Obesity
  Anarkali: Parasites, Respiratory problems, abnormal respiratory sounds
  Rani: Oral cavity, Obesity
  Rajani-Vanaja: Lacerated wounds: left fore leg and rear leg
- Deworming status: Albendozole given once in three months
- Application of oil not practiced
- Blood/ urine/ dung sample testing: Dung tested— Microscopic examination, Once in a month
- Body measurements not taken

Captivity induces certain environments which predispose elephants to ill-health; either the disease is observed in lesser frequency among wild animals or as a consequence of exposure to certain species not usually encountered in the wild (Kaufman and Martin, in press). Overall mean for this parameter was 6.4 (SE = 1.8, N= 7) with 36% values getting a rating less than four (Figure 18).
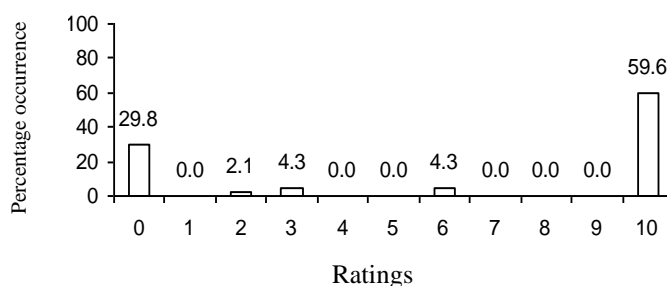
Figure 17: Percentage occurrence of ratings

The disease/ injury which led to other health problems were chronic and incurable and were given low rating values. Mean rating (Figure 19) was 5.1 (SE = 0.9, N =7). Captive elephants are normally subjected to the practice of application of oil to different parts of the body: such as insect repellant/ to bring down body temperatures. Mean rating was 0.0 (SE = 0.0, N =7).

Taking body measurement of elephants is considered to be an important source of recording growth, development and any deviation from the normal. Mean rating was 0.0 (SE =0.0, N =7).

Ds/In: Nature of disease/ injury   Dw: Deworming done
Fq-dw: Frequency of deworming   Ol: Oiling done
Ts: Tests of dung/ urine/ blood   Fq-ts: Frequency of tests
Bd: Body measurements taken
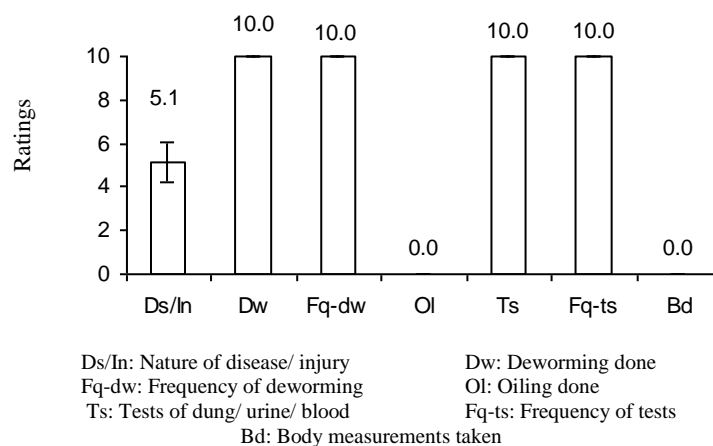
Figure 18: Ratings for health and veterinary care related parameters

Veterinary personnel and record maintenance
- One veterinary doctor with 21 years experience with elephants
- Associated with zoo, daily visits
- Two veterinary assistants available
- Veterinary clinic facility: mini OT, lab, x-ray, Incinator, quarantine, I.P. Ward, Tranquilizer, Dart kit.

Table 1: Profile of facilities available in Zoological Park

	SQ	CS	C	CV	PS	AS	Ch	ZM	AM
No.	0	1	1	available	1	1	available	1	8

SQ: Staff Quarters, CS: Cooking Shed, C: Cook, CV: Cooking Vessels, PS: Provision Shed, AS: Animal Stand, Ch: Chain ZM: Zoo Manager AK: Animal keeper

Availability of veterinary doctors and assistants along with maintenance of clinical/ service/ health records provides an indication of care by the management. It could also be an indirect pointer towards the effect of captivity on elephant health. Mean rating was 9.7 (SE = 0.3, N= 7), and 86% values are under 10 (Figure 20).
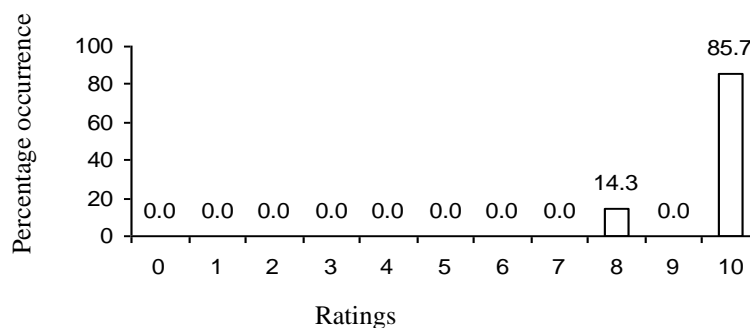
Figure 19: Percentage occurrence of ratings

Mean rating was 8.0 (SE =0.0, N =7) indicating experience in between 20 and 30 years. Daily visits to check the animal's health was given high rating value. Mean rating (Figure 21) was 10.0 (SE =0.0, N=7).

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Vt: Availability of veterinary doctor   Vt-e: Experience with elephants
Ex-n: Number of years experience with elephants   Vs: Frequency of visits
Vt-as: Veterinary assistant availability   Vt-c: Veterinary care facilities available
Rc: Maintenance of records
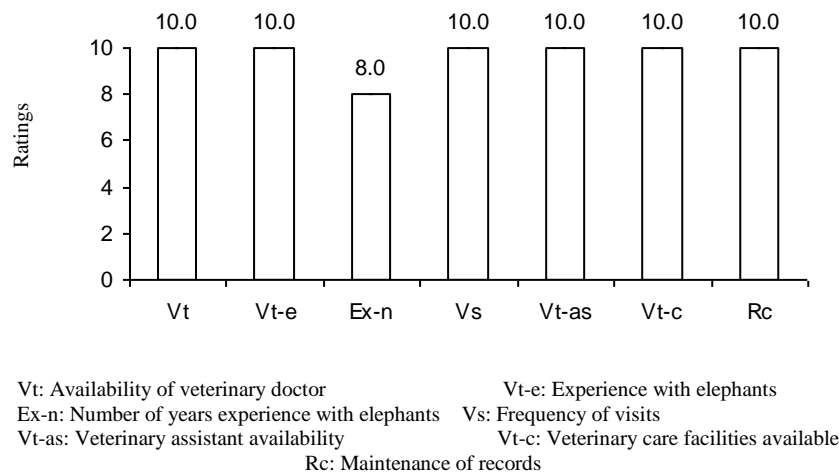
Figure 20: Ratings for veterinary personnel and record maintenance related parameters

Funds required

Overall fund required for each item/animal/year: 4 to 5 lakhs. Funds given: same as required

Welfare status of mahouts

Eight handlers were said to be taking care of the elephants. Mean age was 44.6 yrs (SE = 2.3, N = 8). Mean number of years of experience was 22.5 (SE = 2.6, N=8), ranging from 12 to 35 yrs. Mean number of years of experience with his elephant was 18.7 yrs. (SE = 1.8, N = 12).

Four of the interviewed handlers had relatives in this profession, while one did not. Of the seven mahouts/ handlers, only two were said to have undergone training, the others were said to have learnt at the zoo. Agriculture, tailoring and "Paliya" were listed as family occupations. All the handlers (N = 8) were said to be educated/ literate. Education level ranged from being literate to 10th standard.

Four of the handlers (N = 8) had relatives having worked as animal keeper in the zoo. Of the remaining, two had been mahouts and the rest worked as tailor or in the defence sector. Mean salary was Rs. 95,950 (SE = 10,282.60, N = 8). Most of the handlers (N = 8) were permanent employees, while two were temporarily employed. All the handlers were married with number of children varying from one to eleven.

Number of commands known to handlers ranged from 15 to 36. All the handlers were said to spend 8 hours with their animal. All the handlers used tools to control the animal. Tool used were Metal ankush, wooden ankus, stick pike, bill-hook, kukri. All the handlers were subjected to health check-ups as per zoo protocol. All the handlers were insured. Mean insurance amount was Rs. 50,000 (SE = 16366.30, N = 8). Except for one mahout, all the handlers were said to consume alcohol. Timings of consumption varied from after work to during work hours. Overall ratings for mahouts was 6.3 (SE = 0.4, N= 121) when all the individual rating values were considered across all the observed sub-parameters, 22% value come under 0 and about 40 % under 10 (Figure 22).
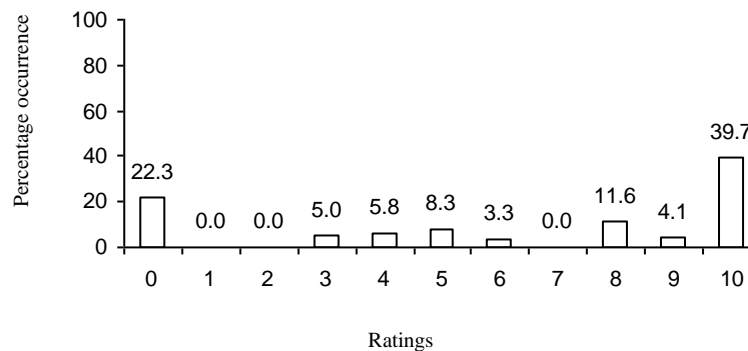
Figure 21: Percentage occurrence of ratings across all sub-parameters

Twelve sub-parameters were used to assess. Overall mean rating was 6.1 (SE = 0.4 N = 90) with 50 % values getting scores between 8 and 10. High rating values have been given for mahouts whose family occupation is handling elephants as this shows tradition based knowledge of the animal. Mean rating was 0.0 (SE =0.0, N=3) with all three mahouts not specifying this as a family occupation. Rating values were designed to reflect a salary capable of supporting a family of four in urban areas. Low rating values indicate inadequate salary. Mean rating value was 9.8 (SE = 0.2, N = 8). Provision of accommodation for handlers was given high rating value. Mean rating was 8.3 (SE = 1.7, N = 6). Handlers covered by insurance were given high rating values. Mean rating was 10.0 (SE = 0.0, N = 8). Consumption of alcohol (Figure 23) by the handlers was given low rating as this practice might endanger the lives of elephants/ people. Mean rating was 1.3 (SE = 1.3, N = 8).

Tr: Training recieved	Fm: Family occupation	Ed: Education status
Sl: Salary	Ch-n: Number of children	Rel: Having mahouts as relatives
Acc: Accommodation availability	Ln: Languages known	Ht: Health check-up status
Ins: Insurance availability	Ins-a: Amount insured for	Al: Alcohol consumption
	T-al: timings of consumption	
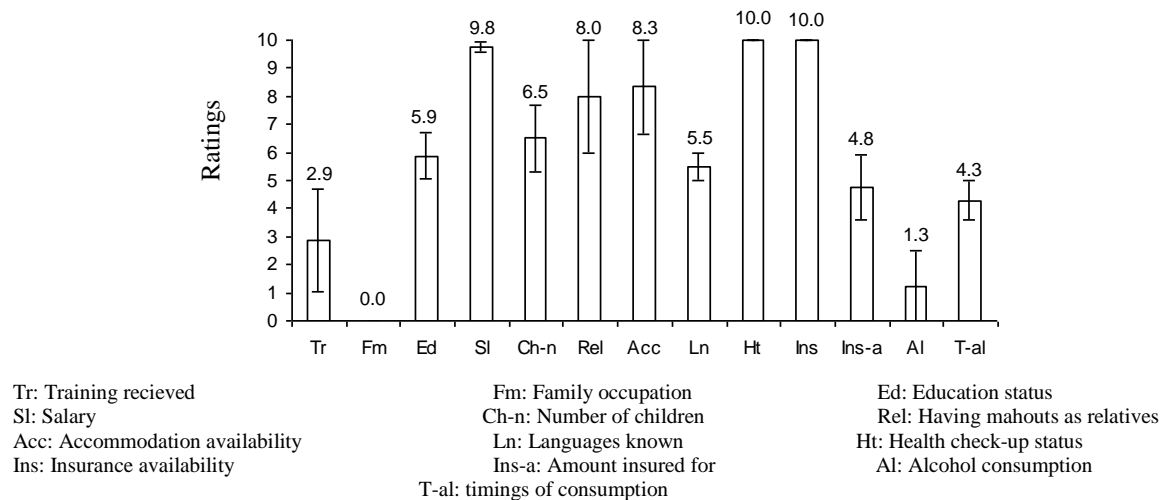
Figure 22: Ratings for socio-economic and profession sub-parameters

Mahout-elephant relation

This was rated considering the handler's experience in the profession (Figure 24), use of tools to control the animal and knowledge of commands. Mean rating was 6.7 (SE = 0.7, N= 31).

Ex-a: Experience as % of his age	Tl: Use of tools
Cm: Knowledge of commands	Hr: Hours spent with elephant
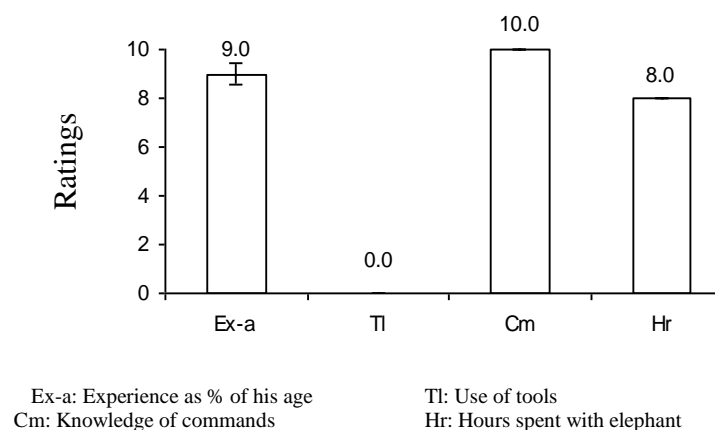
Figure 23: Ratings for mahout-elephant relation sub-parameters

Overall ratings for elephants in Zoological Park

Overall mean rating for the elephants in the zoo was 6.2 (SE = 0.2, N= 373) considered across all the observed sub-parameters. When captive conditions involving physical, social and physiological status were rated exclusively ignoring availability of veterinary personnel and performance of veterinary routines, overall mean rating was 5.7 (SE = 0.3, N= 268) with rating values less than five, contributing 42 % of all the scores (Figure 25).
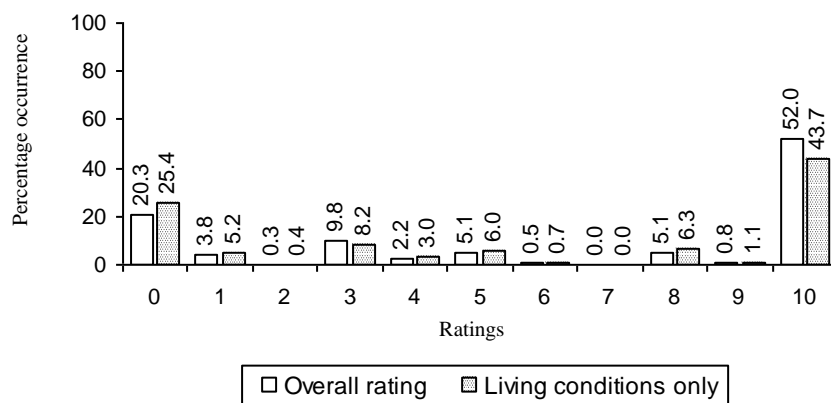
Figure 24: Percentage occurrence of ratings

Discussion

The ecological and social needs of large-sized mammals such as elephants are complex. They are active for the most part of a day foraging/ searching for companions covering many kilometres of varied habitat (Poole and Granli, in press), they form and maintain social relations with a number of individuals (Vidya and Sukunmar, 2005), are able to recognise individuals, use varied means of communication among themselves and have been observed to use tools in different contexts (Kurt and Garai, 2007). These characteristics of physical, social and cognitive abilities entail that captive elephants should be provided with an environment which enables the expression of their species-specific behaviour without having to curtail it due to the expediency of economics.

Elephants at the Nehru zoological park, Hyderabad, were assessed for deviations, if any, experienced in their overall living environment as opposed to those observed for wild, free-ranging conditions. The greater the deviation, the more inappropriate the captive environment is considered to be. The overall mean rating for the elephants in the zoo was 6.2.

There are two aspects to be considered regarding the overall rating:
1. The occurrence of sub-parameters whose values could only be zero or ten without any range in between, indicating presence-absence of a feature (referred to as Yes-No types). Such sub-parameters formed 50% of the observed sub-parameters. Ten scores from such sub-parameters contributed to 38 % of all the individual rating values. This indicates presence of features suitable to elephants.
   However, rating values indicating satisfactory conditions among non-"Yes-No" types, which provide insight into a feature, was only 7.2 % among the observed sub-parameters.
2. Ignoring availability of veterinary personnel and performance of veterinary routines, only physical, social and physiological status considered, overall mean rating was 5.7.

Features of the zoo not conducive to elephants:
1. An elephant's biology is associated with being active for 80 % of a day, travelling across varied habitats (Kane, et al., 2005). The zoo elephants were allowed, when not being used for work, to roam within the four acre enclosure. However, this was limited to people-friendly zoo working hours only (9 hours a day).
   In the absence of information regarding managerial efforts to provide for natural conditions within this area, it is difficult to assess the quality of the open space.
2. Shelter: use of hard substrates has been associated with foot and related health problems in captive elephants (Poole and Granli, in press), (Benz, 2005). All the elephants were exposed to concrete floors for a minimum of 15 hours a day. Also, despite availability of space with natural substrate, all the elephants were confined to their enclosures at night. Three of the seven elephants were said to be experiencing foot related injuries.
3. Wild elephants are said to drink water at least once a day (Shoshani and Eisenberg, 1982). Provision of water through taps implies unavailability when the elephant needs to drink, as they have to depend on people for this. Tap water was a source in this zoo. This source assumes greater importance when ambient temperatures are considered: during summer, temperatures can reach 40° C or more. Bathing with water is considered to be thermoregulatory in elephants (Mckay, 1973).

4. Elephants are social animals, females maintaining long-lasting bonds with other group members (Sukumar, 2003). Young and growing males too need the learning experience of a social group (Lee and Moss, in press).
    On the face of it, the group structure of the elephants in this zoo included males and females of varying ages, allowing interaction. However, their work schedule and overnight chaining prevented expression of species-specific behaviours. Three of the elephants, namely, Jayan (36 yrs, male), Rani (44 yrs, female) and Rajani/Vanaja (41 yrs, female) were used for providing rides to zoo visitors. Rajani was also said to be used in temple festivals. In addition, the remaining elephants were said to be made to seek money by their mahouts from visitors. All the elephants were chained (one front and one back leg) at night within their enclosures for 15 hours. Thus, the entire schedule effectively reduced the opportunity available for the elephants to engage in social behaviour.
5. Among the female elephants, only one animal was said to have given birth— despite the occurrence of adult, reproductively active females and males in the group. Some causes for an abnormal reproductive state could be occurrence of stress due to isolation/ social inexperience/ poor handling (Clubb and Mason, 2002).

Veterinary routine

The zoo has access to a veterinary clinic facility with basic facilities. There is a doctor, with assistants, for veterinary care for the zoo animals.

1. Veterinary routines such as deworming have been practiced regularly. However, the practice of taking body measurements is absent. Body measurements are an indicator of growth and development and have been associated with such important factors as sexual maturity in elephants (Kurt and Garai, 2007).
2. Only dung samples seem to have been tested for the presence of endo-parasites. Three of the seven elephants were reportedly observed to be having respiratory problems. With the facilities available, blood tests could also have been done to check for prevalent diseases and / or bio-chemical parameters.
3. Records though available, were reportedly not maintained.

Transfer across facilities

Mean age at purchase or transfer into this zoo was 13.6 yrs (SE = 4.6, N =7). This age was calculated based on the age of the elephant and year of purchase/ transfer. Kurt and Garai (2007) state the need for young males to establish a period for their musth behaviour and for females to learn/ rise in dominance hierarchy. Both these characteristics maybe achieved when the elephants are older than 20 yrs. The transfer of elephants at a learning age, coupled with the fact of breakage of social bonds in their previous group, if any, might be a source of stress.

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Section 3:
Zoo elephants in Assam

Executive Summary

The zoo cum botanical garden in Guwahati, Assam was established in mid 20th century over a 1.75 sq km area. It houses a variety of indigenous and exotic animals. It houses elephants which have all been rescued from the wild.

This investigation assesses the welfare status of captive elephants and handlers in the zoo by evaluating the physical, social, physiological features of the elephants along with provision for veterinary care and the professional experience and socio-economic status of handlers.

The welfare status of captive elephants has been assessed by comparing physical/ physiological/ social and psychological features in captivity with those observed in the wild. Deviations from wild conditions have been considered to represent poor welfare. The greater the deviation, the poorer the welfare. Deviation from the wild state for the parameters observed was rated using a scale developed by elephant experts.

Assam zoo maintained nine elephants, of which six were males and three females. All the elephants in the zoo were rescued from the wild. Mean Rating (M-R) was 3.0 implying a deviation of 50% from for Expert Rating (E-R).

All the elephants were used for display and some for providing rides to tourists and the M-R was 3.0 with a deviation of 62.5% from E-R.

The elephants were housed in enclosures with earthen flooring and a forest of limited area was adjacent to the enclosure. M-R was 5.9 implying an overall deviation of 26.7% from E-R.

Tap water and a pond was the source of water; tap water was in the *Pilkhana,* Pond, at a distance of 500 m, was used as a bathing source and the pond was described as "unhygienic". M-R was 3.4 indicating an overall deviation of 50.9% from E-R.

Ability to choose when and where to sleep may be absent/restricted for captive elephants due to the control exercised by people. Tethering elephants at night will cause difficulties in movement while sleeping and may result in long-term health problems as a consequence of ill-suited sleeping positions/ poor substrates.

The elephants were walked within the zoo premises for varying durations ranging from 1.5- 2.5 h/day for a distance of 3 km. M-R was 2.3 with a deviation of 70.8% from E-R.

All the elephants had opportunity for interaction and the group consisted of individuals whose mean age was only 9.7 yrs. M-R was 4.3 showing a deviation of 46.7% from E-R.

All the elephants were chained with a plain type of chain and the elephants were tethered by a loose chain to the pole of a tree in the enclosure. M-R was 0.0 with 100% deviation from E-R.

Male and female elephants above 12 y were used for work and work involved providing rides for tourists and carrying fodder. *Gaddi & Gaddeli* (60-90 Kg) were used as cushion while carrying tourists (two per trip). M-R for work type was 4.5, for work duration M-R was 4.0 showing a deviation of 43.8 and 50% respectively from E-R.

Except for a physically handicapped 6 y old female elephant, all others were allowed limited duration of grazing. Free-ranging was either daily during break from duties or else 2 hours a day for three days a week on a rotational basis. Stall feed was Banyan (Ficus sp.) stems, carrot (*Daucus carota*), wheat (*Triticum* sp.), rice (*Oryza*), garlic (*Allium sativum*) ration, sugarcane (*Sachraum* sp.), Banana (*Musa* sp.) stem, Dol grass, Para grass, Pulses (1-2 kg). M-R was 5.3 showing a deviation of 33.8% from E-R.

Reproductive activity of the elephants was not known. Abscesses, stomach related problems, parasites, lacerated wounds were reported. All elephants were dewormed once in 6 months, immunised annually against Foot and Mouth disease, Hemorrhagic Septicemia, Anthrax and Rabies. M-R was 6.2 indicating a deviation of 11.3% from E-R.

All elephants had access to two veterinary doctors with 25 and 15 y experience respectively in treating elephants. The doctors were said to visit the zoo everyday. M-R was 7.1 implying a deviation of 10.7% from E-R.

Mean age of handlers was 34.6 yrs (ranging from 29 to 37 yrs) and experience in this profession ranged from 12- 34 yrs. M-R was 5.6 with a deviation of 37.7% from E-R. All handlers belonged to the tribal/muslim community, education ranged from class 9th to Pre-University level. M-R was 5.0 implying a deviation of 28.7% from E-R.

Overall mean rating for the elephants, considering all the observed parameters, was 4.8 indicating a deviation of 40.3% from the experts' rating. That is, on an average, the deviation was 40% from standards considered suitable for elephants.

Introduction

The zoo cum botanical garden in Guwahati, Assam was established in mid 20th century over a 1.75 sq km area. It houses a variety of indigenous and exotic animals. One among the zoo's aims of conservation is a means of providing rehabilitation for wildlife. It houses elephants which have all been rescued from the wild.

Objective

Existing conditions of captivity may/ may not be suitable for the elephants in that location. Handlers (mahouts/ assistants) also form an integral part of a captive elephant situation. Hence, this study aims to:

- Assess the welfare status of captive elephants in the zoo by evaluating the physical, social, physiological features of the elephants along with provision for veterinary care
- Assess the professional experience and socio-economic status of handlers

Method

Poole and Granli (2009) suggest provision for biologically relevant mental stimulation and physical activity as a way of meeting the biological and behavioural needs of captive elephants. The default environment for elephant, i.e., the wild has shaped elephant needs, an environment in which the need for expansive physical space and complex social interactions have been shaped. Keeping elephants in captivity in alien conditions, with control on day-to-day routines being exercised by people and not by elephants themselves, will have an effect on the welfare of these animals. The welfare status of captive elephants has been assessed by comparing physical/ physiological/ social and psychological features in captivity with those observed in the wild. Deviations from wild conditions have been considered to represent poor welfare. The greater the deviation, the poorer the welfare. Deviation from the wild state for the parameters observed was rated using a scale developed by elephant experts.

Data was collected through observations of elephants/ interview of relevant personnel.

Data Processing

The rating method

A team of 31 experts including elephant biologists, veterinary doctors (studying wildlife disease and captive elephant disease), welfare personnel (working on wildlife conservation and welfare issues), wildlife managers (managing wild, captive elephants) and elephant mahouts rated different parameters of importance to the welfare of captive elephants (Varma, 2008; Varma, et al., 2008; Varma and Prasad, 2008). This rating was then used to assess the welfare status of elephants and elephant keepers:

- Experts rated a total of 114 welfare parameters covering all the major aspects of captivity
- The rating scale was from zero (unsuitable conditions) to ten (suitable conditions). With this logic, experts used maxima based on their concept of the importance of a particular parameter to an elephant. For example mean expert rating of 8.0 (SE= 0.5, N=29) for a parameter 'floor' and 9.0 (SE=0.4, N=31) for 'source of water' was arrived at from the ratings suggested by each expert
- A mean rating for each parameter, across all the participating experts, has been used as the Experts' Rating (E-R) which represents the importance attached to a parameter.
- For example, if an elephant is exposed only to natural flooring, the animal receives a rating of 8 and for entirely unnatural flooring the value is 0; if animal is exposed to both natural and unnatural flooring, the value is 4 (as 8+0/2= 8/2= 4). If an elephant is exposed to a natural water source, such as a river, it receives a value of 9; if the source of water is large lakes or reservoirs, it gets 4.5. A value of 3.5 is assigned for small water bodies like tanks and ponds. Tap water (running) gets 2.5 and if only buckets, pots, and tankers are in use, then the allocated value is 0.5.
- Data for an elephant or a group of animals was collected. With this data Mean Rating (M-R) was calculated for a given parameter, along with its sub-parameters. Thus the Mean Rating (M-R) denotes welfare status of existing conditions on the ground for the particular parameter.
- In this investigation, variables which represent a common feature of the captive condition have been grouped to form a parameter. The variables have been termed sub-parameters. For example, the variables shelter type, shelter size, floor type in the shelter; all represent different aspects of the physical space provided to the elephant. Hence, they are grouped together to form the parameter "Shelter" and each constituent variable is a sub-parameter. In this investigation, the E-R for a

parameter (say, shelter) represents the mean of E-Rs across all related sub-parameters. M-R is also based on similar lines.

- E-R and M-R for each of the zoos here represent the average across related parameters observed for that zoo. For instance, E-R / M-R for a parameter "shelter" represent the average of related parameters (termed sub-parameters) such as type, flooring, size, and shade availability. Not all related parameters will be rated for each of the zoos. The number of such related parameters varies for each zoo.
- Results have been presented comparing E-R and M-R as a means of comparing the extent of deviation present in the parameters observed. The difference between E-R and M-R (expressed as percentage) indicates deviation from the prescribed norm.
- For handlers, the difference between the maxima provided by experts (E-R) and existing status (M-R) has been used to indicate the professional/ socio-economic status of value to the handler and his elephant.
- N refers to number of sub-parameters for an observed parameter.

Result

Assam zoo maintained nine elephants, of which six were males and three females. Figure-1 gives mean ages of males and females. Female age ranged from 5.4 – 19 yrs while male age ranged from 5.2 – 14.1 yrs.
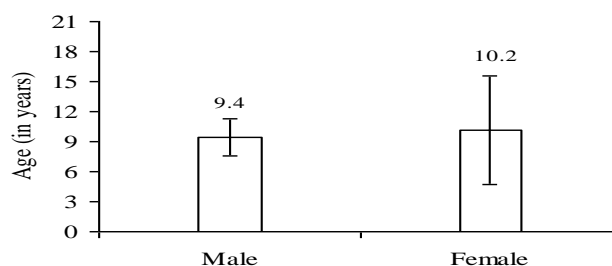
Figure 1: Mean age of male and female elephants

Source

Transfer of elephants from a wild environment to captive conditions involves exposure to a number of human controlled features. This change of environment will be stressful.

- All the elephants in the zoo were rescued from the wild
- Age at rescue ranged from week/ month old calf to an eight year old male
- Most elephants (six of the eight for which data was available) were less than four years old when rescued

M-R was 3.0 (SE= 0.0, N= 9) implying a deviation of 50% from E-R.

Purpose of keeping

Keeping elephants in semi-natural conditions without commercial interest has been given high rating.

- All the elephants were used for display
- Some for providing rides for tourists

M-R was 3.0 (SE= 0.0, N= 7) with a deviation of 62.5% from E-R.

Shelter

The physical space provided for elephants is an important determinant of welfare as wild elephants are known to traverse vast distances across varied terrain (Poole and Granli, 2009), their home range size may range from 100 to 300 sq km (Sukumar, 2003).

- The elephants were housed in enclosures with earthen flooring
- A forest of limited area was adjacent to the enclosure
- Shade was available in the form of trees
- The enclosure was cleaned twice daily but hygiene was described as "moderate"

M-R was 5.9 (SE= 1.3, N= 7) implying an overall deviation of 26.7% from E-R (Figures 2 and 3).
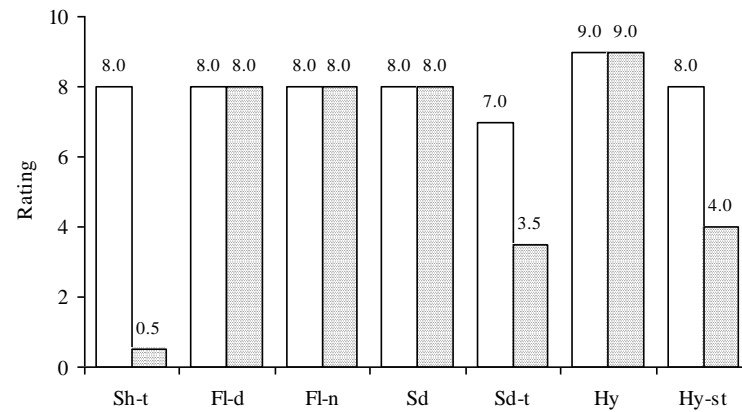
Figure 2: Comparison of E-R and M-R for shelter sub-parameters
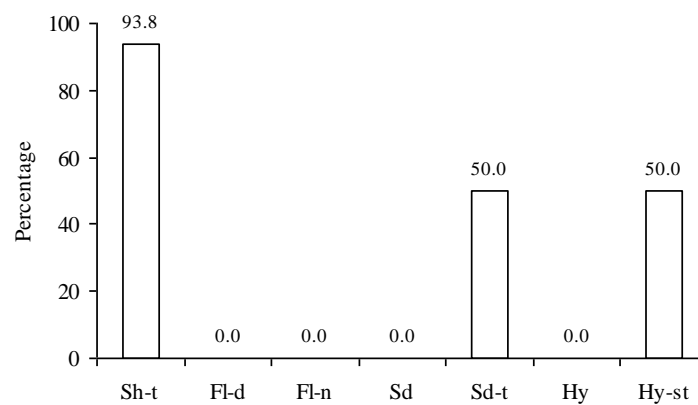
Sh-t: Shelter type   Fl-d: Floor (day)
Fl-n: Floor (night)   Sd: Shade availability
Hy: Hygiene maintenance   Hy-st: Status of hygiene

Figure 3: Percent deviation from E-R for shelter sub-parameters

Water

Access to water for drinking is an important part of a wild elephant's range of activity, dust-bathing, wallowing and socialising complementing the range of behaviours (McKay, 1973). In captivity, handlers bathe elephants, hence materials used for scrubbing has also been rated.

- Tap water and a pond was the source of water; tap water was in the *Pilkhana*
- Pond, at a distance of 500 m, was used as a bathing source
- The pond was described as "unhygienic"
- The elephants consumed water 2-4 times/ day; bathing was twice daily in summer and once daily in winter
- Bath duration was 0.5 – 2 h; scrub materials were coconut husks, grass and stone

M-R was 3.4 (SE= 1.1, N= 7) indicating an overall deviation of 50.9% from E-R (Figures 4 and 5).
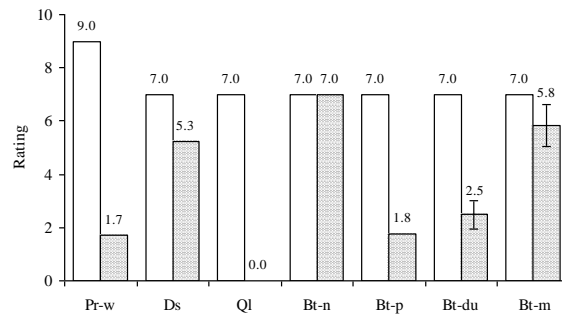
Figure 4: Comparison of E-R and M-R for water sub-parameters
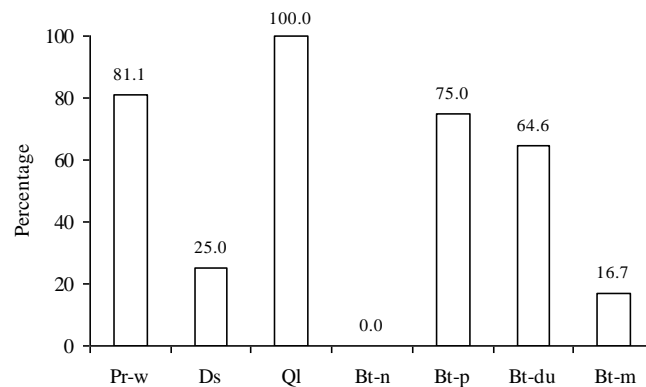
Pr-w: Perennial source of running water   Ds: Distance to water source
Ql: Water quality tests   Bt-n: Bathing number of times/day
Bt-p: Bathing place   Bt-du: Bath duration
Bt-m: Bathing materials

Figure 5: Percent deviation from E-R for water sub-parameters

Sleep

Ability to choose when and where to sleep may be absent/restricted for captive elephants due to the control exercised by people. Tethering elephants at night will cause difficulties in movement while sleeping and may result in long-term health problems as a consequence of ill-suited sleeping positions/ poor substrates.

- The enclosure was also the sleeping place for all the elephants
- Hygiene maintenance was moderate in the enclosure

M-R was 3.0 (SE= 0.0, N=8) showing a deviation of 62.5% from E-R for this single parameter.

Walk

A species-typical activity that is also integral to maintenance of foot care is the opportunity provided to walk for captive elephants. (Mikota et al., 1994) mention the association between reduced magnitude of walks for elephants in western zoos and the need to provide for foot care.

- The elephants were walked within the zoo premises for varying durations ranging from 1.5 to 2.5 h/day for a distance of 3km.
- Time of walk was in the morning or between 2 to 4 p.m.

M-R was 2.3 (SE= 1.6, N= 3) with a deviation of 70.8% from E-R (Figures 6 and 7).
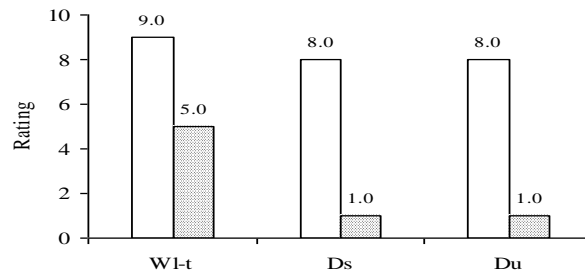
Figure 6: Comparison of E-R and M-R for walk sub-parameters
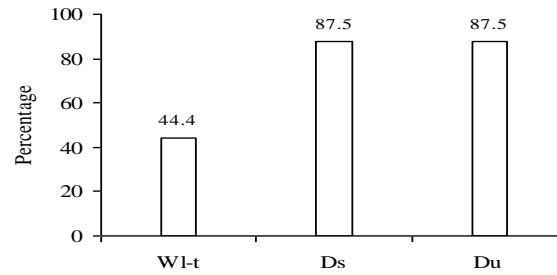
Wl-t: Time of walk   Ds: Distance covered   Du: Walk duration

Figure 7: Percent deviation from E-R for walk sub-parameters

Social interaction

Elephant society has been described as complex (Poole and Taylor, 1999), lasting across generations (Sukumar, 2003). In captivity, even if companions are present, it will be limited in terms of duration or group composition.

- All the elephants had opportunity for interaction
- The group consisted of individuals whose mean age was only 9.7 yrs
- Interaction hours was restricted to 2- 2.5 h

M-R was 4.3 (SE= 2.6, N= 3) showing a deviation of 46.7% from E-R (Figures 8 and 9).
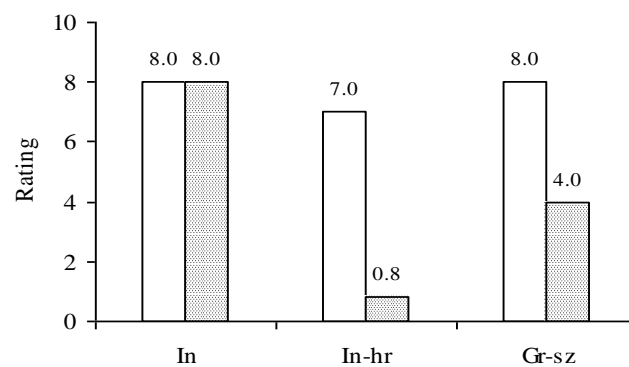
Figure 8: Comparison of E-R and M-R for interaction sub-parameters
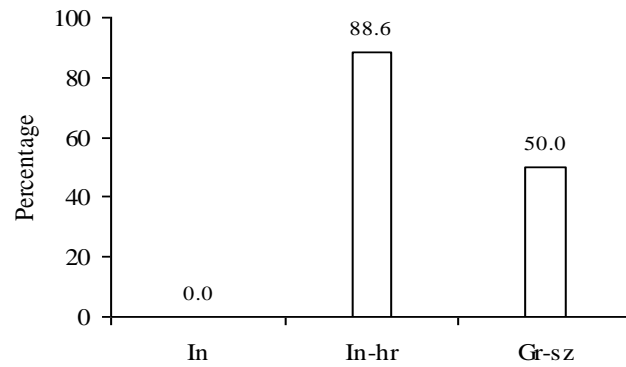
In: Interaction   In hr: Interaction hours   Gr-sz: Group Size

Figure 9: Percent deviation from E-R for interaction sub-parameters

Chaining

The practice of chaining captive elephants is widespread as it is considered a way of managing the animals. Restraining elephants' movements will create frustration due to inability to perform species-typical behaviours. Prolonged duration of a single activity without recourse to move freely may not be suitable for their psychological and physical health.

- All the elephants were chained, with a plain type of chain
- The elephants were tethered by a loose chain to the pole of a tree in the enclosure
- Chains were removed when the elephants were walked/ bathed
- The elephants that were left to free range at night were hobbled

M-R was 0.0 (SE= 0.0, N= 4) with 100% deviation from E-R (Figures 10 and 11).
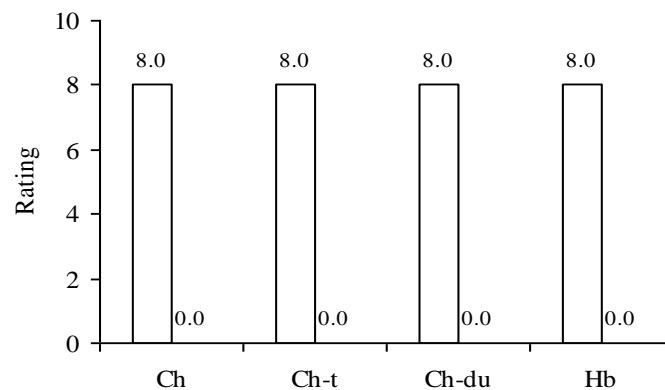
Figure 10: Comparison of E-R and M-R for chaining sub-parameters
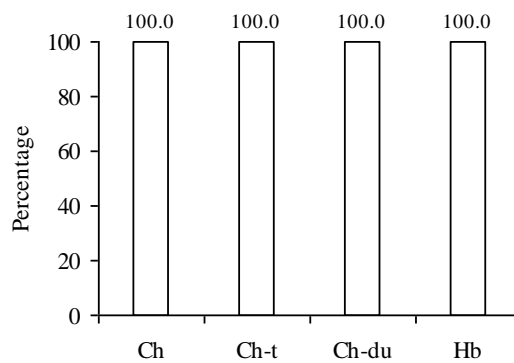
Ch: Chaining status   Ch-t: Chain type   Ch-du: Chaining duration
Hb: Hobbling of forelegs

Figure 11: Percent deviation from E-R for chaining sub-parameters

Observed behaviour
Temperament that enables easy handling of elephants has been given high rating.

- Three of the elephants (all females) were described as quiet/ reliable, one was said to be easily frightened.
- There were no reports of aggression towards people

M-R for temperament was 6.0 (SE= 2.3, N= 4) and for occurrence of aggression/ killing/ injury of people was 9.0 (SE= 0.0, N= 3) showing a deviation of 25% and 0.0% respectively, from E-R.

Work
The kind of work elephants perform/ do not perform is an important indicator of their captive condition. Absence of work and restriction on movement is not conducive to a healthy psychological/ physical constitution.

- Male and female elephants above 12 yrs were used for work
- Work involved providing rides for tourists and carrying fodder
- Duration of work was 1.0 – 1.5h, in the afternoon (2.30 to 4.00 p.m.)
- *Gadd* (60 to 90Kg) was used as cushion while carrying tourists (two per trip)

M-R for work type was 4.5 (SE= 1.4, N= 8), for work duration M-R was 4.0 (SE= 0.0, N= 3) showing a deviation of 43.8 and 50% respectively from E-R.

Food
A wide variety of plants are eaten by wild elephants (McKay, 1973; Sukumar, 1991) using different parts of their body to manipulate it before eating it. Hence, captive elephant need to learn both the variety and ways of eating it. This can be done only when opportunity is given to free range.

- Except for a physically handicapped 6y old female elephant, all others were allowed limited duration of grazing
- Free-ranging was either daily during break from duties/2 hours a day, three days a week on a rotational basis
- Feeding area was the *Pilkhana* or the forest area within the zoo, stall feed was given in the afternoon
- Stall feed was Banyan (Ficus sp.) stems, carrot (*Daucus carota*), wheat (*Triticum* sp.), rice (*Oryza*), garlic (*Allium sativum*) ration, sugarcane (*Sachraum* sp.), Banana (*Musa* sp.) stem, Dol grass, Para grass, Pulses (1 to 2 kg)
- Commercial cattle mineral mix was given
- Ration chart was used

M-R was 5.3 (SE= 1.6, N= 5) showing a deviation of 33.8% from E-R (Figures 12 and 13).
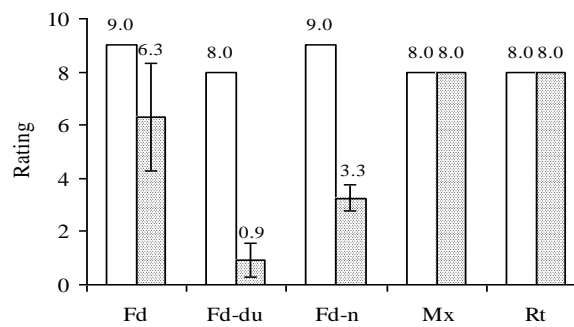
Figure 12: Comparison of E-R and M-R for food sub-parameters
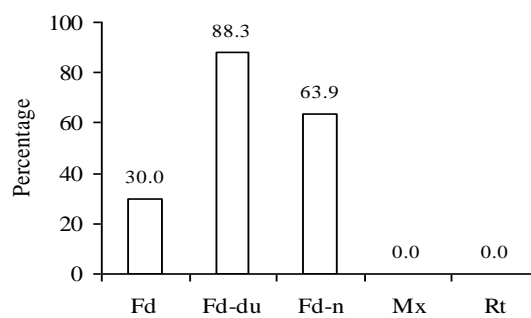
Fd: Food provisioning type   Fd-du: Duration of feeding   Fd-n: Number of food items
Mx: Mineral mix given   Rt: Usage of ration chart

Figure 13: Percent deviation from E-R for food sub-parameters

Reproductive status
Reproductive activity of the elephants was not known (for animals above 10 yrs; three males and one female).

Health status
Captive conditions may predispose elephants to a number of health problems such as prevalence of foot problems (Mikota et al., 1994), excessive weight or malnourishment, etc. Veterinary routines practiced to maintain health has been rated along with disease/ injury occurrence.

- Abscesses, stomach related problems, parasites, lacerated wounds were reported
- Abscesses were seen on foreleg and thigh region
- A female 6y old elephant was reported to have bilateral femoral fracture leading to radial paralysis. She was also blind in one eye
- All elephants were dewormed once in 6 months, immunized annually against Foot and Mouth disease, Hemorrhagic Septicemia, Anthrax, Rabies
- Oiling was not done for all except for a 5.4 yr old female elephant
- Fecal samples tested biannually, blood and urine test was based on necessity

M-R was 6.2 (SE= 0.9, N= 8) indicating a deviation of 11.3% from E-R (Figures 14 and 15).
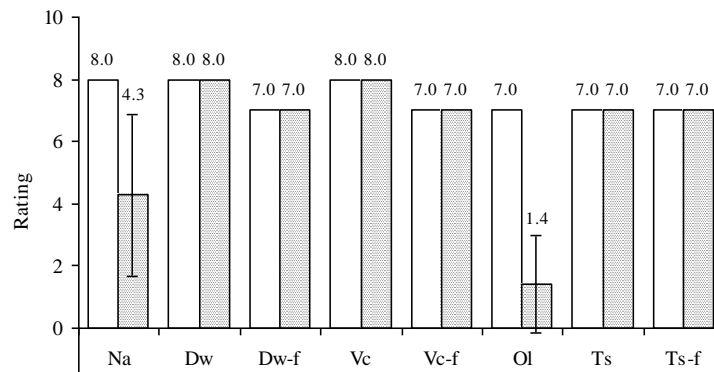
Figure 14: Comparison of E-R and M-R for health sub-parameters
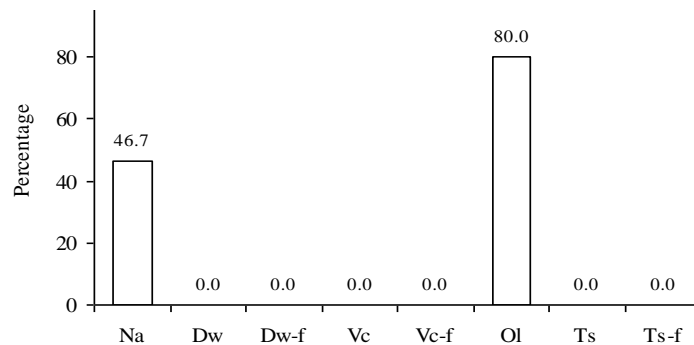
Na: Nature of disease/ injury   Dw: Deworming done   Dw-f: Frequency of deworming
Vc: Vaccination done   Vc-f: Frequency of vaccination   Ol: Oiling done
Ts: Tests of blood/ dung/ urine samples   Ts-f: Frequency of sample testing

Figure 15: Percent deviation from E-R for health sub-parameters

Veterinary personnel and infrastructure

Availability of veterinary personnel of relevant experience and provision of infrastructure is considered to be an important factor in maintaining health.

- All elephants had access to two veterinary doctors with 25 and 15 yrs experience respectively in treating elephants.
- The doctors were said to visit the zoo everyday
- Veterinary assistants were also available
- Staff quarters, cooking shed and vessels, animal stand, camp site, *Pilkhana*, Provision shed, Calf shed, Clinical laboratory, medicine store were available.

M-R was 7.1 (SE= 0.7, N= 7) implying a deviation of 10.7% from E-R (Figures 16 and 17).
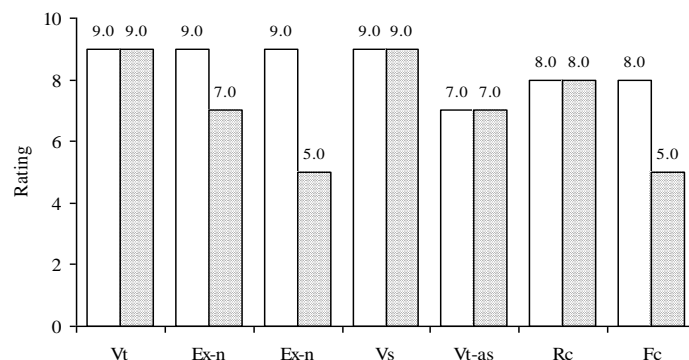
Figure 16: Comparison of E-R and M-R for veterinary personnel sub-parameters

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Vt: availability of veterinary doctor   Ex-n: Number of years of experience
Vs: Frequency of visits   Vt-as: Veterinary assistant availability
Rc: Maintenance of records   Fc: Facilities available
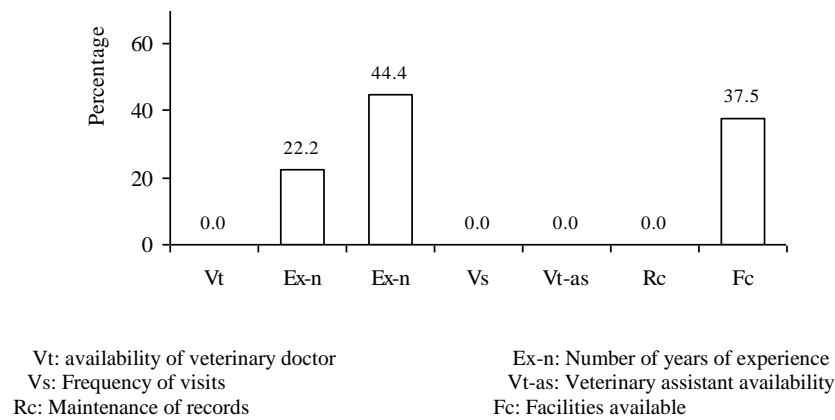
Figure 17: Percent deviation from E-R for health sub-parameters

Figure-18 gives the occurrence of percent deviations, from minimum to maximum, from E-R for all the observed parameters. It can be seen that deviations of 50% or more occurred 22 times (43% of the total).
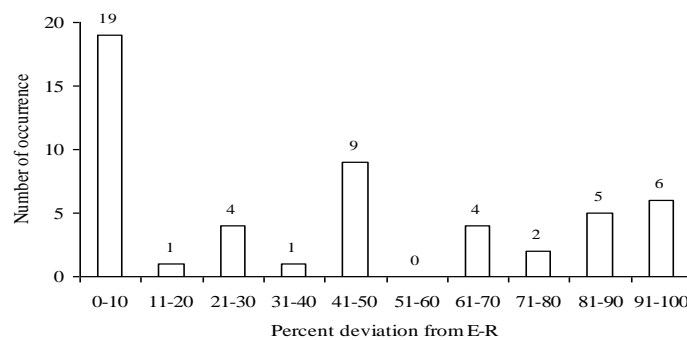
Figure 18: Distribution of percent deviation from E-R across all parameters

Handler status
Data was available for four mahouts and one assistant handler. Mean age was 34.6 yrs (ranging from 29 to 37 yrs).

Professional experience
Poor experience in handling elephants can be dangerous to the animal as well as the handler or general public.
- Experience in this profession ranged from 12 to 34 yrs
- Experience with specific zoo elephant ranged from 0.6 to 5 yrs
- All handlers had opted for this profession as a source of employment
- All had good knowledge of use of commands
- Number of hours spent with elephant ranged from 3.5 to 8 h
- All handlers used tools, wooden stick/ *Khukri* to control their elephant

M-R was 5.6 (SE= 1.7, N= 5) with a deviation of 37.7% from E-R (Figures 19 and 20).
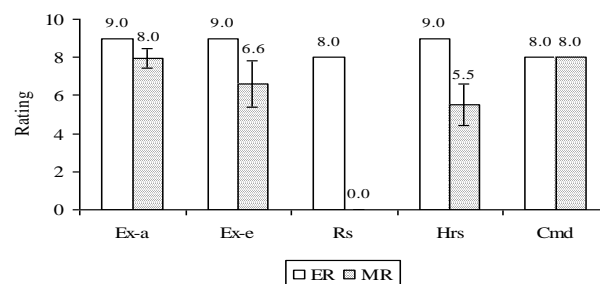
Figure 19: Comparison of E-R and M-R for professional status sub-parameters
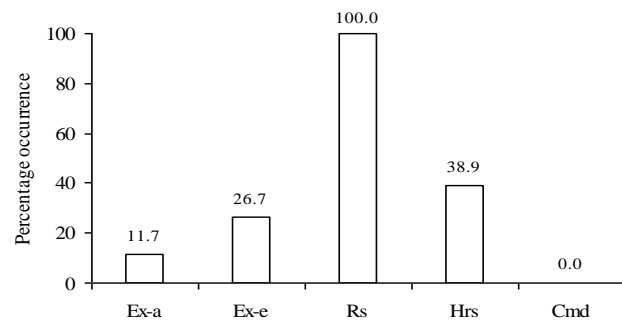
Ex-a: Experience as % of handler age   Ex-a: Experience as % of elephant age
Rs: Reason for choosing this profession   Hrs: Number of hours spent with elephant

Figure 20: Percent deviation from E-R for professional status sub-parameters

Socio-economic status

Prevalence of satisfactory socio-economic conditions in terms of sufficient remuneration, insurance availability, abstinence from alcohol, education at least up to the 10th class, a family occupation dealing with elephants, small family size, etc could help in providing an overall satisfactory status for the handlers which could be reflected in better handling of elephants.

- All handlers belonged to the tribal/ muslim community
- Education ranged from class9th to Pre-University level
- Salary drawn ranged from Rs.84,000 to Rs. 95,000/- annually
- Number of children per family ranged from none to two
- Languages known varied from 1 to 2
- Insurance cover was not available
- Of the interviewed handlers, two did not consume alcohol, while one consumed occasionally after work

M-R was 5.0 (SE= 1.2, N= 7) implying a deviation of 28.7% from E-R (Figures 21 and 22).
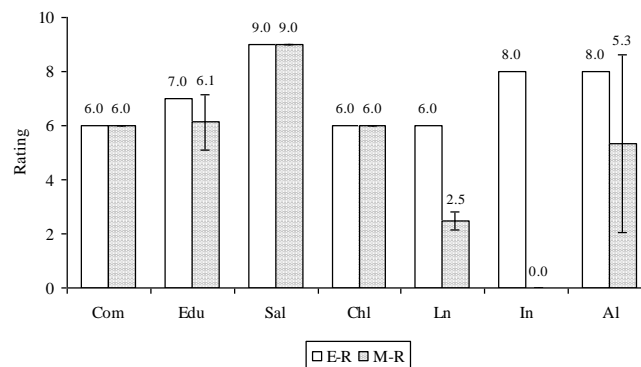
Figure 21: Comparison of E-R and M-R for socio-economic status sub-parameters

Com	Edu	Sal	Chl	Ln	In	Al

Com: Community   Edu: Education level   Sal: Salary drawn   Chl: Number of children
Ln: Languages known   In: Insurance availability   Al: Alcohol consumption
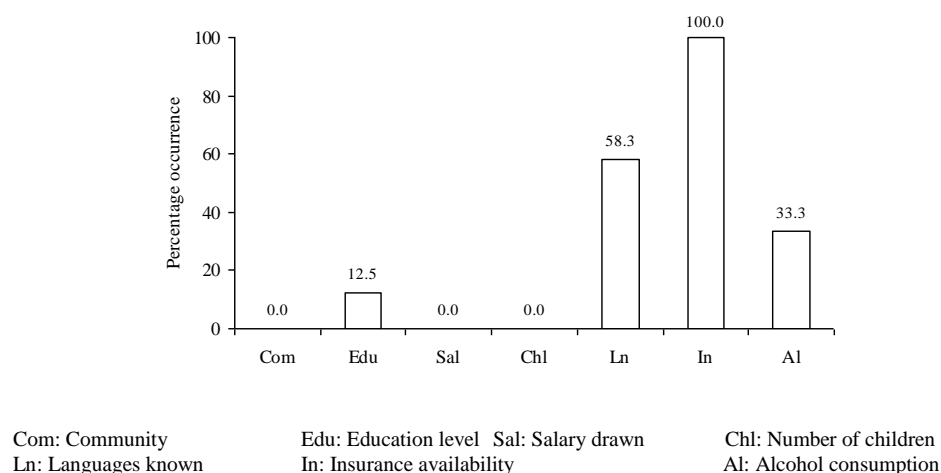
Figure 22: Percent deviation from E-R for socio-economic status sub-parameters

Overall mean rating for the elephants, considering all the observed parameters, was 4.8 (SE= 0.4, N= 51) indicating a deviation of 40.3% from the experts' rating. That is, on an average, the deviation was 40% from standards considered suitable for elephants

Discussion

Captive elephants are dependent on their human benefactors for most of their day to day activities (Bradshaw, 2009). Irrespective of where the elephant is kept, control by the elephant is limited by management decisions. This has consequences for the elephants in terms of the difference in their living conditions (biological and physical) from those experienced by their wild counterparts. It is this difference that has been rated as an indicator of the welfare status of captive elephants in this zoo.

The occurrence of percent deviations (from minimum to maximum), from E-R for all the observed parameters show that deviations of 50% or more occurred 22 times (43% of the total).

Parameters that showed no deviation from E-R:
1. Performance of veterinary routines such as deworming/ immunisation/ sample testing
2. Availability of veterinary personnel of relevant experience

The parameters assessed for welfare included presence-absence types which can only be rated in the two extremes. Such parameters constituted 33% of all the observed parameters. Occurrence of maximum possible rating for such parameters was contributed by health and veterinary personnel (accounting for 6 of the 13 such ratings), 11.8% of all the observed features. That is, nearly 12% of the overall mean rating will contain maximum possible rating for that parameter, contributed by health and veterinary parameters.

Since performance of veterinary routines and availability of veterinary personnel/ infrastructure are common to all the animals in the zoo. The existing welfare rating exclusive to these two parameters may give a precise picture of the status of elephants in the zoo. When these two parameters are excluded, the overall mean rating was 4.0 (SE= 3.0, N= 37) showing a deviation of 49.9% from E-R.

Parameters showing less than 10% deviation:
1. Shelter: provision of an open enclosure with natural substrate and availability of trees was considered suitable for the elephants. This was however, offset by restraining the elephants for most parts of the day by chaining. Consequently, even though flooring was natural, accumulation of excreta in the tethering place led to poor hygiene maintenance and potential source of disease/injury for the elephants.

Parameters showing >50% deviations:
Shelter type, water, food, work and behaviour:

a. The zoo had access to a natural vegetated region of limited space. This was negated by the practice of chaining the elephants in the morning and whenever the animals were not free-ranging. Hence, related features such as walking and opportunity to forage in semi-natural conditions were limited at best. Both these activities constitute nearly 12-18 h of the elephant's daily pattern, depending on food and water availability (Sukumar, 2006). Thus, a major difference in the captive elephants living conditions was observed.

b. The zoo did not have access to perennial source of running water that can reduce contamination. The available bathing source was described as being unhygienic. Drinking water was not accessible to the elephant when needed as the source was tap water.

c. Use of elephants for work of 1-2 h followed by chaining and provision of food is not a healthy practice as it leads to insufficient psychological and physical exercise resulting in negative consequences.

d. Limited interaction, feeling/ touching/ playing, opportunities among the elephants were observed. Considering the complex and long-lasting interactions in elephant society and their 'group living' nature, the absence of the same even when an opportunity exists for its expression is a major negative feature.

e. Foot related problems were observed for three of the young elephants, with one said to be permanently physically disabled. The occurrence of foot problems in young elephants is a cause for concern.

f. Source of elephants: the age structure of the elephants was less than 10y with a single adult female. All the elephants were rescued from the wild. Two aspects can be gleaned from this fact (i) none were captive born (ii) the existing elephant population in the zoo was relatively new. There is no information on the status of elephants prior to this. This leads to a need for a policy for the zoo: the management has to decide whether it wants to continue to rescue and rehabilitate the elephants. If so, release into the wild has to be an option and consequent protocols for proper release of the orphaned/ rescued elephants have to be formulated.

Handler status
The salary paid to handlers was considered to be sufficient; however, there was no provision for insurance cover. All handlers used tools to control their elephant, a practice that may have negative consequences for the elephant.

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Section 4:
Zoo elephants in Gujarat

Executive Summary

Four elephants maintained by two institutions, reside in the state of Gujarat. Of these, two elephants belong to Kankaria Zoo and two belong to a rescue centre, the Geer Foundation.

Welfare status of the elephants was measured by assessment of the living conditions of the elephants, inclusive of the physical, social, physiological and psychological conditions, in order to provide a measure of its welfare status.

Data of the housing conditions, provision of food and water requirements, veterinary care and opportunity for expression of natural behaviours as seen in wild elephants was collected. Each of the observations was represented as a variable or sub-parameter. Each variable/sub-parameter was rated on a 0 – 10 scale for its suitability to the animal. 0 represented the worse possible situation and 10 was considered to be satisfactory.

Mean age of animal kept in the institution was 25 years and the mean rating for source of elephant is 2. Shelter consisted of mud flooring at both places. The rescue centre was 8 – 10 acres in size. Mean rating for shelter related parameter was 6 with 86% of all the rating getting a score less than 6.

Access to a perennial source of running water in the form of a river, pond or tank was available and mean rating was 8.1 implying occurrence of satisfactory conditions of water availability and use.

All the animals were allowed to walk; two elephants were walked to a nearby forest to forage. This was done in the morning and evening and mean rating for walk was 10.

All the elephants had opportunities for day long social interaction. This feature was rated across five sub-parameters and the mean rating was 5 with 80% of all the values getting a rating less than six.

Elephants belonging to the Geer Foundation were allowed to free range for four hours per day in a nearby forest and the rescue centre elephants were not allowed to free range. Mean rating was 3 pointing towards poor welfare conditions. None of the elephants were made to work/perform for public audience and the mean rating was 10.

Both stall feed and browsing/grazing by the elephants was practiced; stall feed included sugarcane (S*accharum* sp.), green grass and hay. Mean rating was 8 indicating satisfactory status for food provisioning.

Musth was reported for both male elephants and all the animals were exposed to elephants of the opposite sex. Mean rating for reproductive status was 6 implying occurrence of moderate conditions for this feature.

Reports of wounds from chaining for one female elephant and watery eyes for one male elephant (which was a regular feature of the animal) was obtained and the mean rating for health related parameter was 3.

All the elephants had access to a veterinary doctor; however, there was no veterinary care facility for any of the animals. Rating was 6 with 75% of all values getting a rating of five.

The overall rating for elephants was 7 with 50% of all the values getting a rating less than six. This rating indicates occurrence of moderate welfare conditions for the observed elephants.

Introduction

Maintenance of elephants in captive conditions by the state or by rescue centres entails that optimum environment is provided for these animals, keeping the welfare of the animal an issue of the highest priority. Four elephants, maintained by two institutions, reside in the state of Gujarat. Of these, two elephants belong to Kankaria zoo and two belong to a rescue centre, the Geer Foundation.

Objective

Information on the welfare status of the elephants by assessment of the living conditions, inclusive of the physical, social, physiological and psychological conditions of the elephants in order to provide a measure of its welfare status.

Method

Data was collected through observation and interviews with mahout/management regarding such aspects as housing conditions, provision of everyday food and water requirements, veterinary care and opportunity for expression of natural behaviours as seen in wild elephants. Each of these features was represented as a variable or sub-parameter. Each variable/sub-parameter was rated on a 0 – 10 scale for its suitability to the animal. 0 represented the worse possible situation and 10 was considered to be satisfactory. The suitability of a sub-parameter depended on the replication of near natural conditions for the animal, i.e., any feature which provided conditions experienced by the animal its wild state was given a rating of 10.

Rating values were graded in the following manner:
- 0 – 2.4:   Bad welfare conditions
- 2.5 – 4.9:   Poor
- 5.0 – 7.4:   Moderate
- 7.5 – 10.0: Satisfactory

Some variables have been clubbed together to represent the overall conditions for that parameter. For instance, the parameter 'shelter' includes sub-parameters such as shelter type, size, flooring, closed or open type, duration the animal is kept within, maintenance of hygiene and materials used. Each sub-parameter is given a mean rating calculated across the observed number of individuals. The mean sub-parametric values are then considered together to give an overall mean for the parameter.

Result

Of the four, two elephants – a female (20 years) and a male (25 years) belonged to the Gir Foundation of the state Forest department. The remaining two animals (one female, 25 yrs., and one male, 30 yrs.) belonged to a zoo. Mean age was 25 (SE = 2.04, N = 4) years and the ages of individual elephants are approximate. Clubb and Mason (2002) cite several authors who state that transfer of elephants across different owners/management systems may result in stress due to breakage of established social relationships and/or introduction of new and unknown animals into a group. Hence, low ratings have been given. Mean rating was 2.0 (SE = 0, N = 4).

Shelter

- Shelter consisted of mud flooring at both places. The rescue centre was 8 – 10 acres in size.
- Hygiene of the shelter was described as good.

The housing conditions provided was rated across seven sub-parameters. Mean rating value was 5.7 (SE = 0.71, N= 7, henceforth *N** refers to number of sub-parameters) with 86% of all the ratings getting a score less than 6 (Figure 1).
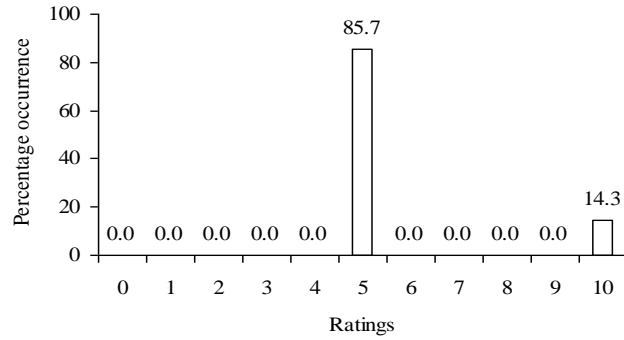
Figure 1: Percentage occurrence of ratings for shelter

Elephants kept in natural forest conditions and allowed to free range are given high rating values. Any deviation from this state gets a corresponding lower rating. Mean rating was 5.0 (SE = 0.0, N = 4). Small size of shelters is given low rating, considering the range covered by elephants in the wild. Rating was 5.0 (SE = 0.0, N = 4). Elephants housed with natural/earthen flooring have been given higher ratings (Figure 2). Rating was 10.0 (SE = 0.0, N = 4). Accumulation of dung and urine near an animal's tethering site leads to associated diseases for the animal. Mean rating was 5.0   (SE = 0.0, N = 4).

Sh: Shelter type   Sh-Sz: Shelter size
Fl: Floor type   Clt: Type of closed enclosure
Du: Duration animal kept in enclosure   Cl-N: No. of times cleaned/ day or week
M: Materials used for cleaning
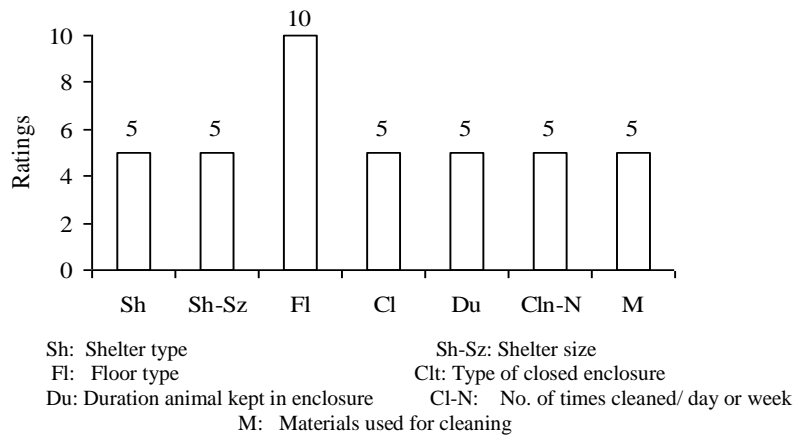
Figure 2: Ratings for shelter sub-parameters

Water availability

- There was access to perennial source of running water in form of river.
- Pond/tanks were also available as water source.
- Distance to water source ranged from 100 meters to zero meters.
- The elephants were said to drink 3 to 4 times/day.
- Bathing frequency was twice per day in a river.
- Bath duration was two hours.

Availability and access to water, for drinking and bathing, is an important part of an elephant's life. Under captive conditions, water may not always be accessible when the animal needs it. This parameter was rated using nine sub-parameters (Figure 3), mean rating was 8.1 (SE = 1.2, N = 9) implying occurrence of satisfactory conditions of water availability and use.

Figure 3: Percentage occurrence of ratings for water

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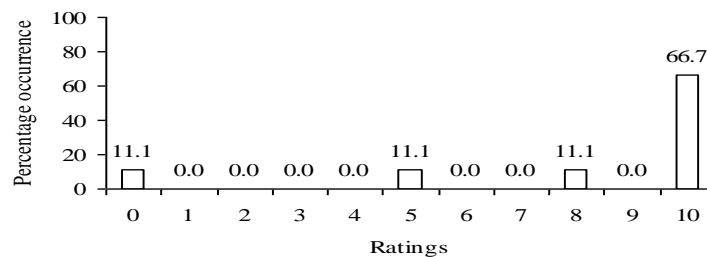
Access to running water throughout the year was given high rating value as such sources are comparatively free of contamination as opposed to stagnant water. Rating was 10.0 (SE = 0.0, N = 4). Water sources which were easily accessible to the animals when needed were given higher rating. Mean rating was 10.0 (SE = 0.0, N = 4). Provision of bathing at least twice a day was given high rating. Mean rating was 10.0 (SE = 0.0, N = 4). Use of hard, abrasive materials like a scrub while bathing elephants was given lower rating (Figure 4) and the mean rating was 5.0 (SE = 0.0, N = 4).
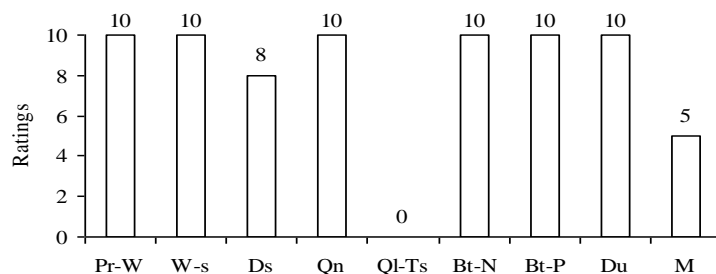
Pr-W: Perennial source of running water   W-s: Water source   Ds: Distance to water   Qn: Quantity of water intake/ day
Ql-Ts: Water quality tests   Bt-N: Number of times bathing   Bt-P: Bathing place
                    Du: Duration of bathM: Bathing materials used

Figure 4: Ratings for water sub-parameters

Rest and sleep

- The animals were not made to work. Hence, opportunity for rest depended on the elephant's choice
- All the animals were allowed to sleep within the shelter premises
- The animals were chained with a five meter chain while sleeping

Duration of sleep was four hours and captive elephants need periods of rest and sleep, especially if they are on display for public in zoos. This parameter was rated considering duration of rest/ sleep, place and size of sleeping area (Figure 5). Mean rating was 8.6 (SE = 0.92, N= 7).
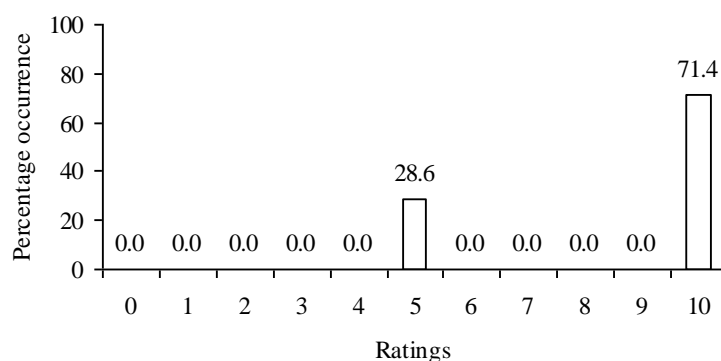
Figure 5: Percentage occurrence of ratings for rest and sleep

All the observed elephants were allowed to rest and not given any work (Figure 6). Rating was 10.0 (SE = 0.0, N = 4). Resting place was similar to the shelter. Rating was 10.0 (SE = 0.0, N = 4). The elephants were chained with a five metre chain at night, hence sleeping area was restricted. Rating was 5.0 (SE = 0.0, N = 4).

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Rs: Rest availability   Rshr: Resting hours/ day   s-p: Resting place   Sl: Sleep availability
Sl-p: Sleeping place   Sl-Sz: Sleeping place size   Du: Sleep duration
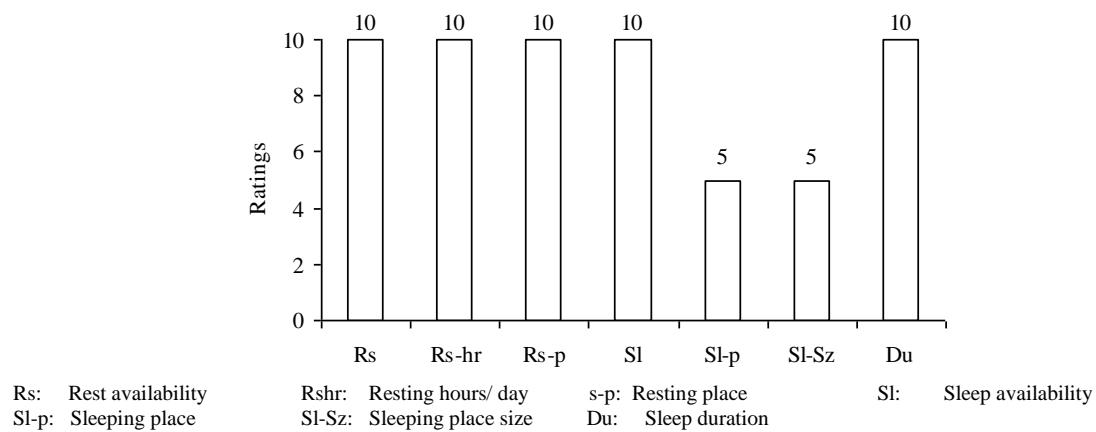
Figure 6: Ratings for Rest & Sleep sub-parameters

Opportunity for exercise (walk)
- All the animals were walked.
- Two elephants were walked to a nearby forest to forage within. This was done in the morning and evening. Nature of terrain was mud.
- Distance covered was 4 – 5 km.

Female Asian elephants have been recorded to range over 30 to 800 km^2 while males may range upto 200 km^2 (Sukumar, 2003). Confined space due to chaining or lack of physical space implies need for suitable opportunity for walking. Mean rating was 10.0 (SE = 0.0, N = 6) indicating occurrence of satisfactory conditions (Figure 7).
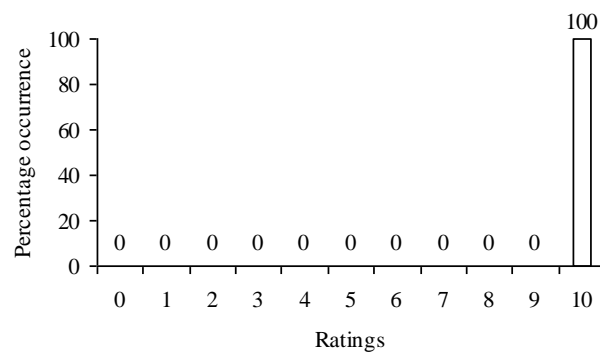
Figure 7: Percentage occurrence of ratings for walk

All the observed elephants were walked to a nearby forest. Rating value was 10.0 (SE = 0.0, N = 4). The elephants were reported to be walked on earthen/natural surfaces (Figure 8). Rating value was 10.0 (SE = 0.0, N = 4).

Wl: Allowed to walk   Wl-A: Area of walking   T: Time of walking
Na: Nature of terrain   Ds: Distance covered   Hr/dy: Hours/day during walking
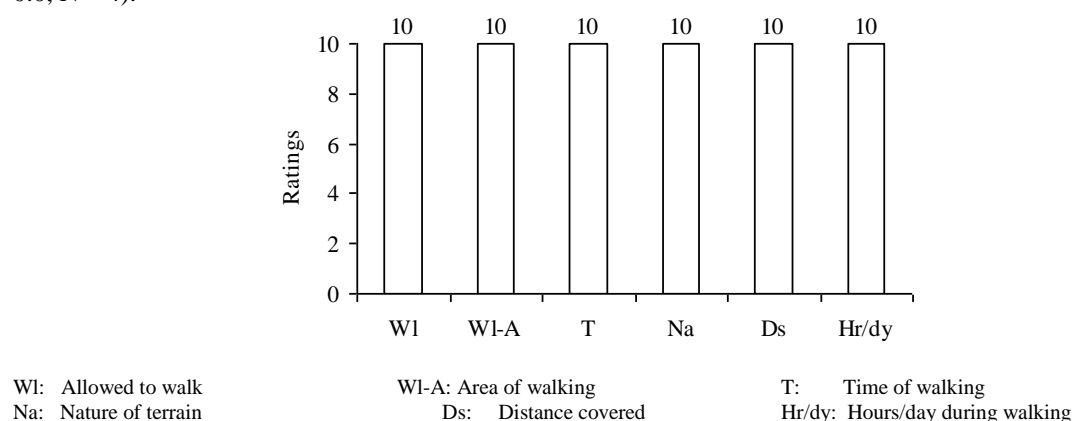
Figure 8: Ratings for walk sub-parameters

Social interaction

- All the elephants had opportunity for social interaction.
- Interaction hours were throughout the day.
- Each elephant had one member of the opposite sex for interaction.
- Distance between the animals was zero.

Female elephants in the wild live in maternal groups where several individuals of different ages interact (Schulte, 2000). Young male elephants too live within such groups until they become independent. Captivity forces restrictions on the expression of choices by the elephants regarding interaction with others. This feature was rated across five sub-parameters. The mean rating was 4.8 (SE = 1.5, N= 5) with 80% of all the values getting a rating less than six (Figure 9).
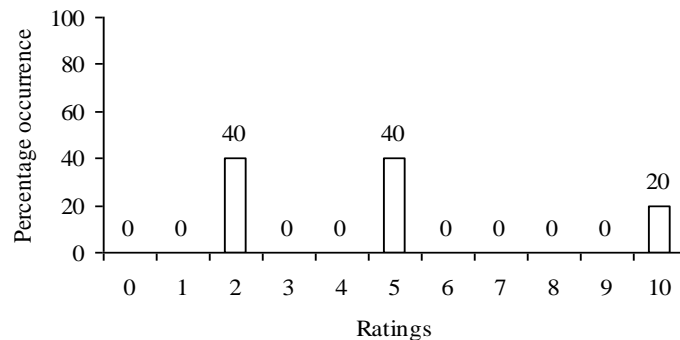
Figure 9: Percentage occurrence of ratings for social interaction

All the observed animals were allowed to interact. Rating was 10.0 (SE = 0.0, N = 4). When elephants were allowed to interact under free ranging conditions, high rating values were given. Rating was 5.0 (SE = 0.0, N = 4) implying occurrence of moderate conditions. Group sizes that replicate natural herd structures were given high rating. Rating was 2.0 (SE = 0.0, N = 4) indicating of poor conditions for the group size (Figure 10).

In: Interaction   In-Hr: Interaction Hours,
N: Number of individuals A/S: Age & Sex
In-Dis: Interaction Distance
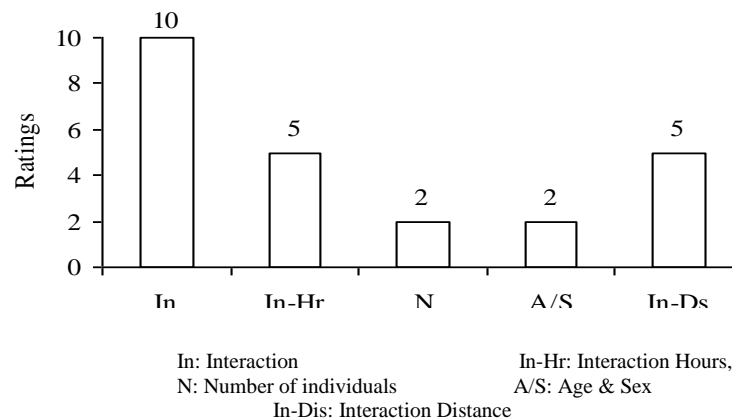
Figure 10: Ratings for social interaction sub-parameters

Chaining

- Elephants belonging to the Gir Foundation were allowed to free range for four hours per day at a nearby forest.
- The rescue centre elephants were not allowed to free range.
- All the animals were chained for 12 hours with a five metre long chain during night.

Captive elephants are generally chained to control their movement and it is an easy way of handling the animals. Improper fixing of chains or continuous chaining of the same region of the elephant's body may result in abrasion induced injury to the animal (Kurt and Garai, 2007). Mean rating was 2.9 (SE = 1.3, N = 4) which is an indication of poor welfare conditions (Figure 11).
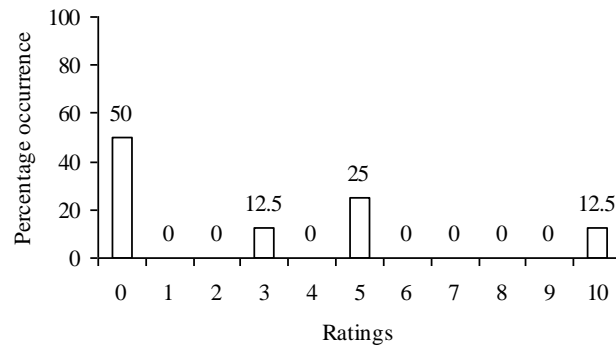
Figure 11: Percentage occurrence of ratings for chaining

Two of the elephants were allowed to free range during the day. Mean rating value was 5.0 (SE = 2.9, N = 4). All the animals were chained for an average of 12 hours (Figure 12). Mean rating was 0.0 (SE = 0.0, N = 4).
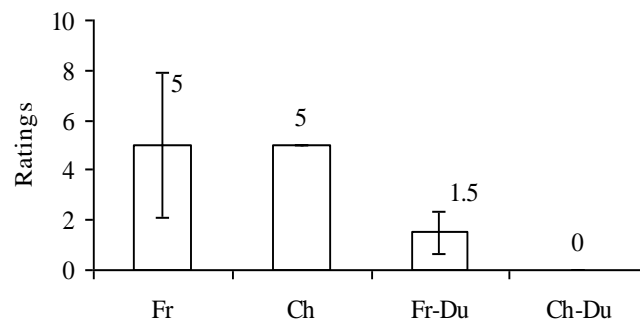
Fr: Free ranging status   Ch: Chaining status
Fr-Du: Duration of free range   Ch-Du: Duration of chaining

Figure 12: Ratings for chain sub-parameters

Behaviour
- All the elephants were described as quiet.
- Three elephants had not caused any injury/death of people. However, a twenty year old male at the rescue centre had been aggressive towards people.
- Except the 20 yr old male elephant, none of the animals exhibited stereotypic behaviour.

Imposition of a captive and alien environment may express itself in terms of abnormal behaviour among the animals. The temperament of the animal is also an indication of the ease with which the elephant can be handled. Overall mean rating was 8.1 (SE = 0.7, N = 4) indicating satisfactory conditions for the observed sub-parameters (Figure 13).
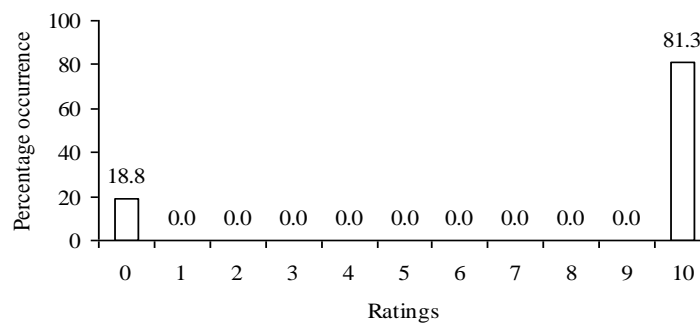
Figure 13: Percentage occurrence of ratings for behaviour

Elephants that were calm/quiet were given high rating values as this could be an indication of being comfortable with the environment. However, this temperament could also be a pointer to existence of abnormal behaviour in the form of apathy to its surroundings. Rating was 10.0 (SE = 0.0, N = 4). Stereotypy (Figure 14) is considered to be an indicator of abnormal behaviour. Rating was 7.5 (SE = 2.5, N = 4).

Ps: Personality   Kl/In: Incidents of killing/injuring people
St: Occurrence of stereotypic behaviour   In: Intensity of stereotypy
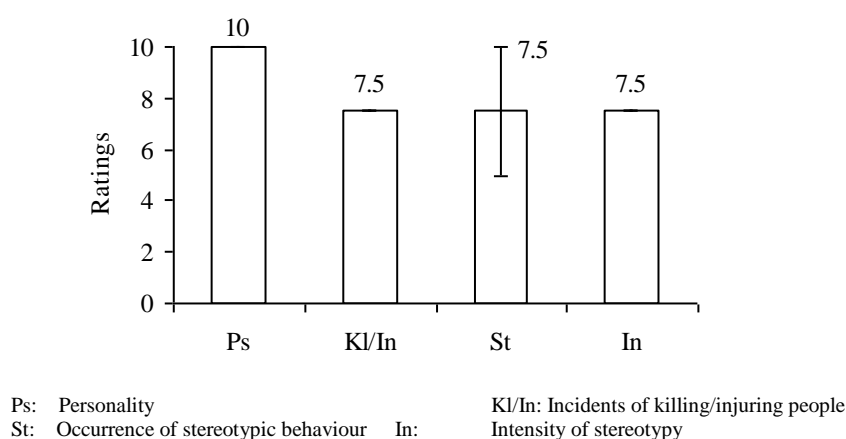
Figure 14: Ratings for behaviour sub-parameters

Work
- None of the elephants were made to work or perform for public audience.

Work type defines what the elephant does as part of its daily routine. Any work alien to the animal's natural behaviour has been given lower rating values. Mean rating value was 10.0 (SE = 0.0, N = 2) as the observed animals were not made to perform any work.

Provision of food
- Both stall feed and browsing/grazing by the elephants was practiced.
- Stall feed included sugarcane (*Saccharum* sp.), green grass and hay.

Elephants which are allowed to graze/browse under natural conditions along with a provision of supplements have been given high rating values. Mean rating value was 7.8 (SE = 1.3, N = 4) indicating satisfactory status for food provisioning (Figure 15).
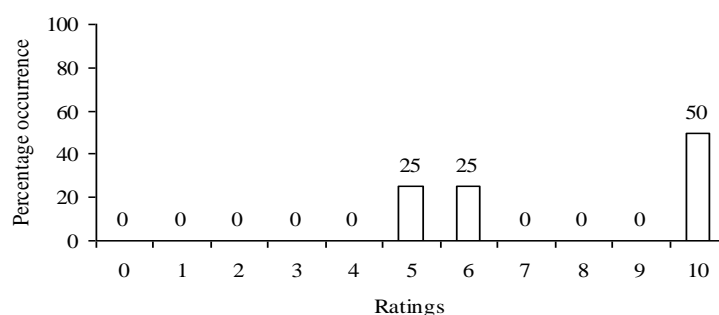
Figure 15: Percentage occurrence of ratings for Food

Elephants were reported to obtain feed from both stall feed and free-ranging for foraging. Hence, rating value was 10.0 (SE = 0.0, N = 4). Low rating values show (Figure 16) unsuitability in terms of chances of contamination, low accessibility of food to the animal and absence of appropriate physical environment while feeding. Mean rating value was 5.0 (SE = 0.0, N = 4).

Fd: Type of food provisioning   Fd-N: Number of food items
Fd-A: Feeding area   Rt: Usage of ration chart
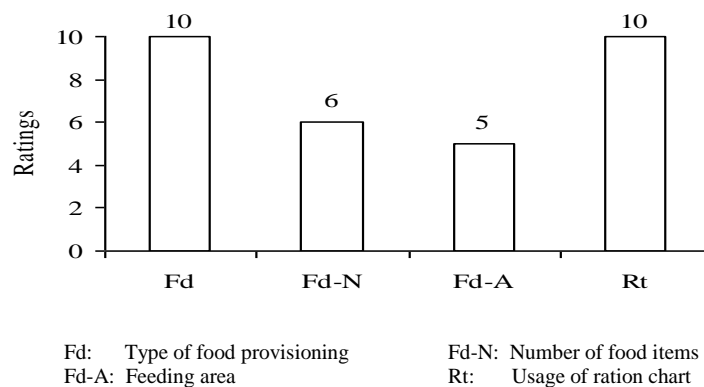
Figure 16: Ratings for food sub-parameters

Reproductive status

- Musth was reported for both male elephants.
- All the animals were exposed to elephants of the opposite sex.
- Mating source for the female was captive male.
- There were no successful matings reported for any of the elephants.

Reproductive status was rated in terms of occurrence of oestrus/musth, exposure to males, factors related to pregnancy and birth/siring of offspring. Mean rating was 5.8 (SE = 2.0, N = 6) implying occurrence of moderate conditions for this feature (Figure 17).
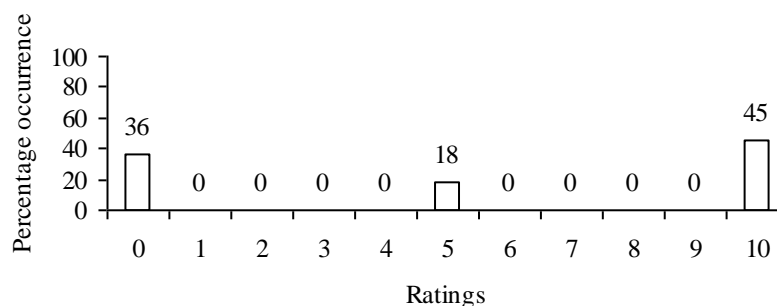
Figure 17: Percentage occurrence of ratings for reproductive status

Data for females was not available. However, both males were observed to be in musth. Rating was 10.0. The observed elephants were maintained in each institution as a pair: a male and a female. Hence, rating was 10.0 (SE = 0.0, N = 4). None of the elephants had given birth or sired any offspring (Figure 18) despite being allowed to mate. Rating was 0.0 (SE = 0.0, N = 4).

Mu: Occurrence of musth   Ex: Exposure to elephants of opposite sex
Br: Breeding opportunity   Ex-Fq: Frequency of exposure
M-S: Male source   Cv: No. of calves given birth to/sired
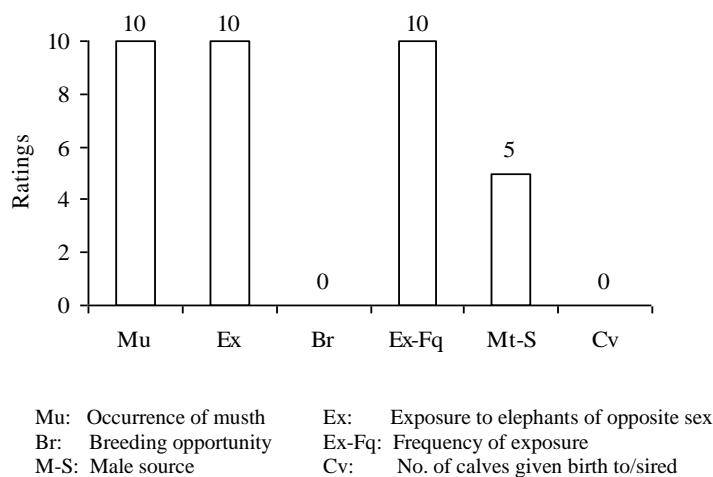
Figure 18: Ratings for reproductive status sub-parameters

Health status

- Wounds from chaining were reported for the twenty year old female at the Gir Foundation, the male elephant had foot problems and the frequency was said to be rare.
- Male elephant at the rescue centre was said to have watery eyes which was a regular feature of the animal.
- No blood/urine/dung sample tests were done for any of the elephants.
- Body measurements had not been taken.

Ill-health is considered to be an indicator of poor welfare conditions (Clubb and Mason, 2002). This parameter was rated using several sub-parameters (Figure 19) such as frequency of disease/injury occurrence, tests of blood/urine or dung and measuring morphometric aspects of the animal. Mean rating value was 2.5 (SE = 1.4, N= 4) indicating poor health conditions.
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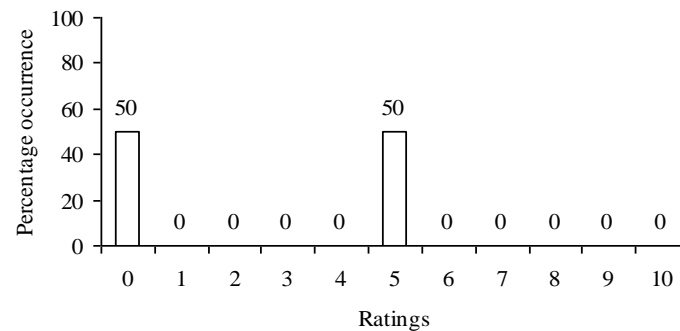
Figure 19: Percentage occurrence of ratings for health status

Occurrence of disease/injury was rated considering the extent of pain and its effect on further ill-health of the animal. Rating was 5.0 (SE = 0.0, N = 4). No tests were conducted on samples from the animals (Figure 20). Hence, the rating was 0.0 (SE = 0.0, N = 4).

Di: Disease/Injury occurrence   Fq: Frequency of occurrence
Ts: Blood/ dung/Urine tests   Bd: Body measurements taken
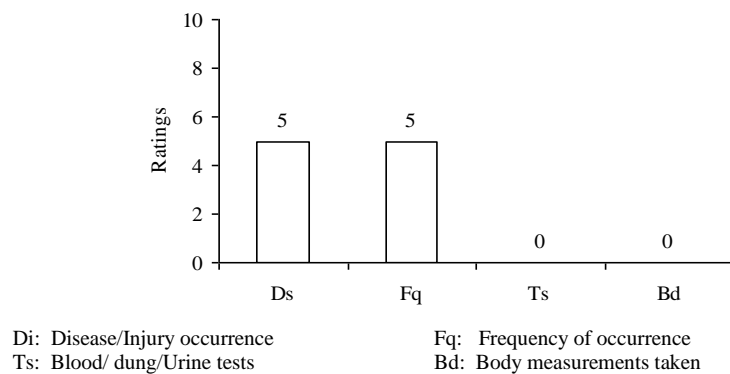
Figure 20: Ratings for health sub-parameters

Veterinary care

- All the elephants had access to a veterinary doctor.
- The Gir foundation doctor did not have any experience in treating elephants and was available only on call.
- The Rescue centre doctor had 10 years experience in treating elephants and was available daily.
- All the doctors had treated other wildlife animals.
- There was no veterinary care facility for any of the animals.

Maintenance of elephants in a facility makes it mandatory for veterinary care to be available. Rating was 6.3 (SE = 1.3, N= 4) with 75% of all values getting a rating of five (Figure 21).

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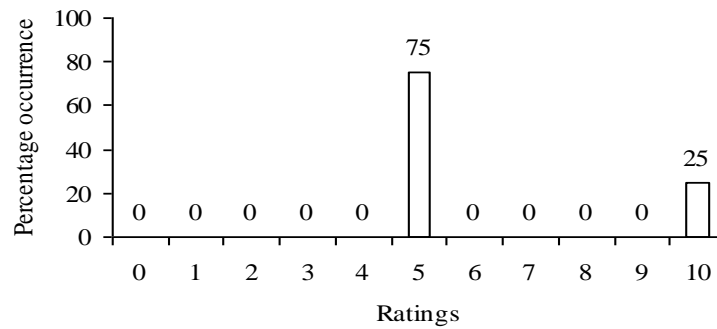
Figure 21: Figure Percentage occurrence of ratings for veterinary care

Availability of doctors with facility was given high rating values. Rating value was 10.0 (SE = 0.0, N = 4) indicating availability of doctors. Doctors with experience in treating elephants were given high rating values. Rating value was 5.0 (SE = 0.0, N = 4).

Vt-D: Availability of Veterinary doctor   Ex-E: Experience in treating elephants
Ex-N: Number of years treating elephants   Vs: Frequency of doctor's visits
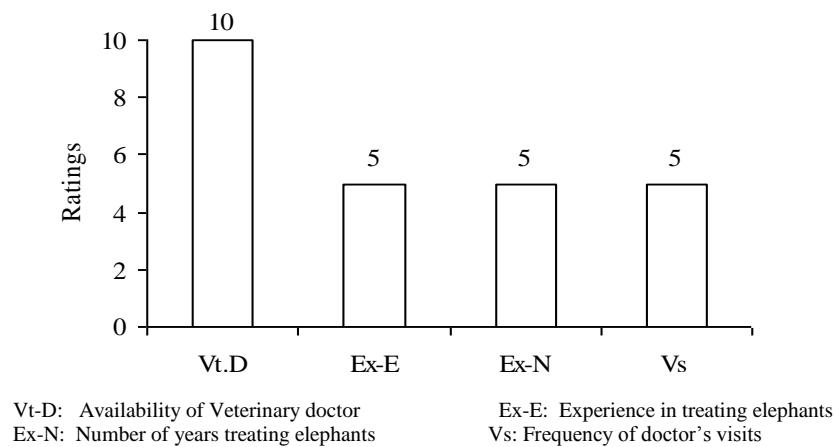
Figure 22: Ratings for veterinary care sub-parameters

Record maintenance
- Records were maintained at both locations.

Records for sub-parameters such as clinical/service/any other type and its maintenance indicate care taken by a management in the upkeep of the facility. It also aids in managing resources. Mean rating value was 5.0 (SE = 0.0, N= 2) showing that both sub-parameters were given a rating of 5.0.

Overall ratings
Overall ratings for elephants, when considered across all individual values, irrespective of parameters, was 6.7 (SE = 0.22, N** = 258, *N** refers to number of individual rating values across all the elephants observed*) with 50 % of all the values getting a rating less than six (Figure 23).
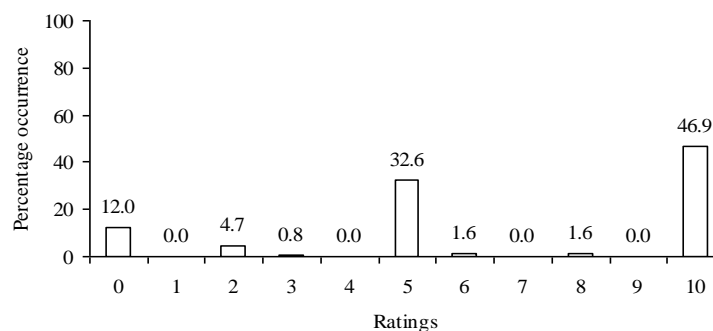
Figure 23: Percentage occurrence of ratings across all parameters

Discussion

The overall rating value for elephants was 7 with 50% of all the values getting a rating less than six. This rating value indicates moderate welfare conditions for the observed elephants. One feature of the data was the use of sub-parameters with only two types of values: 0 or 10. Such "Yes-No" type of sub-parameters formed 24.6 % of the data. Of this, 67.5% were 10 (Yes) scores which was 16.7% of the overall data. The occurrence of score 10 shows the existence of a suitable sub-parameter for the elephant. However, detailed insight using related sub-parameters may not be given such high rating values as they were not the "Yes-No" types. Thus, the occurrence of nearly 17% having score 10 could add to the overall rating value of the elephants.

Rating values above 7.5 have been considered to indicate satisfactory welfare conditions. Some of the parameters which were in this category were:

Water: Asian elephants are reported to drink water at least once a day (Shoshani and Eisenberg, 1982). Hence, access to suitable water sources is important. There was provision of running water in the form of a river, close to the elephant's location, and the animals were reported to be drinking.
Rest and sleep: Kurt and Garai (2007) state that wild adult elephants rest during the hottest parts of a day and sleep at night. This parameter was given high rating value as none of the observed animals were made to work, allowing the animals to rest or sleep.
Walk: All the observed elephants were walked to a nearby forest or within the enclosure on natural terrain.
Observed behaviour: The observed elephants were all described as quiet. However, only one elephant, a 30 year old male was said to have exhibited aggression towards people in one incident. This elephant was also said to exhibit stereotypic behaviour.
Food provisioning: The animals were given stall feed and also allowed to free range for foraging.

However, these animals were not provided all the necessary conditions needed for an elephant in captivity.

Poole and Granli (2005) state, keeping the knowledge gained from studies of wild African elephants as a reference, that a captive environment should ensure that the elephant's needs are met. They highlight that captive environments should, among other important aspects, enable an elephant to be able to choose social partners, remain unchained and have their preferred social companions during parturition. As the social behaviour of both Asian and African elephants are comparable (Kurt and Garai, 2007), the insight by Poole and Granli can be applied to captive Asian elephants also.
The observed elephants, in the two institutions in Gujarat, were part of a very restricted group size – limited to only two animals, a male and a female, in each case. This represents a deviation from the group size seen among wild elephants where related adult females and their offspring form a social grouping (Schulte, 2000).
Kurt and Garai (2007) state that learning forms an integral part of elephant society; mothering, allomothering, leadership, etc. for females, and successfully siring offspring for males form an important part of an elephant's life. Thus, the presence of pairs of elephants of opposite sex does not ensure the expression of normal behaviour by the animals. This maybe a likely causal factor for the elephants not having produced any offspring.
All the elephants were said to be chained for 12 hours at night. Kurt and Garai (2007) point out the disadvantages of chaining elephants: improper fixing or constant chaining of the same region can lead to injury due to abrasive action. Gruber et al. (2000) report incidence of stereotypy among chained elephants.
Tests on blood/dung/urine for biochemical parameters of body condition had not been conducted.
Body measurements were not taken for the elephants. Such measurements give an indication of growth and any deviations from the normal.

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Section 5:
Zoo Elephants in Karnataka

Executive Summary

Bannerghatta Biological Park (BBP) has a unique status vis-à-vis the nature of expansive forests it controls. The park is recognised by the Zoo Authority of India, and is home to a number of confined animals, including the Asian elephant. This investigation evaluates the welfare of both the elephants and mahouts/cawadis.

Data was collected through observation of elephants and interview of personnel/ management. Each of these features, referred to as a parameter, has been rated on a 0 to 10 scale with 0 representing the worst possible situation and 10 implying a satisfactory state, closer to what an animal experiences in the wild.

The zoo maintains seven elephants with mean age of 30.3 yrs and the lone male in the group is 15 yrs of age. The zoo has elephants consisting of two generations of mother–daughter pairs, along with unrelated elephants which were rescued from different institutions or captured from the wild. The mean rating for this parameter was 5 implying moderate conditions.

All the observed elephants are left to free range in the adjacent forest and kept in enclosures during the day for display to the public. Overall mean rating was 8 showing occurrence of satisfactory conditions.

The elephant enclosures have facilities for drinking water, and are also left in the adjacent forest to free range. Overall rating was 5.5 with 36% of all values getting a rating less than 5.

All the elephants are allowed to walk. Hence, the rating assigned was 10; the observed females are given an opportunity to interact, (except for the single male) for a mean duration of 13 hours. Group size included six elephants of varying ages, all females. Overall mean rating for this parameter was 8 indicating the existence of satisfactory conditions.

All the elephants are described as calm, except for the rescued male which is rough at times. One adult female has injured people. None has shown signs of stereotypy except for the male which exhibits high intensity of nodding head/folding trunk. Overall mean rating was 9 indicating satisfactory conditions.

Only two elephants are made to work, carrying tourists for safari rides. Shade and water are available, with opportunity for rest (0.5–1 h); overall mean rating was 5.

The zoo elephants are allowed to graze/browse, at night, in the nearby forest. Along with this, supplements are provided through stall-feed, such as rice, jaggery, coconut, green grass, hay. Overall mean rating was 7, implying satisfactory conditions.

Four adult females exhibit oestrus cycles and have mated successfully, with two having mated with wild elephants. All the four elephants have given birth to calves, total number of calves born range from 2 to 8 since their first pregnancy; overall mean rating was 9.

One female adult elephant rescued from another institution has damaged footpads and dry skin. Three elephants have warty growths; overall mean rating was 8.

The zoo has seven mahouts, with a mean age of 30.9 years; each mahout is assigned to one elephant. All the handlers belonged to Jenu Kuruba or the Muslim community. Two handlers listed agriculture as a family occupation and the rest as mahouts. None, except one of the handlers had undergone health check-ups.

Overall mean rating of 7 for the elephants implies moderate conditions. Optimal conditions in captivity depend on considering the species' natural history and providing, wherever possible, for the needs of captive animals. Free-ranging opportunity in adjacent forest for the Bannerghatta Biological Park elephants is indeed a step in the right direction and will enhance the welfare of the animals.

Introduction
Bannerghatta Biological Park (BBP) has a unique status vis-à-vis the nature of expansive forests it controls. On the one hand, the Park, recognized by the Zoo Authority of India, is home to a number of confined animals which are displayed in various enclosures for the public, and on the other, it is contiguous with a 104-sq km protected piece of forest, declared a national park in 1974, within which diverse wildlife exists. The zoo maintains several animals in captivity, while wild elephants use the adjacent forests as a corridor in their seasonal movement. This stretch of protected area connects to forest patches in the neighbouring state of Tamil Nadu (Varma *et al.,* 2005).

Objective
Captive situations impose a number of features which may be detrimental to the well-being of the animal. This report aims to evaluate the welfare status of the elephants as also of mahouts/cawadis.

Method
Stroud (in press) states the need to consider the elephant's biology, the complex set of variables which shape its behaviour and biology, as a reference to a captive's welfare. This report assesses the welfare of elephants in captivity by looking at the deviations experienced by the animals in their physical, social and behavioural features in comparison with those observed in the wild. Data was collected through observation and interview of personnel/management. Each of these features or sub-parameters has been rated on a 0 to 10 scale with 0 representing the worst possible situation and 10 implying a satisfactory state, closer to what an animal experiences in the wild.

Ratings are graded in the following manner:
- 0–2.4: Bad conditions
- 2.5 4.9: Poor
- 5.0–7.4: Moderate
- 7.5–10.0: Satisfactory

For sub-parameters relating to veterinary care such as availability of veterinary doctors, frequency of visits by the doctor, veterinary routine practiced, etc., satisfactory conditions represent ease of access and prevalence of features conducive to maintaining elephant health. Results depicting rating and percentage occurrence of different values for sub-parameters have been given. Sub-parameters representing a common feature such as shelter or water have been grouped together to form a parameter. Rating for a parameter is the mean across the sub-parameters.

Percentage occurrence of rating from 0 to 10, of each individual rating considering all the observed elephants across all sub-parameters, has been depicted in a graph to show the distribution of overall values from bad to satisfactory conditions.

The welfare of mahouts/handlers has been assessed by examining the socio-economic parameters and the handler's relationship with his animal in terms of experience, knowledge of commands, etc. Bad or poor handler welfare may be associated with poor handling of his animal. *N* refers to number of individuals (elephants or handlers) and *N** to number of sub-parameters.

Results
Population status
The zoo maintained seven elephants with a mean age of 30.3 yrs (range 7 –45 yrs). Mean female age was 34.2 yrs (ranging from 7- 45 yrs). The lone male in the group was 15 years old.

Source of elephants
Moving animals from one location to another could entail different living conditions. This may be a source of stress for the elephants (Clubb and Mason, 2002). The zoo maintained elephants consisting of two generations of mother–daughter pairs, along with unrelated elephants which were rescued from different institutions or captured from the wild. Mean rating for this parameter was 5.3 (SE = 1.8, *N* = 7) implying moderate conditions.

Number of mahouts changed

Frequent changes of mahout may be stressful for both the elephant and the handler as it involves a period of adjustment (Namboothiripad, 1998). Mean rating was 4.2 (SE = 1.7, N = 6) as the number of mahouts changed varied from zero to ten.

Shelter

This parameter represents physical features provided in captivity. All the observed elephants were left to free range in the adjacent forest and kept in enclosures during the day for display to the public. While providing rides for people, two adult female elephants were not in the enclosure. Flooring varied from stone/concrete in the morning to earthen/natural at night or all earthen. Man-made structural (sheet) shade was available for only one elephant while the others had access to shade from trees. Overall mean rating was 7.7 (SE = 1.3, N = 4) implying satisfactory conditions (Figure 1).
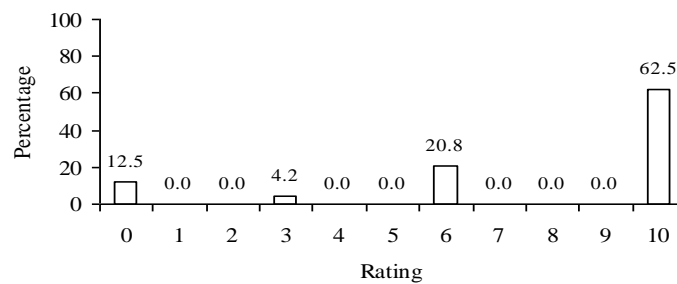
Figure 1: Percentage occurrence of rating for shelter.

Elephants given an opportunity to free range in natural forest conditions are given high rating. Mean rating was 6.9 (SE = 0.7, N = 6) as the elephants were allowed to free range in the nearby forests only at night. Unsuitable substrates can result in foot-related problems (Benz, 2005). Mean rating was 5.0 (SE = 2.5, N = 6) as three of the six observed elephants had stone/concrete floor (Figure 2).

Sh: Shelter type   Fl: Flooring   Fl-n: Flooring (night)   Sd: Shade availability
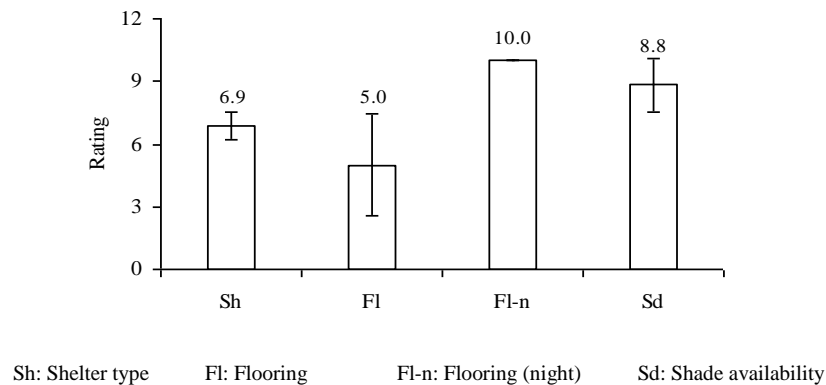
Figure 2: Rating for shelter sub-parameters.

Water

Shoshani and Eisenberg (1982) state that wild elephants drink/bathe at least once a day and do not move far from a source of water. The elephant enclosures had facility for drinking water. The animals seemed to drink 3–4 times and were also left in the adjacent forest to free range. Bathing place was lake/pond and all the animals were bathed daily for a duration ranging from 1 to 2.5 hours using brush/stone/Screw Pine (*Pandanus* spp.) fruit. Distance to water source ranged from 6 ft to 5 km.

Overall rating was 5.5 (SE = 1.2, N = 7) with 36% of all values getting a rating less than 5 (Figure 3).
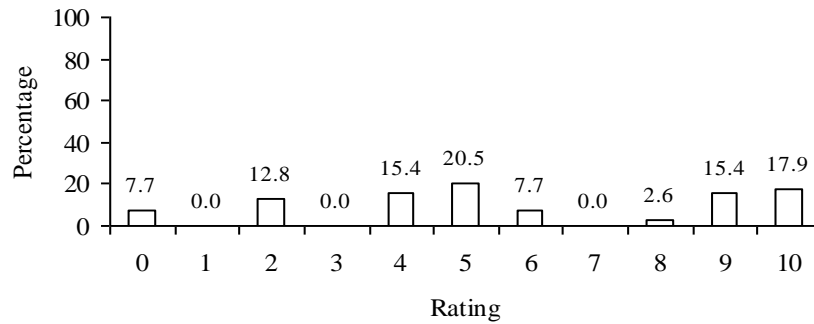
Figure 3: Percentage occurrence of rating for water.

Availability of running water sources such as rivers has been given high rating. All the observed elephants had access to lakes/ponds; mean rating for water-related parameter (Figure 4) was 4.5 (SE = 0.3, N = 6) implying poor conditions for this sub-parameter. Adult elephants are reported to drink around 200 l of water per day (Sukumar, 1991). Elephants allowed to free range in forest conditions with access to water have been given high rating (Figure 4). All the observed elephants were allowed into the adjacent forest at night, hence the rating of 10.0 (SE =0.0, N = 6).

This sub-parameter considers duration of bathing following free-ranging activity by the elephants. The duration ranged from 1 to 2.5 h, hence, mean rating was 6.0 (SE = 0.6, N = 5).

Wt: Availability of water in enclosure   Pr-s: Perennial water source
Ds: Distance to water source   Qn: Quantity of water consumed
Bt-fq: Bathing frequency   Bt-p: Bathing place
Bt-du: Bathing duration   Bt-m: Bathing materials
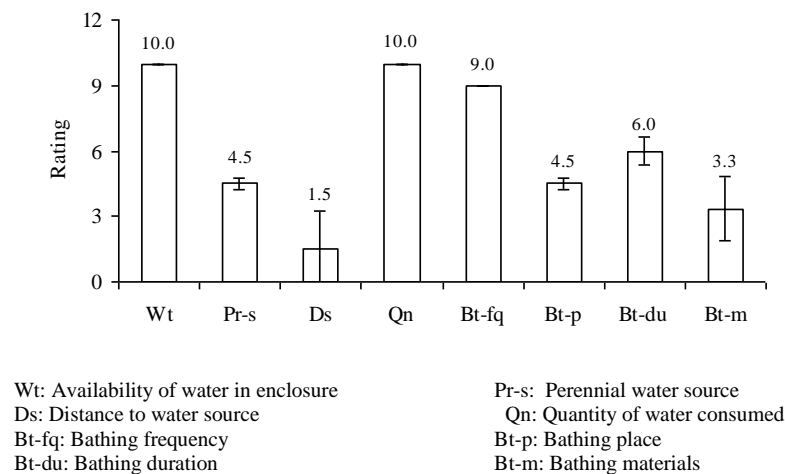
Figure 4: Rating for water-related parameters for captive elephants in BBP.

High rating has been given for provision of suitable sleeping place. The observed elephants were allowed to sleep in the forest with only one adult female elephant sleeping within a shelter. Mean rating was 10.0 (SE =0.0, N = 3) implying satisfactory conditions.

Elephants have been observed to sleep for 3–4 hours at night (Kurt and Garai, 2007). Deviations from this duration have been given low rating. Mean duration of sleep was 3.6 h (ranging from 1–6 h). Rating of 5.6 (SE = 2.9, N = 4) suggests moderate conditions.

Walk
All the elephants were given opportunity to walk. Hence, the rating of 10.0 (SE = 0.0, N = 7).

Social Interaction
Elephants are highly social animals with females spending their lives in the company of related individuals (Sukumar, 2003). Males disperse gradually from their natal herd as they attain sexual maturity (Poole and Moss, 2008). The observed female elephants were all given an opportunity to interact, except for the single

male. The animals were allowed to interact for a mean duration of 13 hours (range 5–24 h). Group size included six elephants of varying ages, all females.

Overall mean rating for this parameter (Figure 5) was 7.9 (SE = 1.7, N = 3) indicating existence of satisfactory conditions. All animals, except for the single male elephant, were allowed to interact with con-specifics. Mean rating was 8.6 (SE = 1.5, $N = 7$). High rating was given for elephants with unrestricted access to social interaction. Mean rating for interaction hours was 5.2 (SE = 1.6, $N = 5$).

In: opportunity for interaction   In-hr: Interaction hours   Gr-sz: Group size
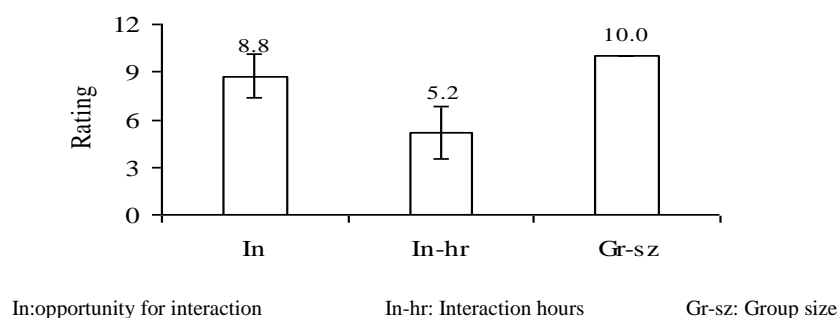
Figure 5: Rating for social interaction related parameters for captive elephants in BBP.

Chaining

The practice of mounting chains on elephants is not only to manage the animal, but also to keep track of it while free ranging. Chains were tied to the legs of all the observed elephants with a mean length of 47.8 cm (range 25–70 cm). Chain size ranged from 2.5 to 5.5 cm, with a length of 360–1200 cm. All the observed elephants were allowed to free range at night in the nearby forest. Use of chains is given low rating. Mean rating was 1.0 (SE = 0.0, N = 7). Free ranging at night is rated considering the use of drag chains/hobbles. Low rating is given for such use. Mean rating was 2.0 (SE= 0.0, $N = 5$).

Behaviour

Ease of handling of the elephant along with occurrence of abnormal behaviour is rated. All the elephants were described as calm, except for the rescued male which was rough at times. One adult female seems to have injured people. None of the elephants was showing signs of stereotypy, except for the male which was said to exhibit high intensity of nodding head/folding trunk. Overall mean rating was 8.7 (SE = 0.5, N = 3) indicating satisfactory conditions (Figure 6).
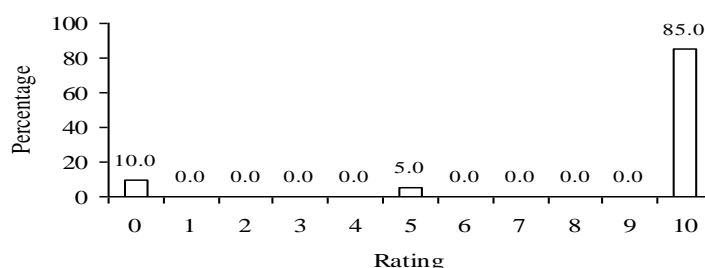
Figure 6: Percentage occurrence of rating for behaviour for captive elephants in BBP.

Mean rating for behaviour-related parameter (Figure 7) was 9.3 (SE = 0.8, $N = 7$) showing ease of handling and quiet temperament of the elephants. Only one elephant, an adult female, seems to have injured two persons. Mean rating was 8.6 (SE = 1.5, $N = 7$).

Be: Observed behaviour   Agg: Incidents of aggression   St: Occurrence of stereotypy

Figure 7: Rating for behaviour-related parameters for captive elephants in BBP.

Work

This parameter has been designed to rate work conditions for the elephant. Work that replicated to the extent possible, the animal's life in the forest, was given high rating. Only two elephants were made to work, carrying tourists for safari rides. Timings varied from 11 a.m. to 5 p.m./12 noon to 5 p.m. Maximum weight carried varied from 300 to 700 kg over a distance of 300–500 m. The number of people carried was 4-6 with provision of an iron/wooden howdah weighing 50–110 kg. Shade and water were available, with opportunity for rest (0.5–1 h). No food was given during work. Overall mean rating was 5.4 (SE= 1.3, N^{**} = 14). N^{**} refers to number of individual ratings considered across all sub-parameters for all elephants observed and 43% of ratings fall in 10 (Figure 8) and 36% under 0 values.
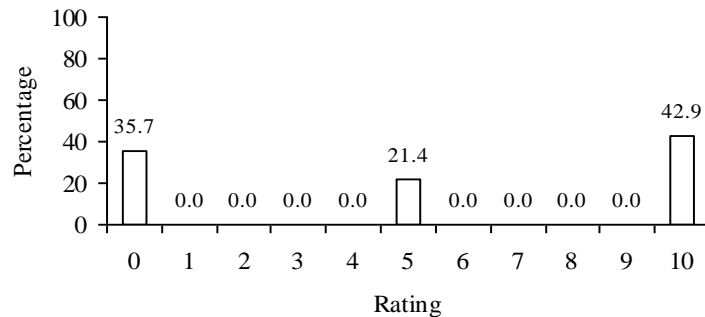
Figure 8: Percentage occurrence of rating for work for captive elephants from BBP.

Nature of work was rated. Only two elephants were used for safari rides. Hence, mean rating for work-related parameter (Figure 9) was 8.0 (SE = 1.4, N = 5). Availability and access to water, when needed by the elephant, was rated. Both working elephants were provided with water, with one elephant said to be provided with insufficient quantity. Mean rating was 7.5 (ranging from 5 to 10). Elephants have been observed to rest during the hottest parts of a day (Kurt and Garai, 2007). Both elephants at the zoo were worked through the day. Mean rating was 0.0.
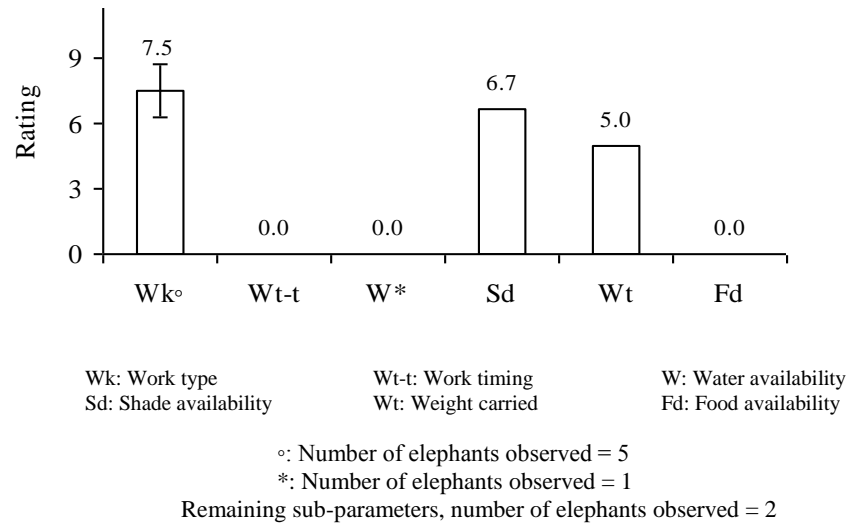
Figure 9: Rating for work-related parameters for captive elephants in BBP.

Food provisioning

Wild elephants have been observed to feed on a number of plants (McKAy, 1973). The zoo elephants were all allowed to graze/browse at night in the nearby forest. Along with this, supplements were provided through stall-feed, such as rice (Oryza sativa), jaggery (sweet derived from sugarcane Sacharrum sp.), coconut (Cocos nucifera), green grass, and hay.

Overall mean rating was 7.0 (SE = 1.2, N = 4) implying occurrence of satisfactory conditions as 50% ratings fall in 10 (Figure 10).
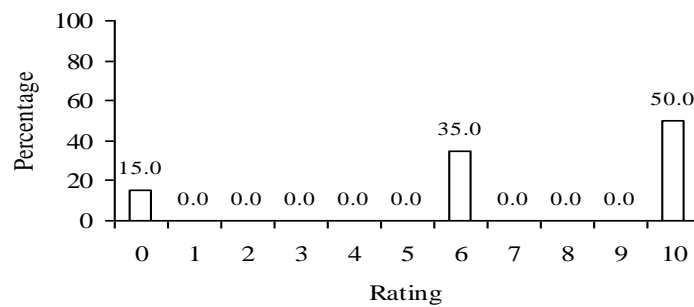
Figure 10: Percentage occurrence of rating for food for captive elephants in BBP.

Opportunity to free range to browse/graze in forest conditions was given high rating as elephants are known to feed on a wide variety of plants (Shoshani and Eisenberg, 1982). Mean rating for food-related parameter (Figure 11) is 6.7 (SE =2.3, N = 6) with two elephants provided only stall feed.

Of the two observed elephants, one adult female seems to have raided crops in the nearby fields.

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Fd: Food provisioning type   Fd-n: No. of food items
Rt: Usage of ration chart   Cr: Crop raiding incidents

*: refers to observation of two elephants only
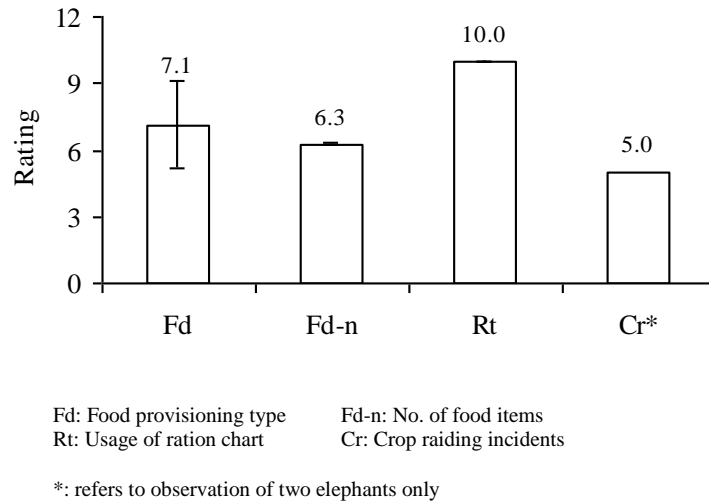
Figure 11: Rating for food-related parameters for elephants in BBP.

Reproductive status

Ratings have been designed to assess the status of reproductive functioning with occurrence of social and physiological aspects representative of those observed in the wild. Four adult females seem to exhibit oestrus cycles and had also mated successfully, with two females having mated with wild elephants. All the four elephants had given birth to calves, total number of calves born ranging from 2 to 8 since their first pregnancy.

Mean calving interval was 5 years (recorded for two elephants). Calf of one elephant had died prematurely. The lone male had not exhibited signs of musth. Overall mean rating was 9.0 (SE = 0.7, N^{**} = 21). N^{**} refers to number of individual ratings across all the sub-parameters for all the elephants observed. Percentage occurrence of rating values for reproductive status suggests that 81% of values fall in 10 (Figure 12).
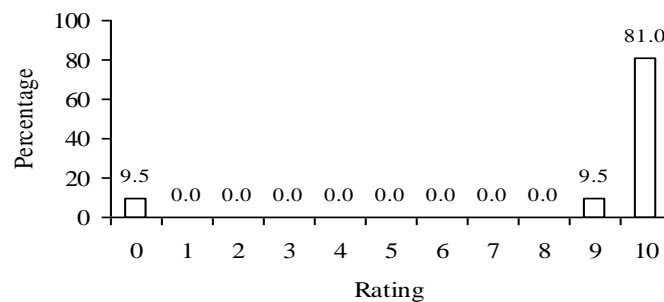
Figure 12: Percentage occurrence of rating for reproductive status for captive elephants in BBP.

Four females seem to exhibit oestrus cycles while the 15-yr-old male had not been in musth. Mean rating for being reproductively active/not (Figure 13) was 10.0 (SE = 0.0, N =4) for the females and 0.0 for the male. Based on the age of the mother, number of births was rated.

High rating is given for numbers which corresponded with age. Mean rating was 10.0 (SE = 0.0, N =4).

Cy: Cycling status   Br: Opportunity for breeding
M-s: Male source   Cw: Presence of cows during birth
Bi-n: Number of births   Pr-b: Premature births
                    Mu: Occurrence of musth

                    *: Number of elephants = 2
                    ∘: Number of elephants = 1
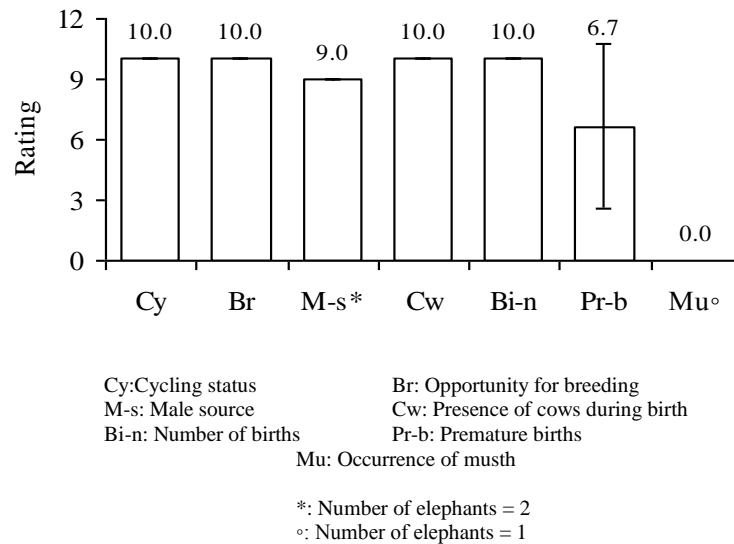
Figure 13: Rating for reproductive status of captive elephants in BBP.

Health status and veterinary routine

Physical conditions and the elephant's way of life in captivity may predispose the animals to certain disease/injuries such as foot problems (Mikota *et al.,* 1994) and excess food (obesity) or malnourishment. One female adult elephant, which was rescued from another institution seems to have damaged footpads and dry skin. Three elephants seem to have warty growths.

The observed elephants were de-wormed and vaccinated with one elephant not being immunised. Oiling was done daily for all the elephants on the head and leg using castor oil. Overall mean rating was 7.7 (SE = 0.9, N^{**} = 18). N^{**} refers to the number of individual ratings across all observed sub-parameters for all the elephants. Percentage occurrence of ratings for health and veterinary status suggest that about 72% values fall in10 (Figure 14).
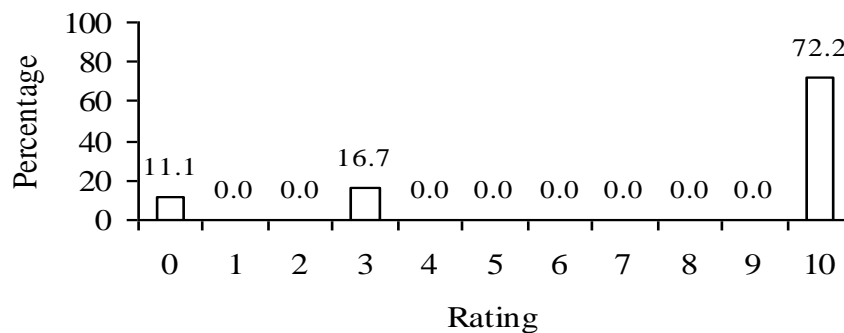
Figure 14: Percentage occurrence of rating for health and veterinary routine for elephants in BBP.

Rating was designed to reflect the nature of disease/injury, its effect on causing further health problems and curability. Mean rating for health and veterinary care-related parameter (Figure 15) was 2.3 (SE = 0.9, N = 4).

Rating for de-worming status was 10.0 (SE= 0.0, N= 4) showing that the practice was followed for the observed elephants.
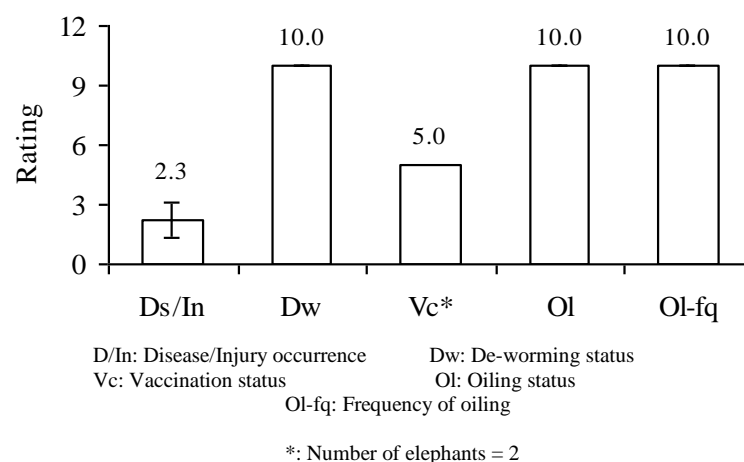
Figure 15: Rating for health and veterinary care-related parameters for elephants in BBP.

Veterinary personnel and infrastructure availability

All the elephants had access to a veterinary doctor and two assistants attached to the zoo. Treatment register seemed to be maintained. The zoo also had hospital and laboratory facilities. Overall mean rating for these parameters (Figure 16) was 10.0 (SE = 0.0, $N = 4$).
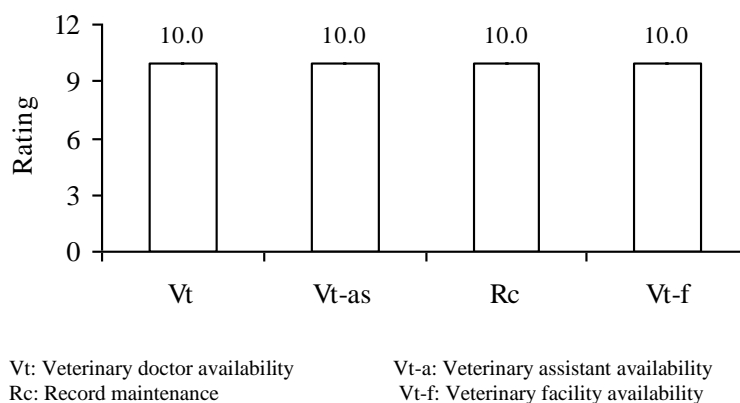
Figure 16: Rating for veterinary personnel and infrastructure for captive elephants in BBP.

Welfare status of mahout

The welfare of mahout/cawadi was assessed by examining their socio-economic profile. Their experience with elephants was rated considering parameters related to professional experience. The zoo had seven mahouts, with a mean age of 30.9 yrs (SE = 2.7, $N = 7$). Each mahout appeared to be assigned to one elephant. The percentage occurrence of overall rating suggests that (Figure 17) about 42% values come under 10.
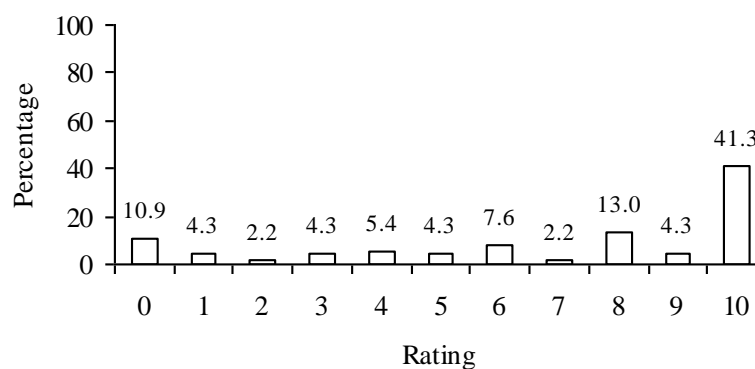
Figure 17: Percentage occurrence of overall rating for mahout welfare parameters.

- All the handlers belonged to Jenu Kuruba/Muslim community.

- Only two handlers' listed agriculture as a family occupation, the rest mentioned being a mahout as a family occupation.
- Education level of the handlers varied from 4th to 8th grade.
- Mean salary was Rs. 33485.71, ranging from Rs 27,000 to Rs. 50,000/- annually.
- All except one, was married with number of children ranging from 1 to 4.
- None except one of the handlers had undergone health check-ups.
- Except one, all the handlers had been insured with their own salary being used for paying the premium amount. Only one handler's premium was paid by the Forest Department.
- Amount for which the handlers were insured varied from Rs.25,000/- to Rs.1,00,000/-
- None of the handlers seemed to consume alcohol.

Overall mean rating for this parameter was 6.9 (SE = 0.4, N = 67) implying occurrence of moderate conditions. N refers to the number of individual ratings considered across all the sub-parameters for socio-economic status.

Mean rating was 6.2 (SE = 0.7, N = 6) showing existence of moderate conditions. Rating of 10 has been designed to represent a salary capable of supporting a family of four in an urban environment. Mean rating was 6.0 (SE= 0.5, N = 7) with only one mahout getting a satisfactory rating of 8.

High rating represents the absence of alcohol consumption (Figure 18). Mean rating was 10.0 (SE = 0.0, N = 5) implying none of the handlers consumed alcohol. Mahout's professional ability was rated based on his experience with a specific elephant in this profession, use of commands and reason for taking up this profession.

- Mean experience (Figure 18) in this profession was 10.9 yrs (ranging from 0.5 to 22 yrs).
- Mean experience with a specific elephant was 4.9 yrs (ranging from 0.5 to 15 yrs).
- Only one handler had joined the profession out of interest while five stated it was a traditional occupation. One mahout had chosen this job as a means of employment.
- All the mahouts seemed to have good knowledge of commands.

Overall mean rating was 6.6 (SE = 0.8, N = 25) showing the existence of moderate conditions for this parameter. N refers to the number of individual ratings across all the sub-parameters observed. When experience in this profession is calculated as percent of mahout's age, it ranged for 3 to 56%. Mean rating was 6.3 (SE = 1.9, N = 6). Experience calculated as a percent of a specific elephant's age ranged from 1 to 90%. Mean rating was 3.9 (SE = 1.6, N = 7).

Ex-e: Experience (% of elephant age)   Ex-a: Experience (% of mahout's age)
Rs: Reason for choosing this profession   Cmy: Community of mahout
Fm: Family occupation   Ed: Education status
Sl: Salary   Ch: Number of children
Ln: Number of languages known   Com: Knowledge of commands
Hlt: Health check-up status   In: Insurance cover availability
In-s: Insurance source   In-a: Insurance amount
                    Al: Alcohol consumption

Figure 18: Ratings for mahout welfare parameters.

Overall mean rating for elephants was 7.3 (SE = 0.2, N^{**} = 241) implying occurrence of moderate conditions. N^{**} refers to number of individual ratings across all the sub-parameters (Figure 18) observed considering all the elephants. Comparison of percentage occurrence of rating (all ratings and 10-0 values) suggests that 10 values dominate all the ratings and also for the ratings from 0/10 type (Figure 19).
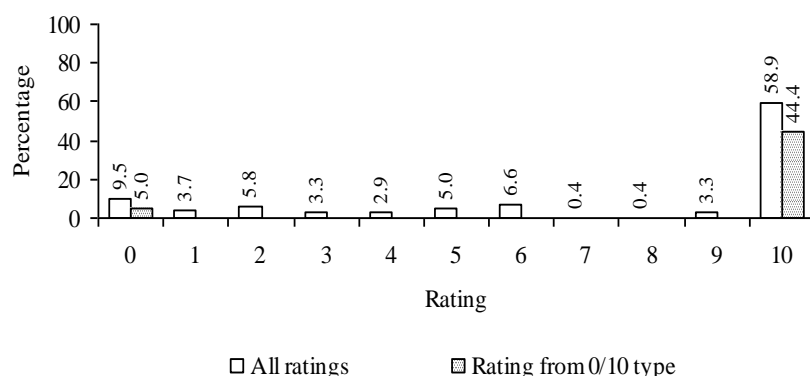
Figure 19: Comparison of percentage occurrence of rating.

Discussion

Overall mean rating for elephants was 7.4; this could be a consequence of two factors:

1. True picture:
   This could represent the actual situation of the elephants in this zoo.

2. Consequence of data type collected:
   The survey consisted of collection of detailed information regarding relevant aspects of the elephants. This included data which was of the "presence–absence" types which could be rated in one of two ratings only: either 0 or 10. The present data contain 45.1% of such observations, of which ten scores contribute 39.5% to the overall rating. This indicates the presence of satisfactory features to the extent of 40%. However, with availability of detailed and relevant information for such data, a more representative situation can be observed. The rating could then be different from the one presented here.

Optimal conditions in captivity depend on considering the species' natural history and providing, wherever possible, for the needs of captive animals (Kane *et al.,* 2007).

- The free-ranging opportunity in adjacent forest for the elephants of Bannerghatta Zoo is indeed a step in the right direction, but this is offset by keeping some of the elephants on concrete/stone floor in the morning. Benz (2005) states that the sole of the elephant's foot has regions of lesser resistance—implying softer areas susceptible to unsuitable substrates. The author also cites several papers which link hard substrates and occurrence of foot problems.

- Use of elephants to provide rides: Two elephants are being used to provide safari rides. The rides ranged 4–5 hours during the day. This may not be conducive to the elephants when air temperatures are high and the elephants' backs are covered by a howdah. This practice may obstruct heat loss in the context of poor thermoregulation as a consequence of poor surface area–volume ratio (Weissenbock, 2006).

- The use of drag chains to ensure that the elephants do not wander too far: consistent use of chains on the same region can lead to wounds which are difficult to heal (Kurt and Garai, 2007). If alternate legs are chained or if other means are employed, it would be a better option.

- Two elephants, an adult male and a female, are both said to be rough at times. Management of these animals needs to be regulated under expert advice to reduce such behaviour.

- Provision of water during summer when the elephants free range: While data is deficient on this particular aspect, it is worthwhile to mention that water sources may be absent in the forest during summer.

- The zoo did not have too many experienced handlers and there was high mahout–elephant turnover—frequent change of mahouts may not be suitable for either mahout/elephant.

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Executive Summary

The Chamarajendra Zoological Garden (Mysore Zoo) is home to a number of indigenous and exotic wildlife. The zoo maintains 11 elephants; of these, three are of Loxodonta spp. (African elephants) and the rest belong to *Elephas maximus* (Asian elephants). Together, there are four males and seven females and their mean ages are 17 years (females) and 24 years (males) respectively.

Data on all these individuals were collected through observation and interview of personnel/management. Each of these features has been rated on a 0 to 10 scale with 0 representing the worst possible situation and 10 implying a satisfactory state, closer to what an animal experiences in the wild. The welfare status of mahouts/handlers has been assessed by examining the socio-economic parameters and the handler's relationship with his animal in terms of experience, knowledge of commands, etc.

High rating is given to elephants born in captivity as this implies less drastic change in living conditions. The mean rating for the source of zoo elephants was 6.5 with three elephants being born in captivity. The elephants are provided with two types of shelter: a day enclosure, 4 acres in size, with natural vegetation, and a night enclosure where the elephants are chained.

All the elephants have access to drinking/bathing water; however, water sources are tanks and taps. The mean rating of 3.9 shows the occurrence of poor conditions. All the animals are walked within the enclosure; two are taken for a walk during the day as part of providing rides; all the elephants have opportunity for interaction. Interaction of elephants was within species with the African species reported to interact among themselves. Opportunity for physical exercise and social interaction was rated and the mean rating was 6.7.

Captive elephants are subjected to chaining for different reasons. This parameter is rated with features of opportunity to free range; the duration, the region of chaining and the mean rating for this parameter are 2 suggesting the prevalence of bad conditions.

Except as display animals at the zoo, the elephants have no specific work; however, two adult elephants are used for tourist rides. All the elephants are given only stall- feed in the enclosure—dry and fresh grass, rice (*Oryza sativa*), coconut (*Cocos nucifera*), jaggery (sweet derived from sugarcane *Sacharrum sp*.), ragi (*Eleusine sp*.) balls, sugarcane (*Sacharrum sp*), greens and others (include grasses and leaves of of different species);the mean rating for food provisioning was 6.2.

Three female elephants were cycling, were exposed to males and the mean rating for female reproductive status was 9.2. Captive conditions may lead to incidence of specific health issues; however, the mean rating for health status for the elephants kept in the Mysore zoo was 9 suggesting satisfactory conditions.

The elephants are treated by a veterinary doctor and two assistants; the zoo associated veterinarian's experience with elephants was 15 years with daily visits to check on the animals. The mean rating was 9 indicating satisfactory conditions.

Welfare of handlers has been assessed in terms of their socio-economic profile and their experience in the profession. Percentage occurrence of overall rating showed 25% incidence of values less than 5.

The overall mean rating for elephants was 6.9; it indicates the occurrence of moderate conditions. Excluding veterinary parameters (as they refer to availability of personnel and schedule of appropriate practices in maintaining animal health and do not involve elephants directly), the overall mean rating was 5.7. The occurrence of scores of 10 to the extent of 42% in the overall rating indicates the prevalence of satisfactory conditions to this extent.

Introduction
The Chamarajendra Zoological Garden (Mysore Zoo) is spread over 250 acres, and is home to a number of indigenous and exotic wildlife. The then ruler of Mysore, Maharaja Chamaraja Wodeyar, had established the zoo in 1892. It is now managed by the Karnataka Forest Department, under the aegis of the Central Zoo Authority. Its stated objective is to educate public about wildlife and conservation of species through *ex-situ* and captive breeding methods (official website: http://www.mysorezoo.in/).

Objective
Captive situations introduce a number of factors into an elephant's life through imposition of living conditions (physical and biological) which may affect its welfare. Also, handlers are integral to elephant management in captivity.
Hence, the conditions existing in the zoo were assessed to:
- Evaluate the welfare status of the elephants
- Evaluate the welfare status of mahouts/cawadis

Method
The behavioural, social and psychological needs of elephants have been shaped by a complex interaction of environmental/social/hereditary factors in the wild. In captive situations, the elephant experiences deviations in its living environment and as a consequence, there is deficiency in satisfying these needs. The deviations can be used to measure the status of its welfare. Veasey (2006) states captivity should provide features which are based on the knowledge of the animal's biology and behavioural ecology. Captive conditions of elephants have been assessed considering their physical, social, behavioural and physiological features. Data was collected through observation and interview of personnel/management. Each of these features or sub-parameters has been rated on a 0-to-10 scale with 0 representing the worst possible situation and 10 implying a satisfactory state, closer to what an animal experiences in the wild.

Rating values were graded in the following manner:

- 0–2.4: bad conditions
- 2.5–4.9: poor
- 5.0–7.4: moderate
- 7.5–10.0: satisfactory

For some sub-parameters such as availability of veterinary doctors, frequency of visits by the doctor, etc., the ideal condition represents the ease of access and prevalence of features conducive to maintaining elephant health. Results depicting rating and percentage occurrence of different values for sub-parameters have been given. Sub-parameters representing a common feature such as shelter or water have been grouped together to form a parameter. Rating for a parameter is the mean across the sub-parameters. Percentage occurrence of rating from 0 to 10, across each individual rating considering all the observed elephants, has been depicted in a graph to show the distribution of overall values from bad to satisfactory conditions.

The welfare status of mahouts/handlers has been assessed by examining the socio-economic parameters and the handler's relationship with his animal in terms of experience, knowledge of commands, etc. Bad or poor handler welfare maybe associated with poor handling of his animal. *N* refers to number of individuals (elephants or handlers) and *N** to number of sub-parameters.

Results
Population status of elephants
Mysore Zoo maintains 11 elephants (four male and seven female) with the mean age of (Figure 1) 19.3 yrs (SE. = 7.4, *N* = 11). Of these, three are *Loxodonta* sp. (African elephants) and the rest are *Elephas maximus* (Asian elephants). The mean age of females (considering both species together) is 16.9 yrs (SE = 8.1, N =7) and of males (Figure 2) is 23.5 yrs (SE. = 18.1, *N* = 4).
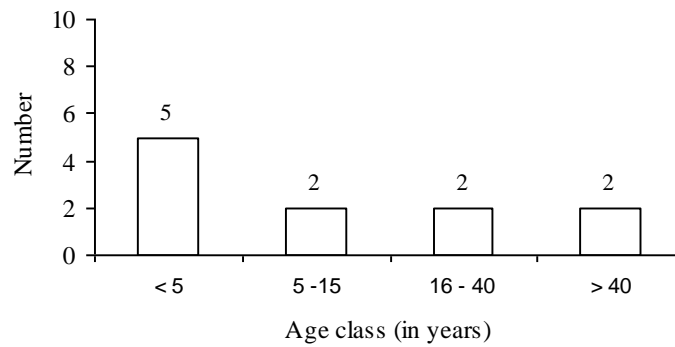
Figure 1: Age distribution of elephants in Mysore Zoo.
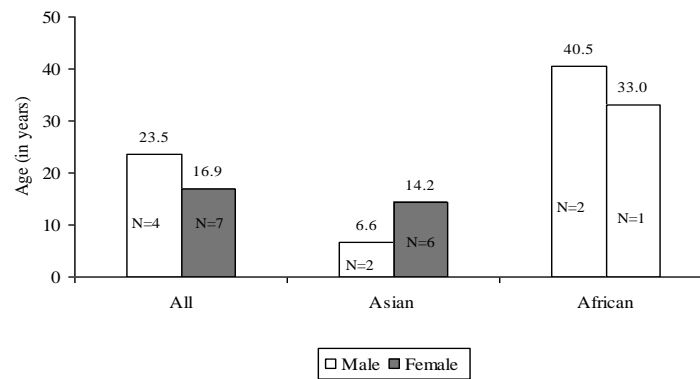
Figure 2: Age distribution of elephants, species and sex wise, in Mysore Zoo.

Source of elephants

- Elephants less than five years, captive born (Figure 2) in the zoo: two in number
- Elephants > 5 and < 15 years, captive born in the zoo: one
- Elephants > 15 years, captive born in the zoo: one
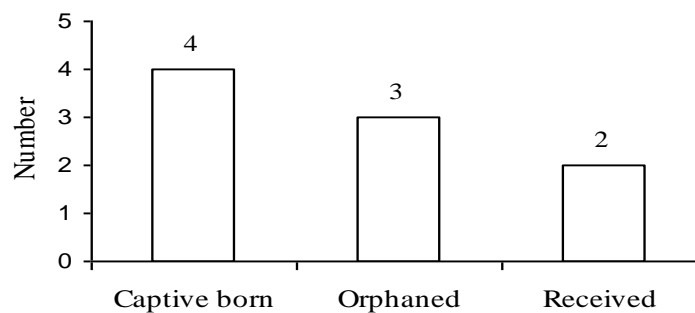
* Received: refers to elephants received in exchange program form other zoos

Figure 3: Source (origin) of elephants.

Change in ownership of elephants with consequent shifting of location has potential negative welfare implications (Clubb and Mason, 2002). High rating is given to elephants born in captivity, as this implies less drastic change in living conditions.

The mean rating for birth was 6.5 (SE. = 1.1, $N = 10$) with only three elephants being born in captivity.

Shelter

- The elephants have two types of shelter: one, a day enclosure, 4 acres in size, with natural vegetation and the second, a night enclosure where the elephants are chained
- Flooring during day is natural, except for two young animals who have concrete floor
- Night flooring is of concrete for all elephants except three adult animals
- Shelter type is open with access to shade (from trees) or from man-made structures such as sheets

The physical conditions provided for captive elephants form an important factor in influencing its welfare. Shelter conditions which approximate wild living conditions have been given high rating. The mean rating was 6.1 (SE. = 1.5, N = 6) indicating the occurrence of moderate conditions. Distribution of ratings for shelter-related parameters suggests (Figure 4) that 10 values dominate.
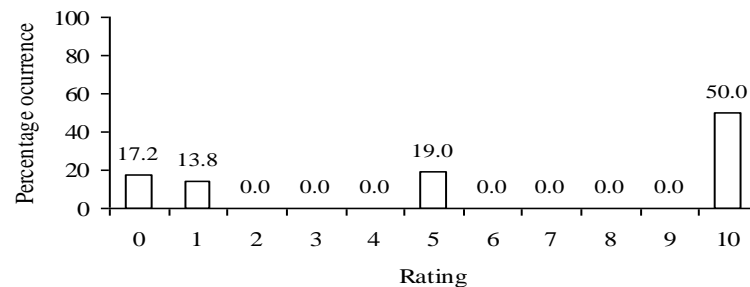
Figure 4: Percentage occurrence of rating for shelter.

Elephants allowed to free range in natural, forest conditions are given high rating. The mean rating for Mysore Zoo for this parameter) was 1.9 (SE. = 1.1, N = 10) implying bad conditions. Rating for space available to the elephant is assigned based on the actual size of the shelter and the size used by the elephants in the context of being restrained by chaining.

The space available to the elephants is 4 acres when the elephants are on "exhibit". They are chained when the Zoo is closed to the visitors. The mean rating for shelter related parameter (Figure 5) was 4.5 (SE. =0.5, N = 10) and highlights poor conditions. The mean rating is 8.0 (SE. = 1.4, N = 10) with only two elephants getting a rating of 0 due to unsuitable substrates.

Sh: Shelter type   Sh-Sz: Shelter size   Fl-d: Flooring (day)
Fl-n: Flooring (night)   Sd: Shade availability   Sd-t: Shade type
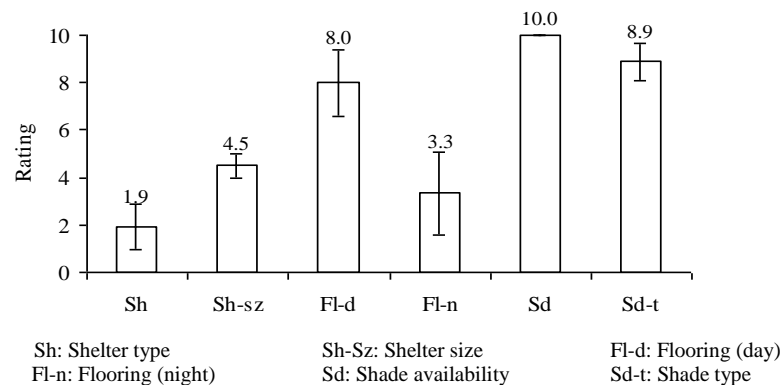
Figure 5: Rating for shelter sub-parameters.

Water

- All the elephants had access to drinking/bathing water
- Water source was through tanks/taps
- Distance to water source varied from 10 to 60 ft
- Mean number of times the elephants drink water is 5.2 (N = 10), consuming a mean of 131.1 l /day (N = 7)
- Bathing frequency varied from twice to thrice a week within the enclosure for a mean of 1.5 h (N = 9) using brush/stone

The quantity and quality of water provided along with landscape features for engaging in activities typical to the species while drinking/bathing are given high rating. The mean rating was 3.9 (SE. = 1.2, N = 5)

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showing prevalence of poor conditions. Distribution of ratings (Figure 6) shows that value 5 dominates, only 2% values fall under 10.
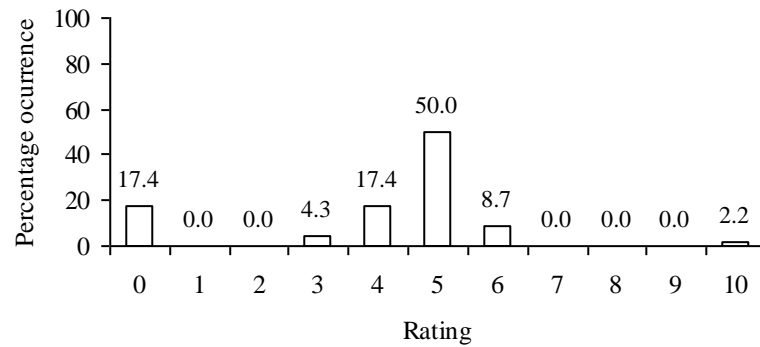
Figure 6: Percentage occurrence of rating for water.

Running water sources harbour relatively less contamination than stagnant water. The mean rating for this parameter was 3.8 (SE. = 0.1, N = 10) as all the elephants have access to water tanks/tap water. The quantity of water consumed was rated in terms of number of times the elephant drank water. The mean rating for this sub-parameter was 5.0 (SE. = 0.0, $N = 10$) as all elephants lived in semi-natural conditions where water was made available through containers.

The zoo uses hard materials as a scrub while bathing and hence was given low rating for this sub-parameter as it could prove injurious to the skin. The mean rating was 0.0 (SE. = 0.0, $N = 7$).

Pr-w: Perennial water source   Dr-fq: Drinking frequency
Bt-fq: Bathing frequency   Bt-du: Bathing duration
Bt-m: Bathing materials
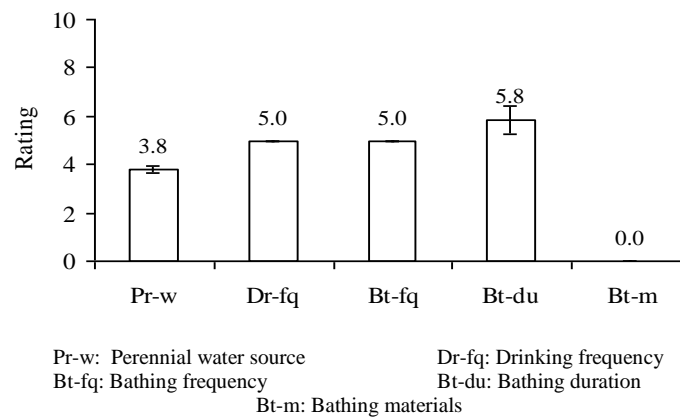
Figure 7: Rating for water-related parameters of elephants from Mysore Zoo

Sleep and related features
- All elephants are rested within the enclosure
- Mean sleeping area is 347.6 sq. ft ($N = 5$) within enclosure/shelter
- Mean sleep duration is 6.7 h ($N = 9$)

The mean rating for provision of suitable place and normal duration of sleep for the elephants was 1.6 (SE. = 0.9, $N = 3$) indicating prevalence of poor conditions, with 85% of ratings occurring below 4 (Figure 8).
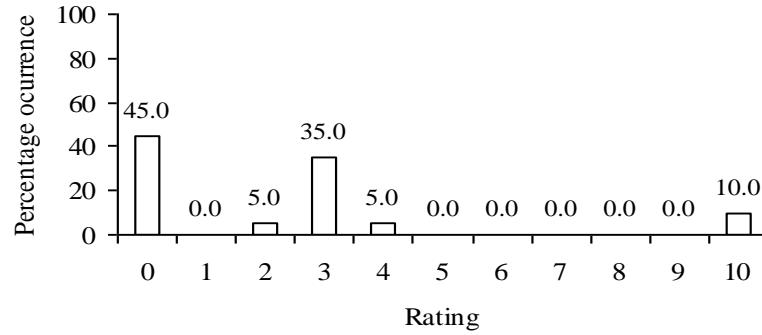
Figure 8: Percentage occurrence of rating for sleep for captive elephants in Mysore Zoo.

Shelter and sleeping place are the same, and hence the rating was similar which was 2.5 (SE. = 0.0, N = 7) because all the animals have been confined to a radius of 10–12 ft. due to the practice of chaining. Elephants sleep for 4 h (Zepelin *et al.,* 2005), and any deviation from this is given low rating. The mean rating for sleep-related parameter (Figure 9) was 2.3 (SE. = 1.5, N = 7) as four of the seven observed animals slept for 6 –11 hours.
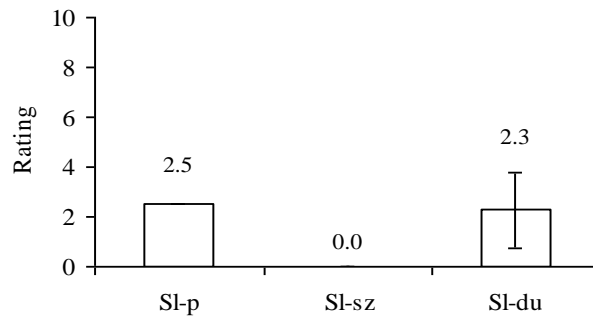
Sl-p: Sleeping place   Sl-sz: Sleeping area (size)   Sl-du: Sleep duration

Figure 9: Rating for sleep-related parameters for captive elephants of Mysore Zoo.

Walk and social interaction
- The animals, numbering 7, are allowed to walk within the enclosure (N = 7)
- Two elephants are taken for walks—during the day as part of providing tourist rides
- The African elephants consisting of two adults and a sub-adult are reported to interact among themselves. However, the adult male has been kept isolated due to injury inflicted by the elephant on the adult female and sub-adult.
- The elephants were given opportunities for interaction (N = 8) except the African adult male and an orphaned young female (one month).

Opportunity for physical exercise and social interaction was rated. The absence of exercise among confined animals will lead to health problems. All the elephants are given an opportunity to walk, hence, the rating for walking was 10.0 (SE = 0.0, N = 10). Elephants are social animals (Sukumar, 2003) and their need for social interaction forms an integral part of their well-being.

The mean rating was 6.7 (SE. = 2.3, N = 3) implying prevalence of moderate conditions with 29% of ratings less than 5 (Figure 10).
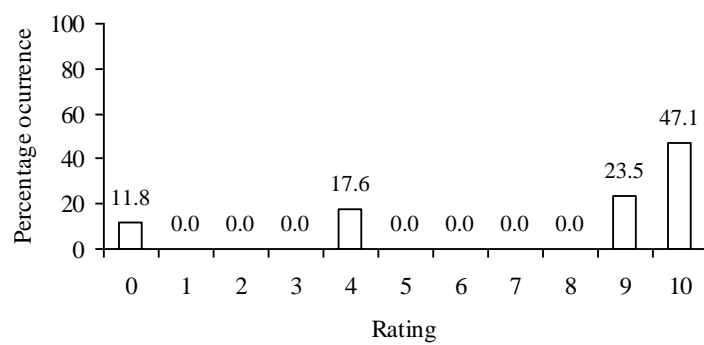
Figure 10: Rating in percentage for f social interaction among captive elephants in Mysore Zoo.

The mean rating for the opportunity for interaction and interaction-related parameter (Figure 10) was 8.0 (SE = 1.4, $N = 10$) with only two elephants reportedly not allowed any interaction. High ratings are given for elephants with unrestricted access to social interaction. Mean rating for interaction (Figure 11) hours was 3.0 (SE. = 0.7, $N = 8$) highlighting the prevalence of poor conditions.

Wl: Opportunity to walk   In: Opportunity for interaction
In-ar: Area of interaction   Gr-sz: Group size
In-hr: Interaction hours
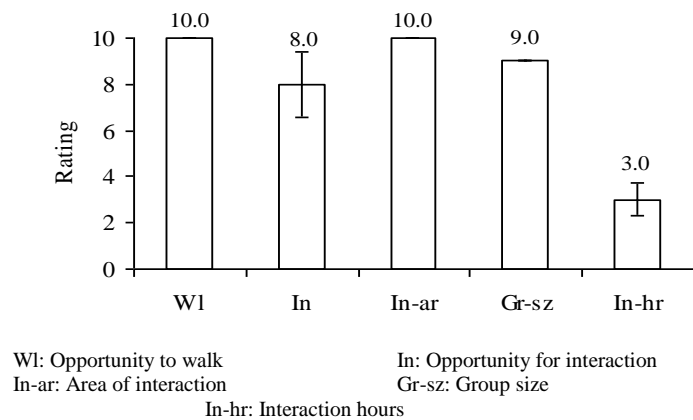
Figure 11: Rating for walk and social interaction-related parameters for captive elephants of Mysore Zoo.

Chaining
- Chain is tied in the leg region; for one adult male both hind legs were chained
- The mean chain weight is 39.8 kg ($N = 4$), size is 0.4 cm ($N = 5$) and length is 342 cm ($N = 5$)
- Chaining duration ranged from 14 to 16 h
- Only two elephants (aged 1.1 and 2.1 yrs) are allowed to free range at night

Captive elephants are subject to chaining for different durations and regions of the body. This parameter is rated considering the opportunity to free range, duration and region of chaining. Mean rating was 1.7 (SE. = 0.9, $N = 4$) showing prevalence of bad conditions as 90% of the values fall within 0–1(Figure 12).
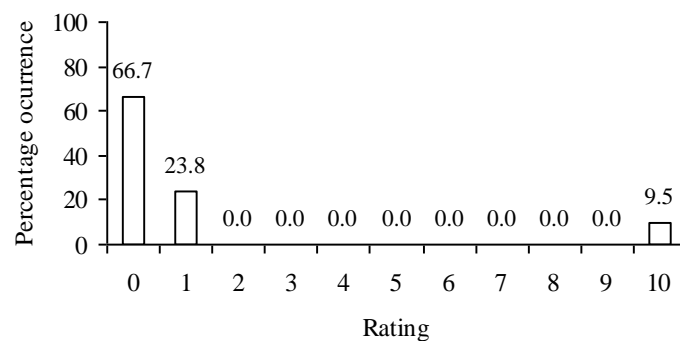
Figure 12: Percentage occurrence of rating for chaining of captive elephants in Mysore Zoo.

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The use of chains in more than one region of the elephant's body is given low rating. Mean rating for chain-related parameters (Figure 13) was 0.8 (SE. = 0.2, $N = 6$) with one adult male being chained by both its hind legs. Mean rating for free ranging at night was 2.5 (SE. = 1.7, $N = 8$) with two elephants allowed to free range.

Ch: Chaining status   Ch-r: Chaining region
Ch-du: Chaining duration   Fr-n: Free ranging at night
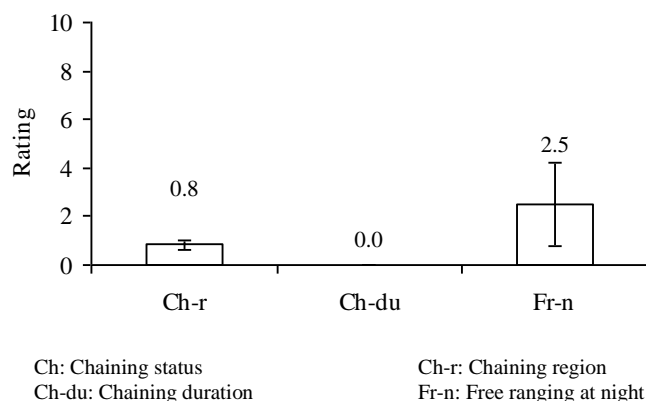
Figure 13: Rating for chain-related parameters for captive elephants of Mysore Zoo.

Behaviour

- Seven elephants are calm; two adult elephants are aggressive towards people; two adult male and female (African species) reported to have been aggressive towards people
- None of the elephants exhibited stereotypic behaviour
- Adult male (African species) reported to be aggressive during musth

Temperament and observed abnormal behaviour, if any, are rated in terms of ease of handling the elephants and occurrence of stereotypy. Elephants that are calm/quiet and are easy to handle are given high rating. The mean rating for temperament was 7.8 (SE.= 1.6, $N = 9$) with two elephants getting a rating of 0 due to their aggressive behaviour towards people. None of the observed elephants exhibited stereotypy. Hence, rating was 10.0 (SE = 0.0, $N = 9$).

Work

Except as display animals at the Zoo, elephants have no specific work; however, two adult elephants—a male and a female—are used for work, involving "20–30 rounds" of walking.

Food provisioning

- All the elephants are given only stall-feed in the enclosure
- Food: Grass, fresh grass, rice (*Oryza sativa*), coconut (*Cocos nucifera*), jaggery (sweet derived from sugarcane *Sacharum sp*.), ragi (*Eleusine sp*.) balls, sugarcane, greens, reed grass, paddy (unmilled rice), nelulu, carrot, sugarcane (*Sacharum sp*), banyan leaves (*Ficus sp.*) straw, eayhulu, fig (*Ficus sp*) leaves
- Special food—Milk, reed grass, carrot, sugarcane, ragi balls, rice for orphaned 1-month baby elephant
- Ration chart is used for all elephants
- For the injured female elephant (adult, African species), food given also included Dal (cooked pulses), grams, Kadle (peanuts/fried gram) Bengal gram

Availability and opportunity to feed on a wide variety of food is considered along with husbandry practices such as hygiene of feeding, place and maintenance of ration chart. The mean rating for this parameter was 6.2 (SE. = 2.8, N = 4) with 40% occurrence of ratings scoring less than 5 (Figure 14).
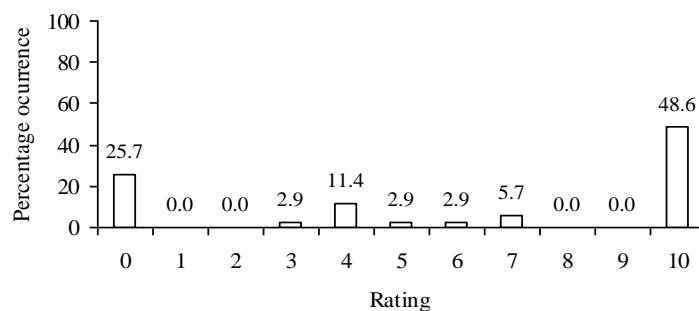
Figure 14: Distribution of rating for food among captive elephants in Mysore Zoo.

Opportunity to free range to browse/graze in forest conditions is given high rating as elephants are known to feed on a wide variety of plants (Shoshani and Eisenberg, 1982). Mean rating for food-related parameter (Figure 15) was 0.0 (SE. = 0.0, N = 9). The total number of foods provided is divided by a factor of two as these represent only stall-feed. This score is then considered as the rating for this sub-parameter. Mean rating was 4.9 (SE = 0.4, N = 9).

Fd: Food provisioning type   Hy: Hygiene of feeding place
Fd-n: No. of food items   Rt: Usage of ration chart
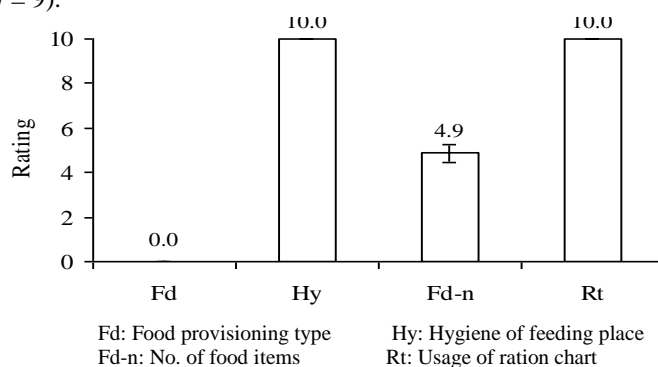
Figure 15: Rating for food-related parameters for captive elephants of Mysore Zoo.

Reproductive status
Female
- Three female elephants (age range: 26–51 yrs, two Asian and one African species) are cycling and are exposed to male elephants.
- All three elephants are exposed to captive males for breeding
- Total of eight births reported for the three elephants considered together
- Age at first birth: 17 yrs (Asian species) and 21 yrs (African species)

Male
- Two elephants (age 12–Asian and 70 yrs– African) are active
- Musth reported for 70-yr old male, rough behaviour during this period, chained 24 hours, sired one male calf with the adult female (African species)

Reproductive activity of adult elephants is associated with good physical health (Kurt and Garai, 2007) and factors linked to captivity such as stress, obesity/malnourishment, and absence of members of opposite sex, among other relevant causes for lack of reproductive activity (Clubb and Mason, 2002).

The mean rating for reproductive status-related parameter (Figure 16) for females was 9.2 (SE. = 0.4, $N**$ = 14) and of male (Figure 17) was 7.5 (SE = 2.9, $N**$ = 4). $N**$ refers to the number of individual ratings across all sub-parameters observed.

Cy: Occurrence of oesrtus cycles   Ex: Exposure to males
M-o: Mating observed/not   M-s: Male source
               Br-n: Number of births
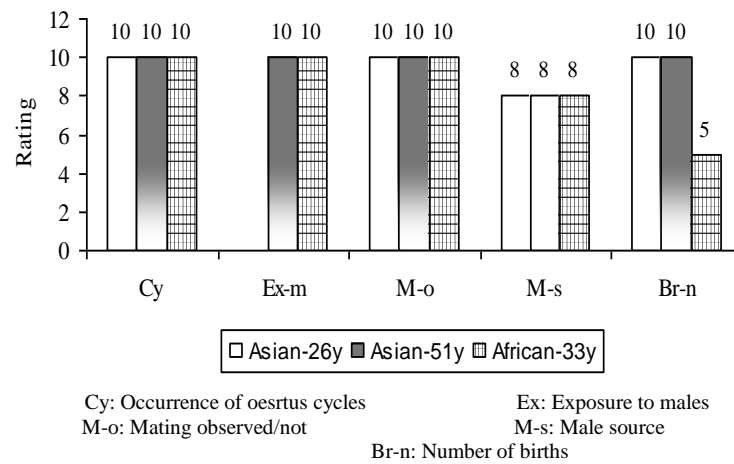
Figure 16: Rating for reproductive status-related parameters of
female elephants in Mysore Zoo.

Rp-a: Reproductively active/not   Mu: Occurrence of musth
               H-mu: Handling of musth
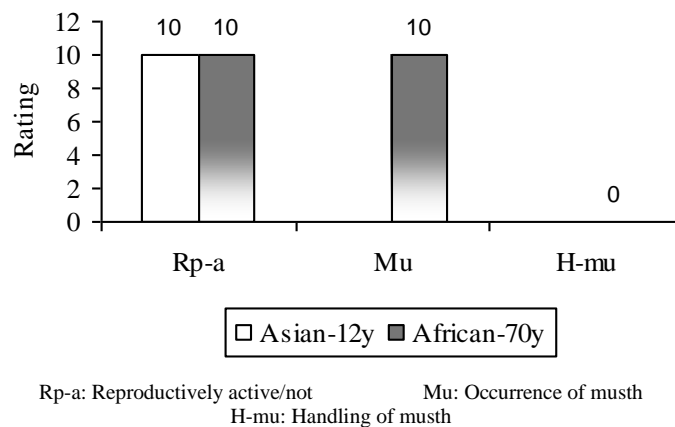
Figure 17: Rating for reproductive status-related parameters of male elephants of Mysore Zoo.

Health status and veterinary care

- Female elephant (African species), 33 yrs, injured following a fall into a trench
- Male elephant, 12 yrs (Asian species), blind in one eye
- Rescued calf (Asian species, one-month old) died
- All elephants de-wormed with various drugs at frequency ranging from once a month to once in three months
- Elephants vaccinated against HS and F&MV every year
- Oiling done on head/leg using castor oil/neem oil, weekly twice dung/urine/blood tests done

Captive conditions may lead to incidence of specific health issues such as foot problems (Mikota *et al.*, 1994), excessive weight due to imbalance in available nutrition, exposure to diseases carried by livestock, etc. Mean rating was 9.1 (SE= 1.0, $N = 8$) and 95% values fall in 10 rating (Figure 18) implying satisfactory conditions.
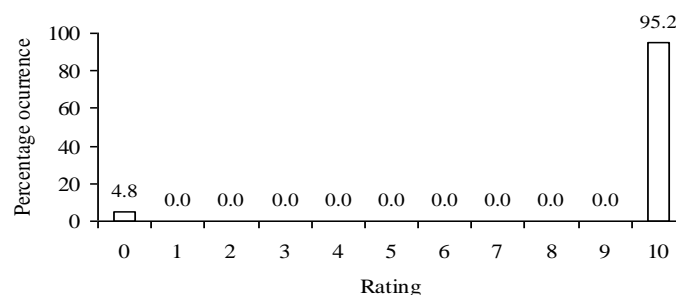
Figure 18: Distribution of rating for health and veterinary care for captive elephants of Mysore Zoo.

Data on disease/injury is available for four of the 11 elephants (two Asian species and two African species. The mean rating for disease/ injury occurrence (Figure 19) was 2.5 (SE = 2.9, $N = 4$) with one rescued calf (aged 1 month) having died. Rating for de-worming was 10.0 (SE= 0.0, $N = 10$) showing that the practice of de-worming is followed for all the elephants. All the elephants were vaccinated (some against Hemorrhagic septicemia (H.S.), some against H.S. and Foot and Mouth disease); hence, rating was 10.0 (SE.= 0.0, $N = 10$) for this sub-parameter. Samples of urine/dung/blood are tested, hence, rating was 10.0 (SE =0.0, $N = 9$).

D/In: Disease/ Injury occurrence   Dw: De-worming status
Dw-fq: De-worming frequency   Vc: Vaccination status
Vc-fq: Vaccination frequency   Ol: Oiling status
Ol-fq: Frequency of oiling   Ts: Tests of urine/dung/blood samples
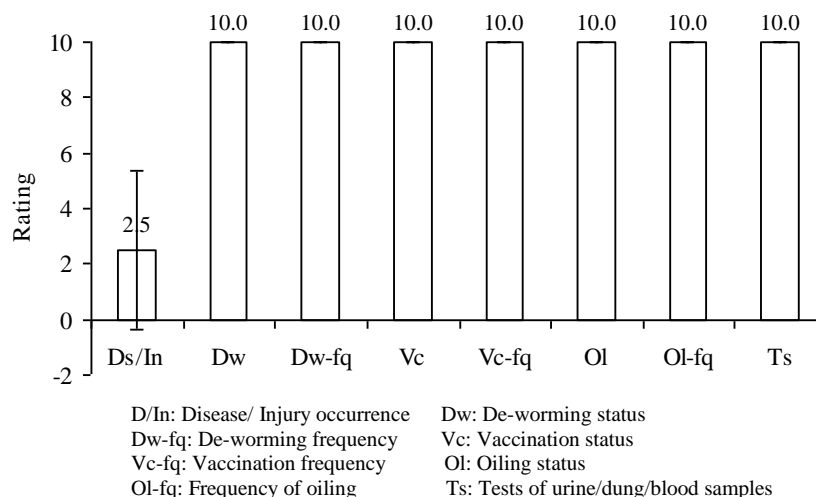
Figure 19: Rating for health and veterinary care of captive elephants of Mysore Zoo.

Veterinary personnel and infrastructure
- The elephants are treated by a veterinary doctor and two assistants
- Experience with elephants is 15 yrs, frequency of visit: daily, associated with zoo
- Veterinary facilities available: Laboratory, drug store, radiology, mobile x-ray, operation theatre
- Staff quarters is average
- Following facilities are available: cooking shed, cooking vessels, provision shed and animal stand
- Personnel included: Manager— (1)and Cook (1)
- Birth, mating and treatment details of elephants are recorded

Timely veterinary care and availability of basic infrastructure can assist in good management. The mean rating for this parameter was 9.3 (SE = 0.8, N = 7) indicating occurrence of satisfactory conditions, 88% ratings fall within 10 (Figure 20).
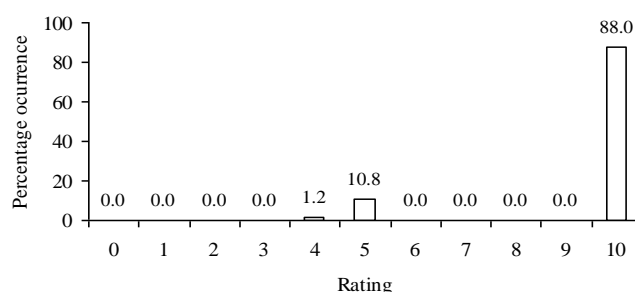
Figure 20: Distribution of rating for veterinary personnel and infrastructure of captive elephants of Mysore Zoo.

The mean rating for veterinary care (Figure 21) availability was 10.0 (SE. = 0.0, $N = 11$) indicating the availability of a veterinary doctor for the care of the elephants. Infrastructure like staff quarters, cooking shed, animal stand, etc. has been rated and high rating shows availability of more than 75% of facilities. The mean rating for this parameter was 4.9 (SE. = 0.1, $N = 10$).

Vt: Veterinary doctor availability   Ex-e: Experience with elephants   Vs:Frequency of visits
Vt-a: Veterinary assistant availability   Rc: Record maintenance   Fc: Facility availability
Fc-t: Facility type
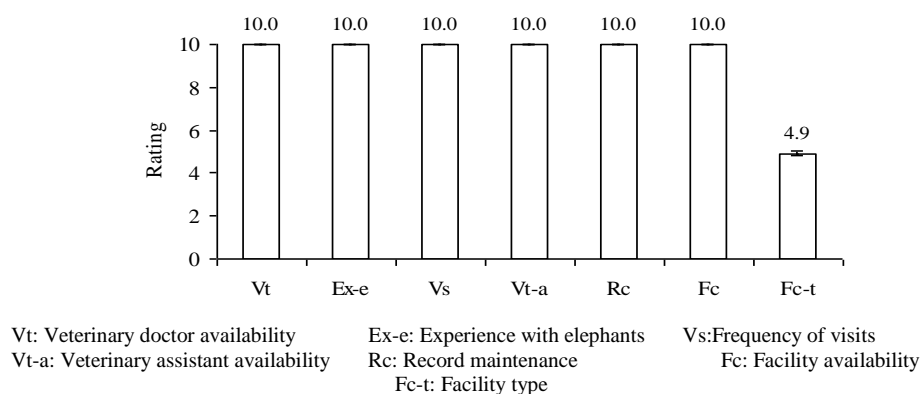
Figure 21: Rating for veterinary personnel and infrastructure availability for captive elephants in Mysore Zoo.

Welfare status of mahout

- The mean age of mahouts is 33.2 yrs (SE. = 4.9, N = 5)
- The mean experience in this profession is 15.7 yrs (SE = 6.9, N = 5)
- The mean experience with a specific elephant is 2.9 yrs (SE = 1.1, N = 17)
- Of the five mahouts, two chose this profession as a means of employment
- Only one mahout did not belong to a tribal/Muslim community (N = 4)
- Only one mahout was not trained in this profession (N = 5)
- Education level ranged from 5th standard to SSLC
- The mean annual salary is Rs.39, 600 (ranging from Rs. 26,400 to 84, 00). Excepting one, all mahouts are married (N = 5) with number of children ranging from 2 to 3
- Wooden stick/wooden ankush/stick is used as tool to control elephants (N = 5)
- Health check-up done by the Government (N = 4)
- Insurance cover available, amount ranging from Rs.50,000 to Rs. 1,00,000/-
- Two mahouts are said to have observed mating of elephants
- Alcohol is not consumed while at work (N = 4), only one mahout drinks after work

The welfare of handlers is assessed in terms of their socio-economic profile and experience in this profession. Percentage occurrence of overall rating, including socio-economic and experience-related parameters, showed 25% incidence of values less than 5 (Figure 22).
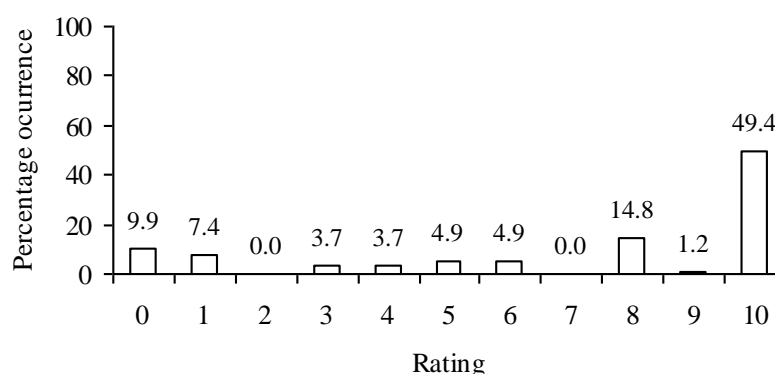
Figure 22: Percentage occurrence of overall rating for mahout of elephants of Mysore Zoo.

Poor socio-economic status may influence the way the elephant is handled. The mean rating for this parameter was 7.6 (SE. = 0.5, N* = 51) implying satisfactory conditions. (N** refers to number of individual ratings considered across all the sub-parameters for socio-economic status). Education level formed one of the parameters used for assessing socio-economic status and the mean rating was 8.0 (SE. = 1.3, N = 4) showing three of the four mahouts had attended school up to 8th standard.

Rating of 10 has been designed to represent a salary capable of supporting a family of four in an urban environment. The mean rating was 6.0 (SE.= 1.2, N = 5) with only one mahout getting a satisfactory rating of 10. Alcohol consumption is a practice observed among some handlers. High rating represents absence of alcohol consumption. The mean rating was 8.0 (SE. = 2.2, N = 5).

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Professional experience was rated to assess the handler's relation with his/ her elephant. This was rated in terms of experience, capability and interest in the profession. Mean rating was 6.3 (SE = 0.7, N** = 30) showing prevalence of moderate conditions (N** refers to number of individual ratings across all the sub-parameters observed). Number of years in this profession is one indication of experience. Duration in the profession is expressed as percent of the mahout's age and is rated to indicate experience in the profession. The mean rating (Figure 23) was 6.4 (SE = 2.1, N = 5) indicating moderate conditions.

The duration as a mahout with a specific elephant is rated as an indication of professional experience. The mean rating was 5.5 (SE. = 1.1, N = 15) implying moderate conditions for this sub-parameter. Becoming a mahout owing to personal interest in the profession and having a tradition of handling elephants are given high rating. The mean rating is 4.8 (SE = 2.2, N = 5).

Ex-a: Experience (% of mahout age)   Ex-e: Experience (% of elephant age)
Rs: Reason for choosing this profession   Cmy: Community of mahout
Rel: Having mahout relatives   Fam: Family occupation
Ed: Education status   Sl: Salary given   Ch: Number of children
Ln: Number of languages known   Com: Knowledge of commands
Hlt: Health check-up status   In: Insurance cover availability
Al: Alcohol consumption   Al-fq: Consumption frequency

Figure 23: Rating for welfare parameters of the mahout.

Overall mean rating for elephants was 6.9 (SE. = 0.2, N** = 406) showing prevalence of moderate conditions. Overall mean rating (excluding veterinary parameters) was 5.7 (SE. = 0.2, N** = 270. N** refers to number of individual ratings across all sub-parameters observed). The occurrence of '10' scores in 42% of the cases (Figure 24) in the overall rating (excluding veterinary and health parameters) shows existence of satisfactory conditions to this extent. The occurrence of 'scores of 10' was 59% when veterinary and health parameters are included (Figure. 24).
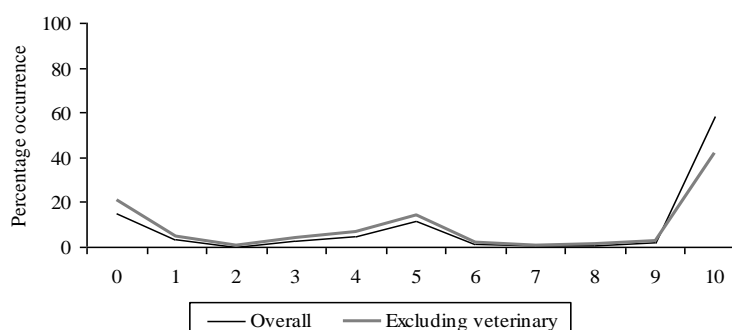
Figure 24: Comparison of percentage of overall rating for elephants.

Discussion

Overall mean rating of 6.9 for elephants indicates the prevalence of moderate conditions. This rating measures the difference between living conditions in captivity and those in the wild as well as provision of suitable veterinary management. Setting veterinary parameters aside, as some health issues of the elephants could be a consequence of captivity, the mean rating can provide a profile of captive conditions by itself. Excluding veterinary parameters, the overall mean rating of the zoo was 5.7.

The occurrence of scores of 10 in the overall rating in 42% of the cases indicates that satisfactory conditions prevail here to this extent. However, a feature of this survey is the use of "presence–absence" type rating with only two values: 10 or 0. Such ratings formed 42% of all the sub-parameters assessed, with scores of 10 from such sub-parameters contributing 39% to the overall rating, indicating the presence of suitable features. However, with greater availability of information about a particular parameter, percentage occurrence of scores of 10 may reduce with consequences on the overall rating.

The World Zoo Conservation Strategy (1993) states conservation of the behavioural repertoire of wild animals along with conservation of a species as being important. It's important to have features which encourage the expression of species-typical behaviour in zoo enclosures. Some aspects of the zoo not conducive to the elephants' species-typical way of life were:

- Wild elephants have been reported to travel long distances as they forage/search for mates/companions (Poole and Moss, 2008). Mysore Zoo elephants are provided a large enclosure, measuring 4 acres. However all except for two elephants (less than three years old) are chained overnight. This practice along with provision of stall-feed frees up the time available for the animals. Elephants are said to forage for nearly 12–18 hours looking for their favoured vegetation (Sukumar, 2000). The absence of any "occupational variables" (Kane *et al.*, 2007) may lead to poor conditions. The use of browse (Kane *et al.,* 2005) and staggered feeding times (Kinzley, in press) have been recommended to aid in providing a more enriched environment for confined animals.

- Absence of free-ranging feed amid suitable and varied habitat in the zoo. Elephants forage and feed on diverse vegetation (Sukumar, 2000), engaging in activities such as manipulating food using their trunk, tusks and feet (Kurt and Garai, 2007). Young captive-born elephants need an opportunity to learn foraging for suitable food from their con-specifics (Kurt and Garai, 2007). Such activities/opportunities are deficient in the zoo.

- Sleep duration: Elephants sleep only for 3–4 hours/day (Kurt and Garai, 2007). Excessive sleeping could be attributed to ill-health or captivity-imposed factors. Kurt and Garai (2007) observed longer sleeping duration among orphaned elephants with retarded body growth in an elephant rescue center. These elephants also integrated, less/none at all, socially into any group. In Mysore Zoo, except for three elephants, mean sleeping duration for adult animals ranged from 5 to 6 hours while the duration for young animals ranged from 8 to 11 hours.

- Reproduction: Mysore Zoo elephants have a successful history of elephant births (Krishnamurthy and Wemmer, 1995). The existing elephants also seem to have given birth. Despite this success and the time-span of its occurrence, the number of elephants has not increased. This may be due to transfer of elephants across institutions/individuals, a fact borne out by the presence of two African elephants in the zoo which were received in exchange from Germany (former West Germany). Clubb and Mason (2002) cite studies on the negative effects of removal/introduction of elephants/social animals from a group. Early separation of dependent young from a group can result in trauma (Bradshaw, in press).

Zoo features conducive to elephants:

- Availability of veterinary care is satisfactory as doctors and assistants are available, veterinary schedules for the elephants are followed and facilities (laboratory, clinical facility, etc.) exist.

- Related individuals in elephant groups: The present group structure of elephants included mother–offspring pairs—three in number. It is reported that the social structure of elephants revolves around protection, care and nurture of infants (Kinzley, in press), occurrence of family groups of mother–dependent offspring (Vidya and Sukumar, 2005), allomothering among unrelated individuals in captivity, in the presence of young elephants (Gadgil and Nair, 1982).

  Maintenance of herd structure consisting of related individuals is considered to be of immense importance, in conjunction with adequate space, for animals in captivity (Kane *et al.,* 2007).

Mahout

The mean rating for mahouts is 7.1 when both socio-economic and professional status is pooled together. This rating implies occurrence of satisfactory conditions.

Parameters for mahout welfare with ratings of less than 5:

- Experience of mahout with specific elephants: The mean duration with specific animals is only 2.9 years, ranging from three months to 18 years. This accounted for only 30% of experience when calculated as a proportion of elephant's age, implying change of mahouts. Assuming the attitude of the mahouts towards his elephant to be average (on a scale of good to bad), frequent change of mahouts involves a period of learning and development of a bond between man and animal. This maybe stressful for both.

It should be noted that the Mysore Zoo has witnessed incidents of poisoning resulting in the death of its elephants (two adult females and an adult male) in the year 2004; forensic reports also confirmed them. Such incidents point towards the vulnerability of elephants to human action in the absence of vigilance/care by employees.

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Section 6:
Zoo Elephants in Kerala

Executive Summary

The zoo in Trivandrum, covering 50 acres, was established in mid-19th century. It has a number of exotic/ indigenous species, including a single female Asian elephant.

This investigation aims to assess the welfare status of elephants. The welfare status of captive elephants has been assessed by comparing physical/ physiological/ social and psychological features in captivity with those observed in the wild. Deviation from the wild state for the parameters observed was rated using a scale developed by elephant experts.

The elephant was caught from the wild by the Forest Department and handed over to the zoo in 1943. Mean Rating (M-R) was 0.0 showing a deviation of 100% from Expert Rating (E-R).

The elephant was maintained in unnatural conditions for the purpose of display to the public as a means of education. M-R was 1.0 with a deviation of 87.5% from E-R.

Two kinds of enclosures were available, a day shelter with earthen flooring and a night shelter with concrete flooring. M-R was 3.9 implying a deviation of 51.3% from E-R.

Tap water was available for drinking, with the elephant consuming water twice at 10a.m. and 4p.m. Bath duration was 2h and scrub material was coconut husk. M-R was 2.9 with a deviation of 58.5% from E-R.

The elephant was walked on tarred roads once a week for 30 minutes, covering a distance of 4 km and a mahout accompanied the elephant. M-R was 3.0 showing a deviation of 66.7% from E-R.

The elephant was kept singly with no access to companions. M-R was 0.0 indicating complete divergence from E-R.

The elephant was chained with a plain type chain weighing 8 Kg, a length of 7 ft and a size of 5 inches. Chaining duration was 16h in open (day) enclosure and around 6h at night; hobbles were used for the fore-legs while in the day enclosure. M-R was 0.8 with a deviation of 90% from E-R.

The elephant was not given any kind of work; hence, M-R was 8.0, indicating no deviation from E-R.

The elephant was stall fed, food being provided in the day and night enclosure. Food given was banana (*Musa* sp.)-500 gm, Palm (*Borassus sp*)-15, Fodder grass-50 kg, Caryota palm-11 kg, Plantains (*Musa* sp.)–100gm, coconut (*Cocos nucifera*) palm-105 kg and Asafoetida-100 gm, Jaggery-2 kg, sugarcane-4-5 kg was also given. M-R was 3.0 with a deviation of 66.7% from E-R.

The elephant was given opportunity to breed, though not in the past 5 years. Present age may be beyond the period for occurrence of oestrus cycles. M-R was 7.0 for this sub-parameter, indicating no deviation from E-R.

The elephant seemed to have corneal opacity and lumps were seen on both forelegs. De-worming was practiced, but immunization and oiling was not done, and the M-R was 2.2 implying a deviation of 72.2% from E-R.

Veterinary doctor was available for the elephant, visiting the zoo daily. The zoo hospital was equipped with a laboratory, out-patient facility and the health record of elephant and service record of handlers was maintained. M-R was 7.5 with a deviation of 16.7% from E-R.

The welfare assessment of the elephant in the zoo revealed an overall mean rating of 3.4 implying an overall deviation of 57.5% from E-R. This means, on an average, nearly 60% deviation from norms considered suitable by experts can be seen in the observed parameters on an average.

Thirty one (of a total of 47) parameters showed deviations of 50% or more, constituting 66% of all the deviations. More than half of the observed parameters deviated by more than 50% from the standards considered suitable by experts.

Introduction
The zoo in Trivandrum, covering 50 acres, was established in mid-19th century. It has a number of exotic/ indigenous species, including a single female Asian elephant. Captive conditions for elephants vary between institutions, with some providing natural conditions and others housing the animals in man-made enclosures with no natural conditions.

Objective
This report aims to assess the welfare status of elephants:
- In terms of provisions made to meet the physical and biological needs of elephants

Method
Bradshaw (2009) reports of welfare studies that are based on the difference between a captive environment and those observed in the wild. The welfare status of captive elephants has been assessed by comparing physical/ physiological/ social and psychological features in captivity with those observed in the wild. Deviations from conditions in the wild have been considered to represent poor welfare. The greater the deviation, the poorer the welfare. Deviation from the wild state for the parameters observed was rated using a scale developed by elephant experts. Data was collected through observations of elephants/ interviews with relevant personnel.

Data Processing
The rating method
A team of 31 experts including elephant biologists, veterinary doctors (studying wildlife disease and captive elephant disease), welfare personnel (working on wildlife conservation and welfare issues), wildlife managers (managing wild, captive elephants) and elephant mahouts rated different parameters of importance to the welfare of captive elephants (Varma, 2008; Varma, et al., 2008; Varma and Prasad, 2008). This rating was then used to assess the welfare status of elephants and elephant keepers:

- Experts rated a total of 114 welfare parameters covering all the major aspects of captivity
- The rating scale was from zero (unsuitable conditions) to ten (suitable conditions). With this logic, experts used maxima based on their concept of the importance of a particular parameter to an elephant. For example mean expert rating of 8.0 (SE= 0.5, N=29) for a parameter 'floor' and 9.0 (SE=0.4, N=31) for 'source of water' was arrived at from the ratings suggested by each expert
- A mean rating for each parameter, across all the participating experts, has been used as the Experts' Rating (E-R) which represents the importance attached to a parameter.
- For example, if an elephant is exposed only to natural flooring, the animal receives a rating of 8 and for entirely unnatural flooring the value is 0; if animal is exposed to both natural and unnatural flooring, the value is 4 (as 8+0/2= 8/2= 4). If an elephant is exposed to a natural water source, such as a river, it receives a value of 9; if the source of water is large lakes or reservoirs, it gets 4.5. A value of 3.5 is assigned for small water bodies like tanks and ponds. Tap water (running) gets 2.5 and if only buckets, pots, and tankers are in use, then the allocated value is 0.5.
- Data for an elephant or a group of animals was collected. With this data Mean Rating (M-R) was calculated for a given parameter, along with its sub-parameters. Thus the Mean Rating (M-R) denotes welfare status of existing conditions on the ground for the particular parameter.
- In this investigation, variables which represent a common feature of the captive condition have been grouped to form a parameter. The variables have been termed sub-parameters. For example, the variables shelter type, shelter size, floor type in the shelter; all represent different aspects of the physical space provided to the elephant. Hence, they are grouped together to form the parameter "Shelter" and each constituent variable is a sub-parameter. In this investigation, the E-R for a parameter (say, shelter) represents the mean of E-Rs across all related sub-parameters. M-R is also based on similar lines.
- E-R and M-R for each of the zoos here represent the average across related parameters observed for that zoo. For instance, E-R / M-R for a parameter "shelter" represent the average of related parameters (termed sub-parameters) such as type, flooring, size, and shade availability. Not all related parameters will be rated for each of the zoos. The number of such related parameters varies for each zoo.
- Results have been presented comparing E-R and M-R as a means of comparing the extent of deviation present in the parameters observed. The difference between E-R and M-R (expressed as percentage) indicates deviation from the prescribed norm.

- For handlers, the difference between the maxima provided by experts (E-R) and existing status (M-R) has been used to indicate the professional/ socio-economic status of value to the handler and his elephant.
- N refers to number of sub-parameters for an observed parameter.

Results
The zoo maintained a single female Asian elephant, Maheshwari, aged more than 70y.

Source
Elephants caught from the wild experience greater change in captivity, implying greater stress, than those who are captive born. Hence, such animals have been assigned low rating.

- The elephant was caught from the wild by the Forest Department and handed over to the zoo in 1943.

M-R was 0.0 showing a deviation of 100% from E-R.

Purpose
- The elephant was mainatianed in unnatural conditions for the purpose of display to the public as a means of education.

M-R was 1.0 with a deviation of 87.5% from E-R.

Shelter
Wild elephants traverse vast distances in search of food, water/ mates (Poole and Granli, 2009) with a home-range size of 100-300sqkm, depending on availability of food/ water (Sukumar, 1989). The absence of sufficient space and/ or suitable substrate in captivity may result in insufficient exercise (physical/ psychological), poor foot health.

- Two kinds of enclosures were available, a day shelter with earthen flooring and a night shelter with concrete flooring
- Total enclosure size was 2050 sq.m, size used by elephant was 40 sq.m
- Partial tree cover was available in the day shelter and the night enclosure was a roofed permanent shelter

M-R was 3.9 (SE= 1.7, N= 7) implying a deviation of 51.3% from E-R (Figures 1 and 2).
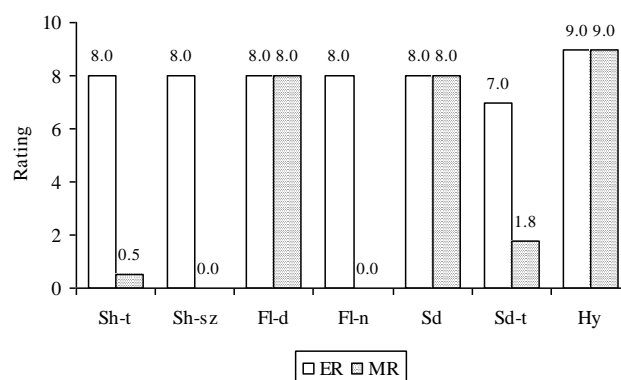

Figure 1: Comparison of E-R and M-R for shelter sub-parameters

Figure 2: Percent deviation from E-R for shelter sub-parameters

Sh-t: Shelter type   Sh-sz: Shelter size   Fl-d: Flooring (day)   Fl-n: Flooring (night)
Sd: Shade availability   Sd-t: Shade type   Hy: Hygiene maintenance

Water

Wild elephants have been observed to include water sources in their home-range, engaging in dust-bathing/ wallowing and socializing (McKay, 1973). Accessibility to water may be limited for captive elephants depending on the source and also opportunity for species-typical activities may be restricted.

- Tap water was available for drinking, with the elephant consuming water twice at 10 a.m. and 4 p.m.
- No quality tests were done on the water
- A pool of 20lt. capacity was available in the night enclosure
- Scrub bath was given once in 2 days, otherwise animal was hosed down in the evening before being housed in the enclosure for the night
- Bath duration was 2 h and scrub material was coconut husk

M-R was 2.9 (SE= 1.1, N = 6) with a deviation of 58.5% from E-R (Figures 3 and 4).

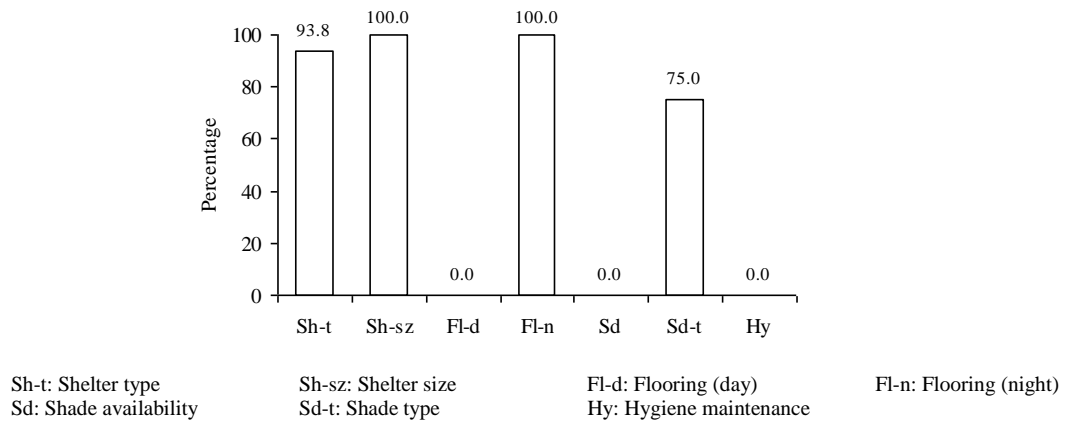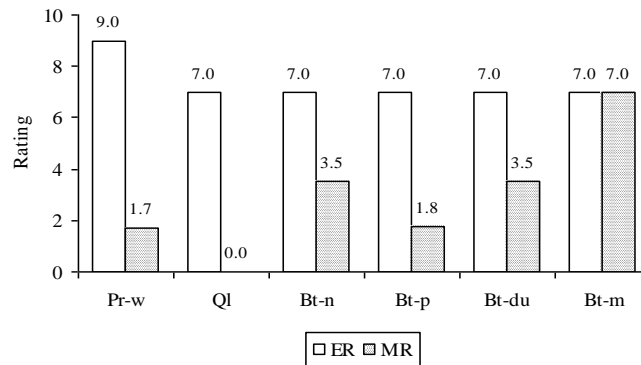Figure 3: Comparison of E-R and M-R for water sub-parameters
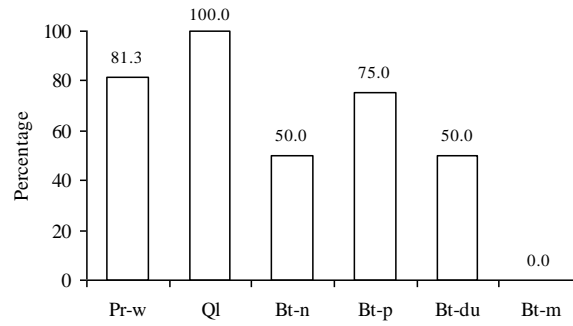
Pr-w: Availability of perennial source of running water   Ql: water quality tests
Bt-n: Bathed number of times   Bt-p: Bathing place
Bt-du: Bath duration   Bt-m: Bathing materials

Figure 4: Percent deviation from E-R for water sub-parameters

Sleep

Occurrence of suitable substrates while sleeping, provision of sufficient space and appropriate duration of sleeping can be considered to be positive indicators of welfare.

- The night enclosure had concrete flooring, no provision for temperature control during winter
- Sleep area/ size was only 40 sq.m
- Sleeping duration was 6-7 h

M-R was 1.5 (SE= 1.5, N = 3) with a deviation of 81.3% from E-R (Figures 5 and 6).

Figure 5: Comparison of E-R and M-R for sleep sub-parameters
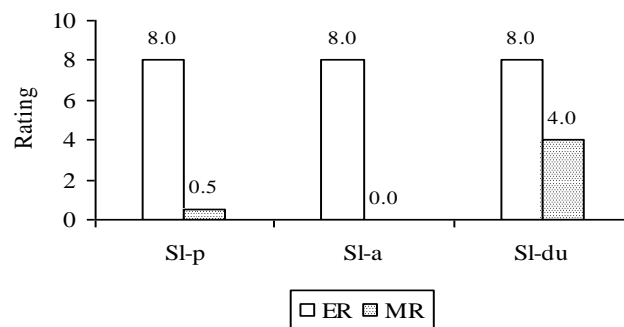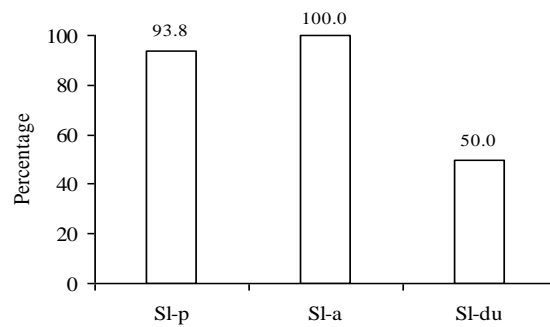

Sl-p: Sleeping place   Sl-a: Sleep area   Sl-du: Sleep duration

Figure 6: Percent deviation from E-R for sleep sub-parameters

Walk

Wild elephants are known for ability to cover vast distances across days of travel (Poole and Granli, 2009). Lack of opportunity to walk and no other "occupation" for a captive elephant may have psychological consequences.

- The elephant was walked on tarred roads once a week for 30 minutes, covering a distance of 4 km
- A mahout accompanied the elephant

M-R was 3.0 (SE= 2.4, N = 4) showing a deviation of 66.7% from E-R (Figures 7 and 8).
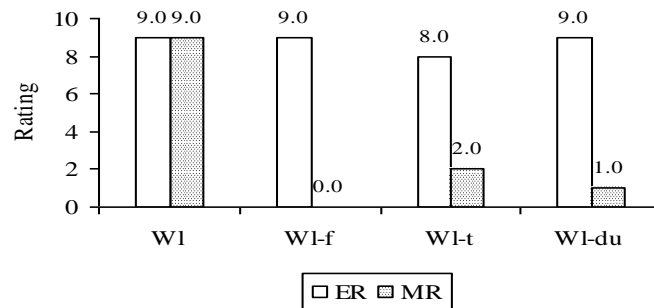
Figure 7: Comparison of E-R and M-R for walk sub-parameters

Wl: Opportunity to walk   Wl-f: Frequency of walks
Wl-t: time of walk   Wl-du: Walking duration
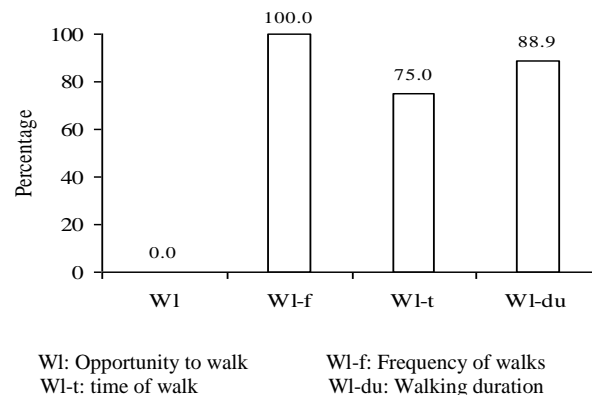
Figure 8: Percent deviation from E-R for walk sub-parameters

Social interaction

Social interaction among herd related members is integral to elephant society, especially females (Sukumar, 2006).

- The elephant was kept singly with no access to companions

M-R was 0.0 indicating complete divergence from E-R.

Chaining

Restriction of movement can be physically damaging as lack of exercise may result in obesity and also chafing of the chain against the skin may result in wounds/ injuries.

- The elephant was chained with a plain type chain weighing 8Kg, a length of 7ft and a size of 5inches.
- Chaining duration was 16h in open (day) enclosure and around 6h at night; hobbles were used for the fore-legs while in the day enclosure
- No opportunity to free range.

M-R was 0.8 (SE= 0.9, N = 5) with a deviation of 90% from E-R (Figures 9 and 10).
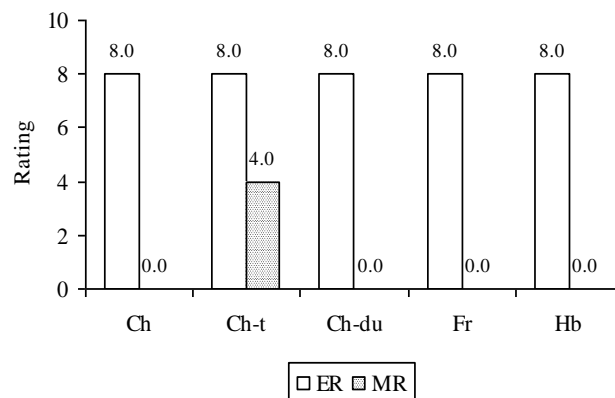
Figure 9: Comparison of E-R and M-R for chaining sub-parameters
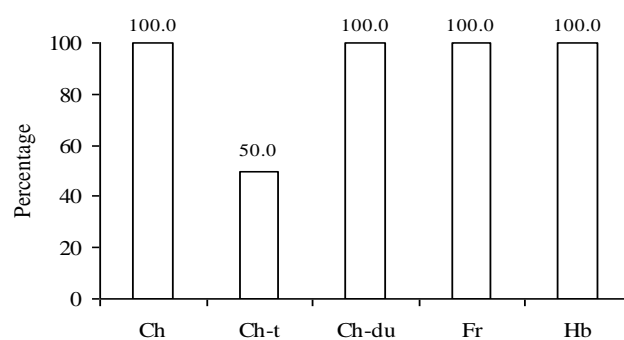
Ch: Chaining status   Ch-t: Chain type   Ch-du: Chaining duration   Fr: Opportunity to free-range
Hb: Use of hobbles (shackling)

Figure 10: Percent deviation from E-R for 'chaining' sub-parameters

Observed behaviour

Elephants which are aggressive and difficult to handle may pose a problem for the management in the way the animal is cared for. Occurrence of stereotypy is an indicator of an underlying cause related to poor welfare.

- The elephant was described as quiet
- The animals was said to be rough towards strangers and new handlers; the animal was aggressively throwing objects at people, if the mahout was not around
- No incidents of killing/ injuring people
- No stereotypy was observed

M-R was 7.7 (SE= 1.1, N = 3) with a deviation 4.2% from E-R (Figures 11 and 12).
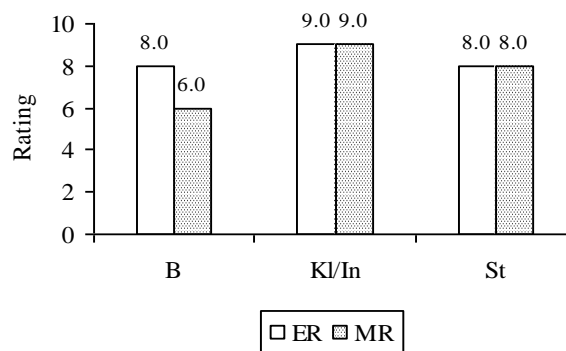
Figure 11: Comparison of E-R and M-R for behaviour sub-parameters
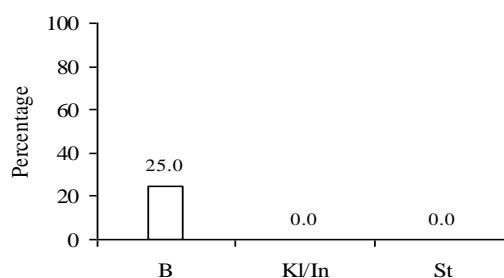
Figure 12: Percent deviation from E-R for behaviour sub-parameters

Work

The elephant was not given any kind of work; hence, M-R was 8.0, indicating no deviation from E-R.

Food provisioning

Wild elephants spend a major part of their activity in foraging (Sukumar, 1991), eating a wide variety of plants. This activity also involves manipulating the food before eating, socialising, providing an opportunity for other herd members to learn. None of this can be seen in captivity for elephants that are stall fed.

- The elephant was stall fed, food being provided in the day and night enclosure
- Food given was banana (*Musa* sp.)−500gms, Palm (Borassus sp.)-15, Fodder grass−50 kg, Caryota palm−11 Kg, Plantains (*Musa* sp.)−100gms, coconut (*Cocos nucifera*) palm−105 kg
- Asafoetida-100 gm, jaggery (sweet derived from sugarcane − *Sacharum sp*) −2 kg, sugarcane-4-5 kg was also given
- No mineral mix was given
- Ration chart was used

M-R was 3.0 (SE= 2.2, N= 4) with a deviation of 66.7% from E-R (Figures 13 and 14).
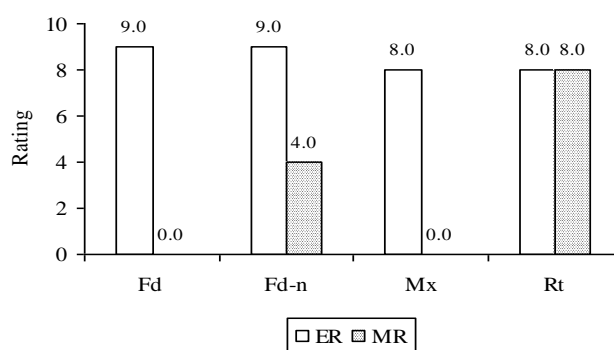
Figure 13: Comparison of E-R and M-R for food sub-parameters

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Fd: Food provisioning   Fd-n: Number of food items   Mx: Mineral mix given
Rt: Usage of ration chart

Figure 14: Percent deviation from E-R for food sub-parameters

Reproductive status

The elephant was given opportunity to breed, though not in the past five years. Present age may be beyond the period of the occurrence of oestrus cycles.

M-R was 7.0 for this sub-parameter, indicating no deviation from E-R.

Health status

Captivity predisposes elephants to certain diseases/ injuries as a consequence of their proximity to people or living conditions. Thus, adherence to prescribed veterinary schedules has been rated.

- The elephant seemed to have corneal opacity
- Lumps were seen on both forelegs
- De-worming was practiced, but immunisation and oiling was not done
- Samples of blood/dung/urine were tested once
- Body measurements were not taken

M-R was 2.2 (SE= 1.5, N= 6) implying a deviation of 72.2% from E-R (Figures 15 and 16).
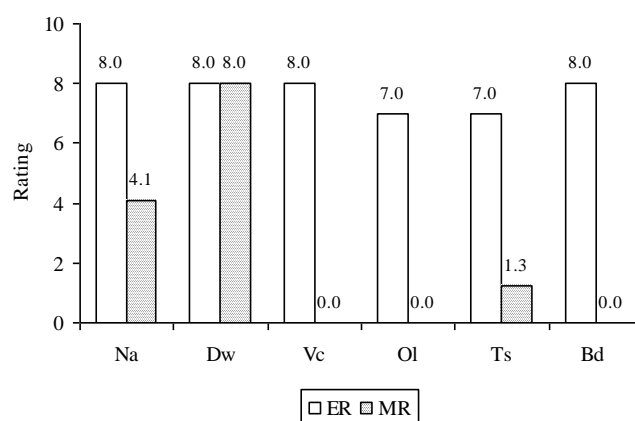
Figure 15: Comparison of E-R and M-R for health sub-parameters

Na: Nature of disease/ injury   Dw: Deworming status
Vc: Vaccination status   Ol: Oiling done
Ts: Sample tests   Bd: Body measurements
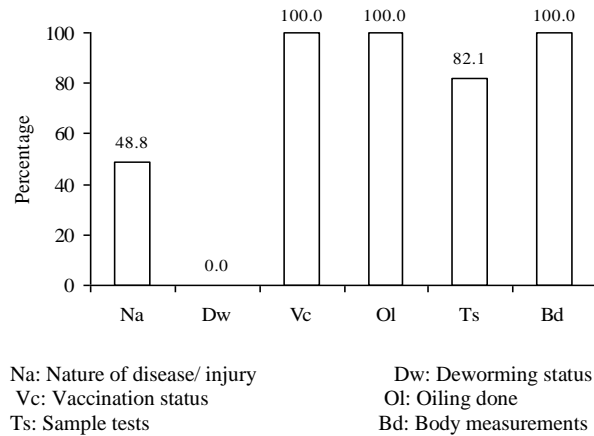
Figure 16: Percent deviation from E-R for health sub-parameters

Veterinary personnel and facilities

Provision for veterinary personnel with relevant experience is important in maintaining health of the elephants. Inadequate infrastructure may add to the deficiency in providing appropriate care.

- Veterinary doctor was available for the elephant, visiting the zoo daily
- The zoo hospital was equipped with a laboratory, out-patient facility
- Other facilities/ infrastructure included: staff quarters, provision/ cooking shed, camp site
- Health record of elephant and service record of handlers was maintained

M-R was 7.5 (SE= 1.4, N = 4) with a deviation of 16.7% from E-R (Figures 17 and 18).
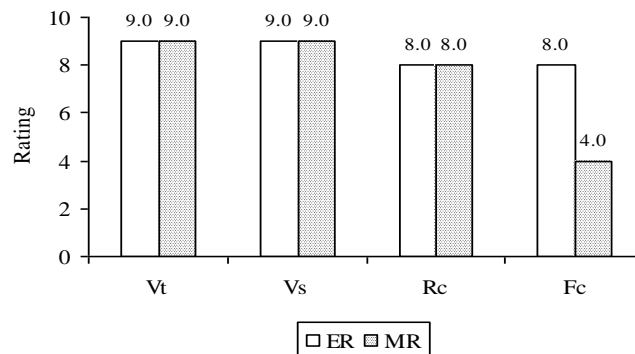
Figure 17: Comparison of E-R and M-R for veterinary personnel and facilities sub-parameters
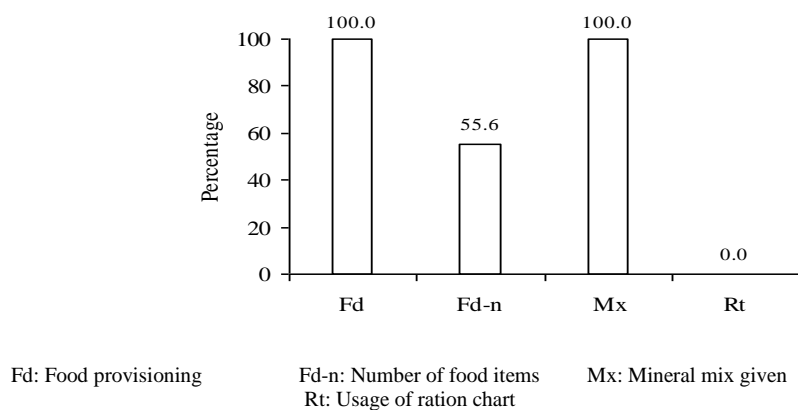

Vt: Availability of veterinary doctor   Vs: Frequency of visits   Rc: Maintenance of records
Fc: Facilities available

Figure 18: Percent deviation from E-R for veterinary personnel and facilities sub-parameters

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Figure-19 gives the distribution of deviation (from E-R) across all observed parameters. It can seen that 31 (of a total of 47) parameters showed deviations of 50% or more, constituting 66% of all the deviations. More than half of the observed parameters deviated by more than 50% from the standards considered suitable by experts.

Figure 19: Distribution of deviation values across all parameters

Overall ratings

The welfare assessment of the elephant in the zoo revealed an overall mean rating of 3.4 (SE= 0.5, N = 47) implying an overall deviation of 57.5% from E-R. This means, on an average, nearly 60% deviation from norms considered suitable by experts can be seen in the observed parameters.

Discussion

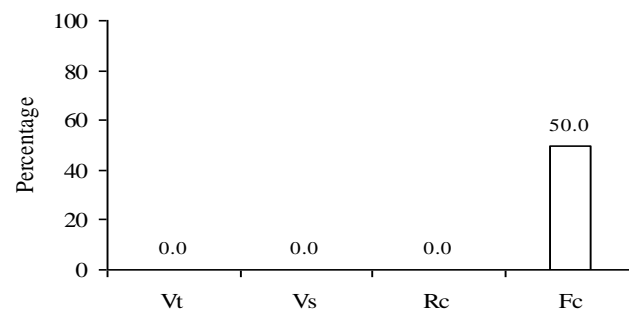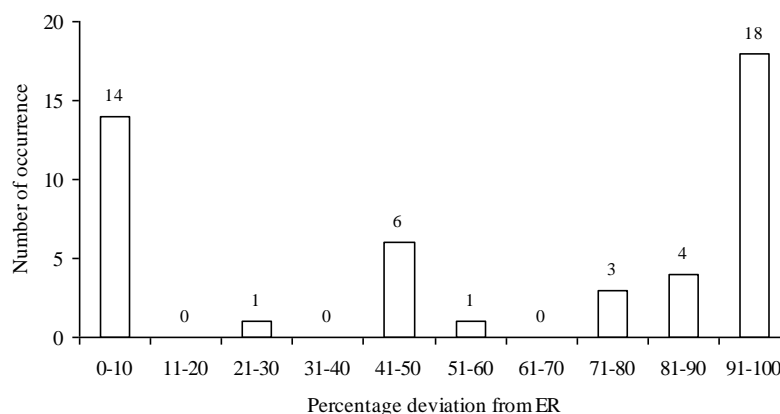The needs of elephants can be assessed based on the knowledge gained from studies on wild elephants. The ecological and biological needs can be incorporated to provide a relatively suitable environment for captive elephants.

Parameters with less than 10% deviation from E-R:
- Absence of stereotypic behaviour, no incidents of killing/ injury— though the elephant was described as quiet, she showed signs of being rough towards strangers. Significantly, the elephant seemed to be attached to her mahout, expressing rough behaviour when the mahout was not around.
- Some aspects of veterinary care such as de-worming, record maintenance, presence of veterinary doctor and clinic facilities were suitable

Parameters deviating from E-R:
Deviations were distributed across all the observed parameters. This implies unsuitability of living conditions even when some features are appropriate.
- Shelter: day flooring was earthen and hence suitable. This was the only suitable feature of the shelter as the elephant was exposed to the sun during the day (due to partial shade availability and restriction on movement). Night shelter was confined to an enclosed area with concrete flooring
- Water was not accessible to the elephant when it needed to drink or bathe. Bathing was done in the evening with only occasional scrubbing
- Walk was on hard surface and of limited duration and frequency
- There was no social interaction as it was a single elephant, the animal seemed to have formed a bond with the mahout
- The elephant was chained for most parts of the day
- No opportunity to graze/ browse, only stall feed

The absence of features integral to a species' biological needs was characteristic of this elephant. Wild elephants are known to be social, especially females, traversing kilometers in groups in search food/ water/ companions. The duration spent in standing still in one place in very low (Poole and Granli, 2009); its opposite was true for this elephant with the animal being chained for at least 20h and taken for a walk occasionally. Psychological stimulation was absent as there was no work, no free movement, no chance for

interaction. The period for which this elephant has been in this condition is not known as previous history was not collected. Irrespective of its history, there can be no doubt that the present conditions are primarily unsuitable for the elephant. In addition, the maintenance of the elephant by the zoo in its current form gives a wrong impression to the public about the biology/ behavioural ecology of a species. It is contrary to its stated aim of trying to educate the public.

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Section 7:
Zoo Elephants in Maharashtra

Executive Summary

This study investigates the welfare status of the captive situation of elephants and their handlers in three zoos in the districts of Thane, Mumbai and Byculla   Maharashtra.

Data was collected through observation and interview of personnel/ management. Each of parameter investigated has been rated on a zero to ten scale with zero representing the worst possible situation and ten implying a satisfactory state, closer to what an animal experiences in the wild.

Rating values were graded in the following manner:
- 0 – 2.4: Bad welfare conditions
- 2.5 – 4.9: poor
- 5.0 – 7.4: moderate
- 7.5 – 10.0: satisfactory

Seven elephants, six females and one male, belonging to three zoos were observed. The zoos were in Poona, Mumbai and Auranagabad. Mean age of the animals was 23.9 yrs with females ranging from 8 – 46 years. The single male was aged 18 yrs. Of seven elephants five were transferred from other institutions, one had been captured and one was captive born. Rating for source of animal was 3.2.

The elephants are kept for commercial use. Rating for purpose of keeping was 0.71 with only two animals belonging to the Poona zoo said to be kept in natural physical environment.

Mean number of mahouts changed was 3.0; mean rating was 3.4 with 60 % of the animals having at least two mahout changes. Frequent changes in mahout/ handler entail adjustments with a new handler and breakage of the bond with the previous handler. This may be a source of stress to the animal.

All the elephants had access to cement enclosed shelters, size varied from 200 ft. to 625 sq.ft within this space for Mumbai and Aurangabad zoos; Poona zoo enclosure size was 8 acres and four elephants had a mix of concrete and earthen flooring, three elephants had only concrete floor. Mean ratings for this parameter was 3.7 with 61 % of all the values getting a rating less than five.

Mumbai and Aurangabad zoo used tap water for drinking/ bathing the animals, Poona zoo had access to water tankers from the local Municipality and a Pond was available at Aurangabad zoo. Mean rating for water related parameters was 4.7 indicating occurrence of poor conditions for water availability.

All the elephants had opportunity to interact, mean number of individuals was 1.2 and duration among individuals for interaction was 15.2 h. Mean rating was 8.3.

Only elephants from Poona zoo were allowed to free range with two front legs shackled, all the elephants were chained at the leg, four with spiked chains and mean chaining duration was 13.5 h. Mean rating was 1.8 with 85 % of the values getting a score less than three, implying occurrence of bad chaining conditions.

All the observed elephants were not used for performing work. Hence, rating was 10.0

One female elephant was exposed to a male travelling and begging elephant but did not breed, one female is not cycling/ bred, one female has given birth. Mean rating value was 5.8 with values occurring in two extremes: zero or ten.

All the elephants were said to experience stomach pain frequently, foot injury (toe nail cracks/ lameness) was seen in three animals, one female had an eye injury and blood/ urine/dung testing was done for three of the elephants. Mean rating was 4.7 with 55 % of all the rating values getting a score less than three.

All the elephants had access to a veterinary doctor, with mean elephant experience of 10.7 yrs, visits of the doctors were daily or weekly and all the zoos had access to a clinic. Mean rating was 8.9 indicating satisfactory conditions.

There were six handlers for the seven elephants observed. Ratio of elephant to mahout varied from 1:1 to 2:1. Mean age of mahout was 46 yrs. overall mean rating for the mahout was 7.0 implying moderate conditions of welfare.

The overall mean rating across all parameters for welfare status of zoo elephants, was 5.7 with 43 % values getting a rating less than five. There was variation in the conditions available to the elephants among the zoos. Thus, 45 % of the sub-parameters showed different rating values among zoos, while the rest indicated uniformity in captive conditions.

Introduction

Elephants in zoos are said to be maintained for various reasons: to create awareness about the animal, for conservation purposes, as a centre to artificially breed and strengthen the gene pool of a species. Whatever maybe the purported objective, the species specific needs of the captive animal have to be met for the animal to maintain its overall welfare.

Objective

- To study the captive situation of elephants in three zoos in the districts of Thane, Mumbai and Byculla in the state of Maharashtra and examine the welfare status of the animals.
- To study the welfare of the mahout/ cawadi
- To provide a measure of the welfare status by grading different features of the captive conditions and of the animals/ handlers.

Method

The basis for measuring welfare has been to look at the deviations in captivity experienced by an elephant as opposed to that experienced in the wild state. This approach looks at the biology of the elephant and its natural history as a way of determining the differences in experiences and consequently welfare (Stroud, in press). Captive conditions of the elephant has been assessed using several aspects such as its housing, food provided, opportunity for exercise/ social interaction, reproductive and health status, occurrence of stereotypy, etc. Data was collected through observation and interview of personnel/ management. Each of these features or sub-parameters has been rated on a zero to ten scale with zero representing the worst possible situation and ten implying a satisfactory state, closer to what an animal experiences in the wild.

Ratings were graded in the following manner:
- 0 – 2.4: Bad welfare conditions
- 2.5 – 4.9: poor
- 5.0 – 7.4: moderate
- 7.5 – 10.0: satisfactory

With some sub-parameters such as availability of veterinary doctors, frequency of visits by the doctor etc, the ideal condition represents ease of access and prevalence of features conducive to maintaining elephant health. Sub-parameters representing a particular feature such as shelter or water have been grouped together to form a parameter. Rating for a parameter is the mean across the sub-parameters. Results representing percentage occurrences of ratings from zero to ten for each sub-parameter have been included. Results depicting ratings for sub-parameters have been given. The welfare status of mahouts/ handlers has been assessed by looking at socio-economic parameters. Along with this, the handler's experience with elephants and attitude towards them has been included. Rating scale for handlers is the same as for elephants.

Result
Population status

Seven elephants, six females and one male, belonging to three zoos were observed and data collected on various aspects of their captive condition. The zoos were in Poona, Mumbai and Auranagabad. Rating values presented are across individual zoos. Mean age of the animals was 23.9 yrs (SE = 6.1, N = 7) with females ranging from 8 – 46 years. The single male was aged 18 yrs.

Source of elephant

- Of seven elephants, five were transferred from other institutions, one, Saraswati, had been captured and one, Laxmi, 11 yrs., was captive born.
- Age at transfer ranged from 4 – 15 years.
- Mean duration of stay within Maharashtra was 9.6 yrs. (SE =3.3, N = 5).

Elephant society, especially of females, represents a network of relationships across a number of individuals which are stable across time and space (Sukumar, 2003). With this background, the shifting of elephants across zoos or institutions implies breakage of social bonds and / or introduction of unknown animals into an established group, leading to stress among the animals. Hence, a low rating indicates that the animal has been shifted across facilities. Rating was 3.2 (SE = 1.2, N = 7) with only one elephant reported to have been born in captivity and remaining within the same institution.

Purpose of keeping

Low ratings imply that the animals are being kept in an un-natural physical environment for commercial use. Rating was 0.71 (SE = 0.5, N = 7) with only two animals, belonging to the Poona zoo, said to be kept in natural physical environment.

Mahout changes

- Mean number of mahouts changed was 3.0 (SE= 1.3, N=5).

Frequent changes in mahout/ handler entail adjustments with a new handler and breakage of the bond with the previous handler. This may be a source of stress to the animal. Mean rating was 3.4 (SE = 1.0, N = 5) with 60 % of the animals having at least two mahout changes.

Shelter

- All the elephants had access to cement enclosed shelters.
- Size varied from 200 ft. to 625 sq.ft within this space for Mumbai and Aurangabad zoos; Poona zoo enclosure size was 8 acres
- Poona zoo had a closed type shelter: 16'×20'×30'
- Four elephants (of two zoos) had a mix of concrete and earthen flooring
- Three elephants (Mumbai zoo) had only concrete floor
- The elephants were kept for a mean duration of 18.1 hrs (2.1, N =7) within the shelter. Outside their shelter, they were kept for a mean duration of 8.4 hrs (SE = 1.3, N = 7).
- The shelter was cleaned an average number of 1.9 times (SE = 0.2, N = 7) using broom, stone, disinfectant.
- None of the zoos reported seasonal variation in temperature

The housing conditions were rated across several sub-parameters. Mean ratings for this parameter was 3.7 (SE = 1.7, N = 5) with 61 % of all the values getting a rating less than five (Figure 1).
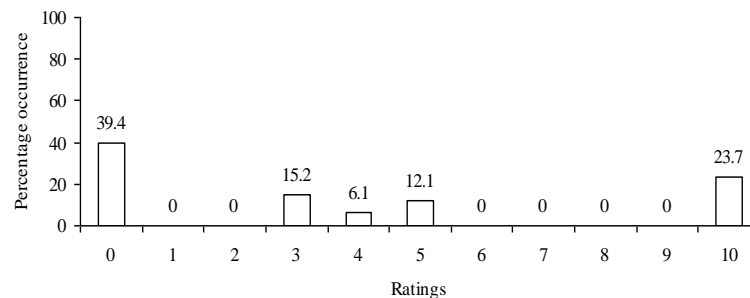
Figure 1: Percentage occurrence of ratings for shelter

Based on the provision to free range in a natural environment, rating values have been assigned. Low rating show occurrence of structurally enclosed space with restricted movement. Rating was 2.9 (SE = 0.28, N = 7) with only two elephants getting a rating more than three. Hard substrates cause several foot related problems among captive animals (Rajankutty, 2004).

Rating was 2.9 (SE = 1.0, N = 7) with all the animals getting a rating less than six as all the elephants were exposed to hard floors during some part of the day. Shelters with a regular cleaning routine were given high ratings (Figure 2). Rating was 10.0 (SE =0.0, N =7).

Sh: Shelter type   Sz: Shelter size   Fl: Floor type
Cl: Closed type shelter   Hy: Hygiene maintenance

Figure 2: Ratings for shelter related parameters

Water

- Mumbai and Aurangabad zoo used tap water for drinking/ bathing the animals
- Poona zoo had access to water tankers from the local Municipality
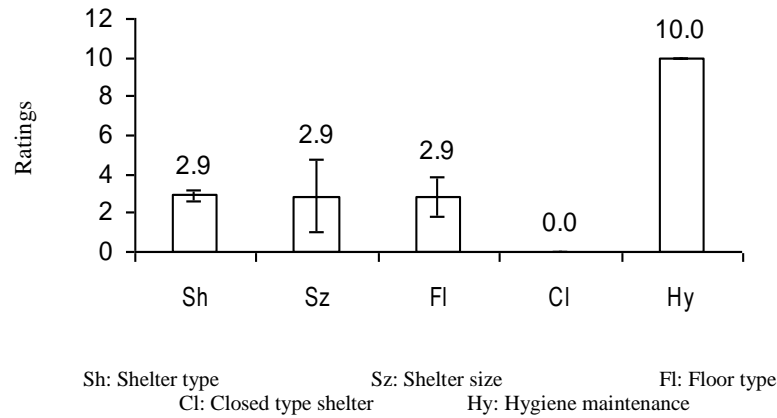- Pond was available at Aurangabad zoo
- The animals were said to drink 5 times/ day (SE = 1.1, N =7).
- Water quality test were not done for any of the zoos
- Duration of bath was 1.7 hrs (SE = 0.2, N = 7), materials used as scrub were stone or brush

Availability of running water, ease of accessibility, testing for water quality are a few sub-parameters considered for rating water. Mean rating was 4.7 (SE = 1.5, N= 6) indicating occurrence of poor conditions for water availability (Figure 3).
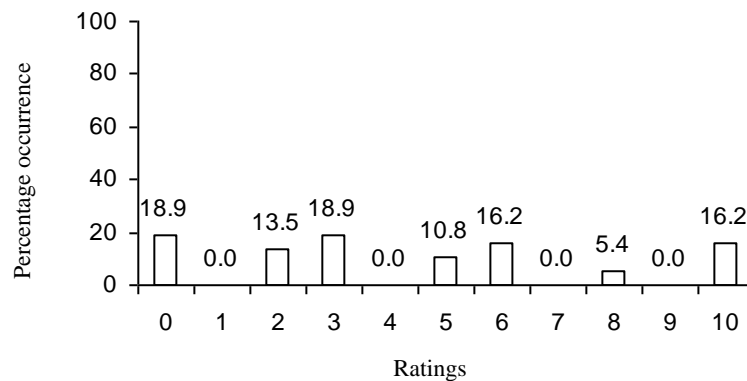.

Figure 3: Percentage occurrence of ratings for water

Running water sources may not be as contaminated as stagnant water. Hence, this has been considered as a sub-parameter for rating. Rating was 3.0 (SE = 0.0, N =7) indicating use of tap water which is a source of running water but is not accessible to the animal when it needs to drink/ bathe. Shoshani and Eisenberg (1982) mention that elephants drink water at least once a day. Adult elephants are said to drink at least 150 l/ day. Rating for this sub-parameter was assigned depending on whether the animal was free ranging or not. Rating was 7.4 (SE = 0.81, N = 7) indicating that the elephants were drinking water as needed. Bathing elephants for too short/ too long a period maybe counterproductive.

This sub-parameter (Figure 4) was graded considering the amount of time the elephant has to free range in a day, before it is brought in by the mahouts for bathing. Rating was 5.7 (SE = 0.2, N = 7) with all the elephants getting a rating between 5.0 and 6.0 which is considered to represent moderate conditions of suitability to the animal.
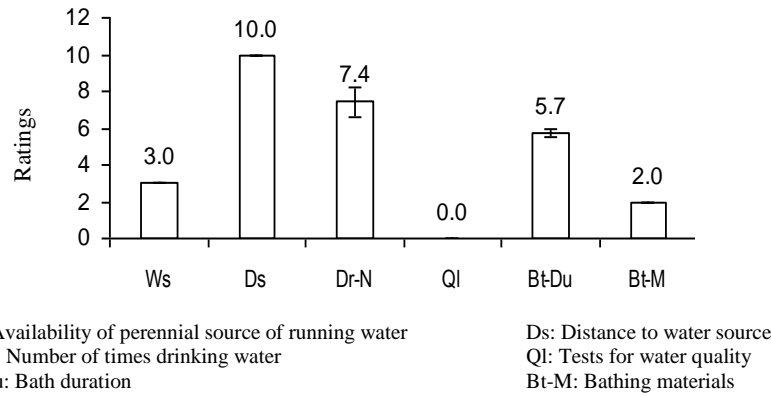
Ws: Availability of perennial source of running water   Ds: Distance to water source
Dr-N: Number of times drinking water   Ql: Tests for water quality
Bt-Du: Bath duration   Bt-M: Bathing materials

Figure 4: Ratings for water sub-parameter

Rest and sleep
- All the animals were allowed to rest, with access to shade
- The animals were said to sleep for a mean of 3.6 hrs (SE = 1.0, N = 7)

Captive environments should provide for the elephant to rest/ sleep. Kurt and Garai (2007) state that wild elephants rest and/ or sleep during different parts of a day. Rating was 7.3 (SE = 1.3, N = 6) implying moderate conditions for this parameter, with 41 % of all the ratings getting a score less than six (Figure 5).
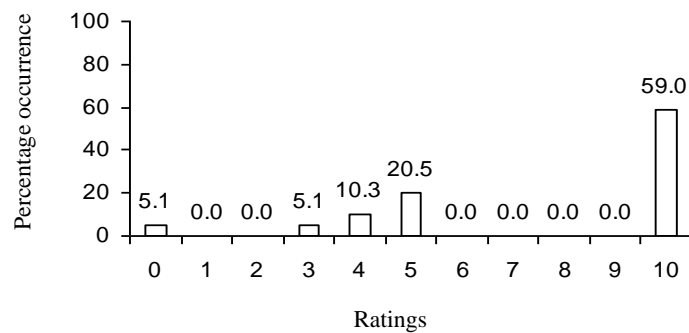
Figure 5: Percentage occurrence of ratings for rest and sleep

All the observed elephants were allowed to rest as they were not made to perform any work. Rating was 10.0 (SE =0.0, N =7). Provision of shade during rest periods was rated. Rating was 10.0 (SE =0.0, N =7) showing that all the animals had access to shade. Excess or little sleep is considered to be indicative of a deviation from the normal duration of 3-4 hours observed among adult animals. Rating was 4.3 (SE = 0.36, N =7) implying poor conditions (Figure 6)
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Rs: Rest availability   Rs-P: Resting place
Sd: Shade availability   Sd-T: Shade type
Sl: Sleep availability   Sl-du: Duration of sleep

Figure 6: Ratings for rest & sleep sub-parameters

Opportunity to walk
- The animals were allowed to walk during daytime
- Mean distance covered was 2.3 kms (SE = 0.7, N =3), mean duration was 2 hrs (SE =0.0, N =4)

Restricting elephants within a confined space or tethering with chains limits the ability to walk and exercise. Rating was 10.0 (SE =0.0, N =7) showing that all the observed animals were allowed to walk.

Opportunity for social interaction
- All the elephants had opportunity to interact
- Mean number of individual was 1.2 (SE =0.2, N = 5) and duration was 15.2 hrs (SE = 3.7, N =5)

Female elephants and young males are part of a social network of animals (Vidya and Sukumar, 2005). This parameter was rated considering the opportunity for interaction, group size and distance between animals. Mean rating was 8.3 (SE = 1.7, N= 3) indicating occurrence of interaction among the animals (Figure 7).
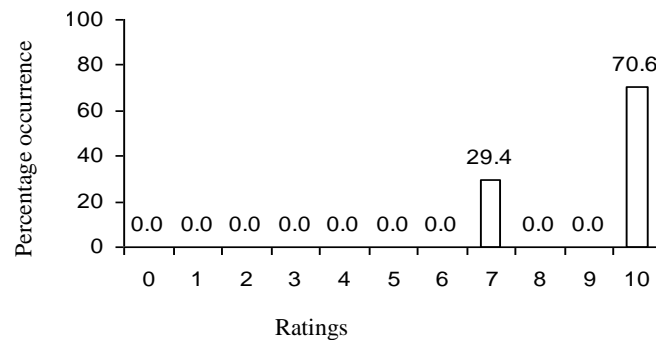
Figure 7: Percentage occurrence of ratings for social interaction

Group size that was similar to the average size observed among wild animals was given high rating value. Rating was 5.0 (SE = 0.0, N =5) with a mean size of 1.2 individuals in a group. The presence of animals close to each other to enable touching and feeling another animal was given higher rating (Figure 8). Rating was 10.0 (SE = 0.0, N =5).

In: Opportunity for interaction   Gr-Sz: Group size
In-Ds: Interaction distance
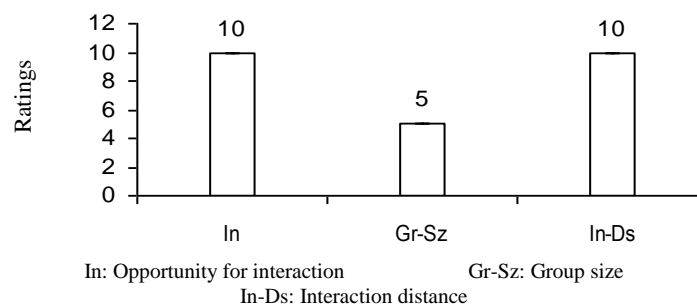
Figure 8: Rating for interaction related parameters

Chaining
- Only elephants form Poona zoo were allowed to free range with two front legs shackled
- All the elephants were chained (N = 7) at the leg, four with spiked chains
- Mean chaining duration was 13.5 hrs (SE = 1.8, N = 6)

Captive elephants are almost universally subjected to having chains, and therefore restricted in their ability to move. This parameter was rated considering the type and region of chaining, duration and whether the animals were allowed to free range. Mean rating was 1.8 (SE = 0.8, N = 4) with 85 % of the values getting a score less than three (Figure 9), implying occurrence of bad chaining conditions.
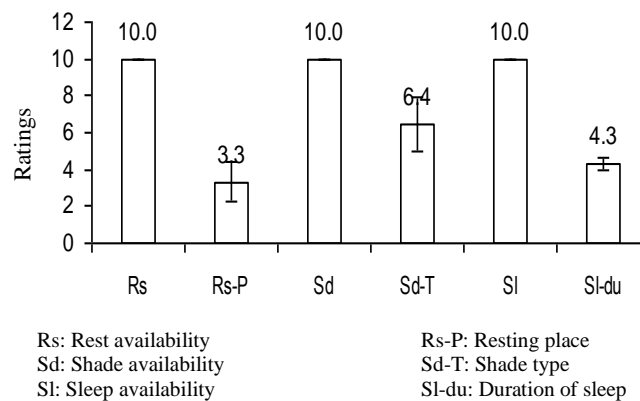
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Figure 9: Percentage occurrence of ratings for chaining

Whether the elephants were allowed to free range or not was rated. Rating value was 2.9 (SE = 1.8, N = 7) with 71 % of all the values getting a rating of zero indicating absence of free ranging opportunity. Only two elephants, belonging to Poona zoo, were allowed to free r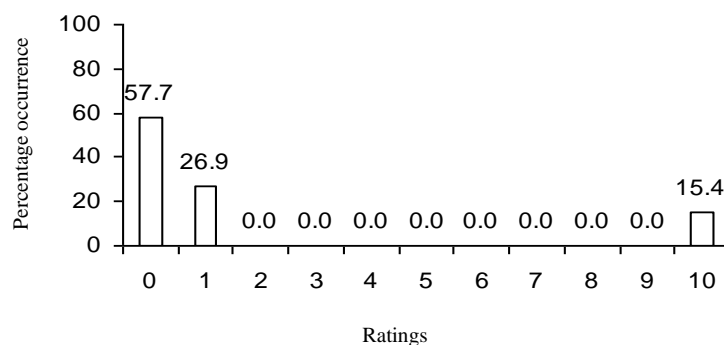ange in the morning. All the observed elephants were chained during the night for a period of 8 – 12 hours. Ratings (Figure 10) were 0.0 (SE = 0.0, N =6).

Fr: Free ranging status   Ch: Chain type
Ch-R: Chaining region   Ch-Du: Chaining duration
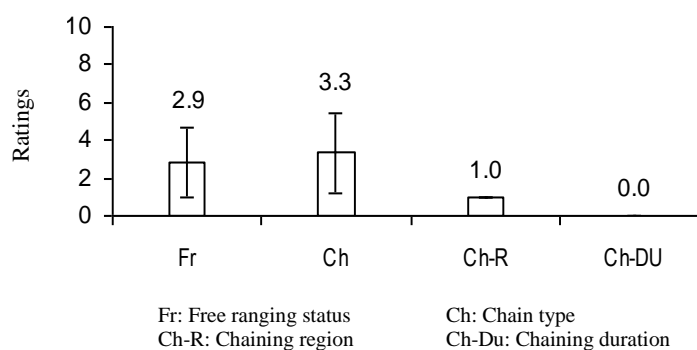
Figure 10: Ratings for chaining related parameters

Observed behaviour
- Six elephants were described as quiet, the male was said to be nervous and undependable
- Male elephant was reported to be aggressive during musth
- Four animals exhibited stereotypic behaviour

This parameter was rated considering the observed personality and occurrence of stereotypic/ aggressive behaviour. Mean rating was 6.7 (SE = 1.9, N = 3) with values occurring in the two extremes: zero and ten (Figure 11).
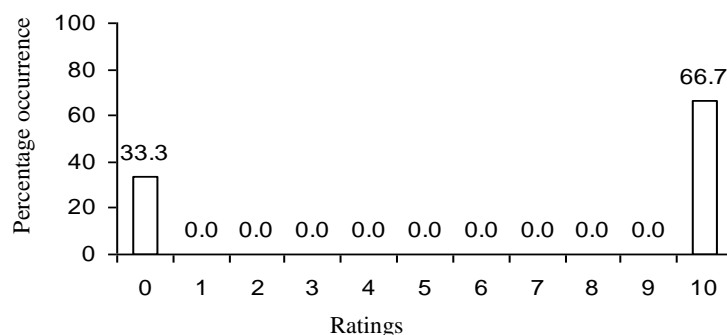
Figure 11: Percentage occurrence of ratings for behaviour

Elephants which were calm/ quiet were given high rating values. Mean rating was 8.6 (SE = 1.4, N = 7) with six elephants getting a score of 10 and the male getting a rating of zero for nervous behaviour. Five of the seven elephants were said to exhibit stereotypy, mean ratings (Figure 12) was 2.9 (SE = 1.8, N = 7).

Ps: Observed personality   Agg: Aggressive behaviour   St-B: Stereotypic behaviour

Figure 12: Ratings for behaviour related parameters

Work type
- The animals were given any kind of work All the observed elephants were not used for performing work. Hence, rating was 10.0 (SE = 0.0, N =7).
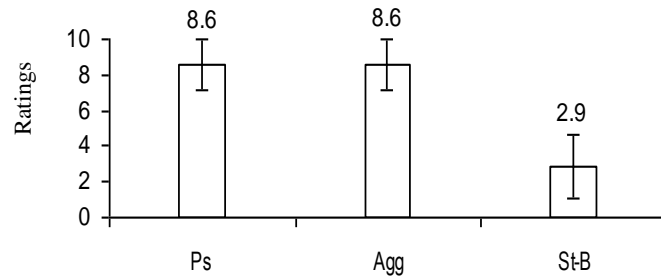
Food provisioning
- All the elephants were given stall feed only
- Mean duration of feeding was 18 hrs (SE = 3.7, N =5).
- Food provided: Sugarcane (Sacharum sp.), Carrots, Green grass, Dry grass, Rice straw, Jaggery, rice, Kadba, Lucerne (Sisyrinchium sp.) grass, fruits, bread
- Two zoos (Mumbai and Aurangabad) provided mineral mixture
- Aurangabad zoo did not maintain a ration chart

Captive elephants depend on their keepers for the amount and kind of food provided. Also, opportunity to free range for browsing/ graze is limited. Such conditions are given low ratings. Overall mean rating was 4.6 (SE = 2.2, N = 4) implying occurrence of poor conditions (Figure 13).
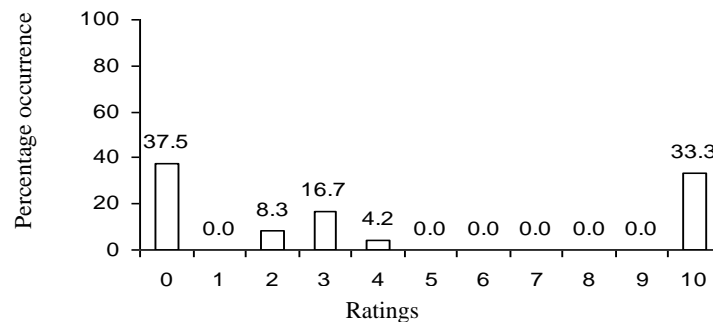
Figure 13: Percentage occurrence of ratings for food provisioning

High rating was given if the animals were allowed to free range and supplemented with stall feed. Mean rating was 0.0 (SE =0.0, N =7 showing absence of free ranging to browse/graze. In the absence of an opportunity to free range, all food items have been given a lower rating.

Mean rating was 2.6 (SE = 0.2, N =7). Mean rating was 6.0 (SE = 2.5, N = 5) with no reported usage for two animals (Figure 14).

Fd: Food provisioning type   Fd-N: Number of food items
Mn: Provision of mineral mix   Rt: Usage of ration chart

Figure 14: Ratings for food related parameters

Reproductive status

- Anarkali, female, 35 yrs, exposed to a male traveling and begging elephant, did not breed
- Laxmi, 46 yrs, not cycling/ bred
- Sarawati, female 40 yrs, gave birth to Laxmi. Source of male was captive elephant in forest camp. Laxmi, now 11 yrs, at the same zoo
- Male elephant, Rajkumar, said to exhibit musth

This parameter was rated taking into account such features as occurrence of musth, exposure to elephants of opposite sex, opportunity to breed. Mean rating was 5.8 (SE = 1.3, N = 3) with values occurring in two extremes: zero or ten (Figure 15).
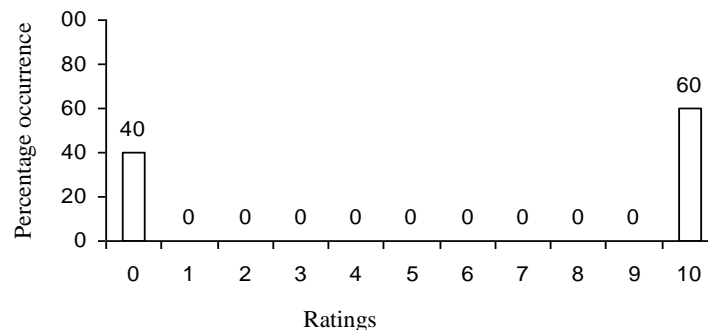
Figure 15: Percentage occurrence of ratings for reproductive status

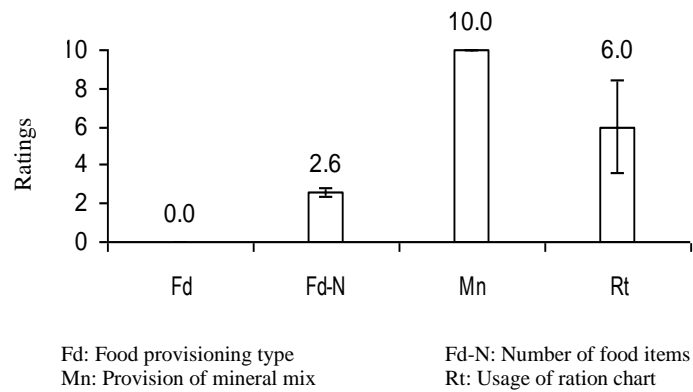The absence of normal reproductive activity in adult animals has been given low ratings. Mean rating was 7.5 (SE = 2.5, N = 4) with only one elephant, Lakshmi, (46 yrs, female) said to be reproductively inactive among the observed elephants. Mean rating was 6.7 (SE = 3.3, N = 3) with one animal (Lakshmi, 46 yrs., female) not being exposed to males. Only one elephant, Saraswati (40 yrs, female) was said to have given birth to a calf. All the other observed elephants were given ratings of zero (Figure 16).

Rp: Reproductively active/ not   Ex: Exposure to opposite sex   Br: Opportunity to breed
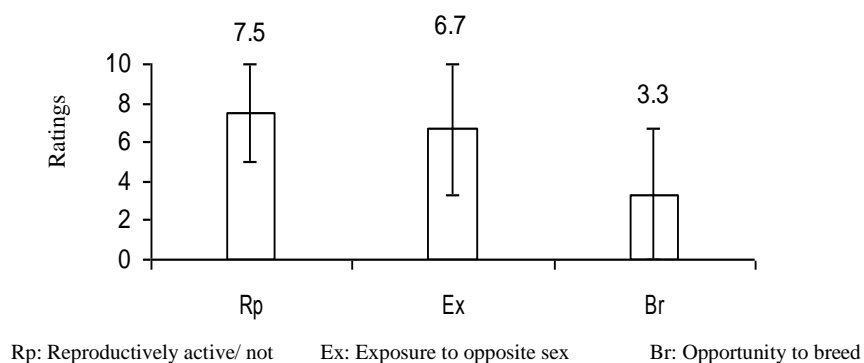
Figure 16: Ratings for reproductive status related parameters

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Health status

- All the elephants were said to experience stomach pain frequently
- Foot injury (toe nail cracks/ lameness) was seen in three animals
- Anarkali was said to have an eye injury
- All the animals were de-wormed with Albendazole, varying from once in three months to 2 -3 times a year
- None of the animals was vaccinated
- Oil was applied for four of the elephants
- Blood/ urine/dung testing was done for three of the elephants

Disease by itself can be a source of poor welfare and the occurrence of certain diseases as a consequence of captive conditions may also contribute to lowered welfare (Kaufman and Martin, in press). This parameter was rated using such features as: occurrence of disease/ injury, performance of routine veterinary practices such as de-worming/ vaccination, etc. Mean rating was 4.7 (SE =1.6, N = 7) with 55 % of all the rating values getting a score less than three (Figure 17).
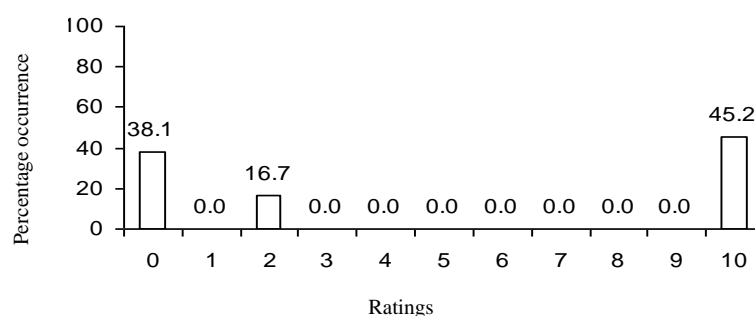
Figure 17: Percentage occurrence of ratings for health status

Disease/ injury was rated considering the extent of distress or pain the disease/ injury caused in the animal. Mean rating was 2.0 (SE =0.0, N=7). The practice of de-worming elephants was given high ratings. Mean rating was 10.0 (SE =0.0, N =7). Biochemical/ physical tests of samples when conducted are a valuable source of data regarding its health. Mean rating was 5.0 (SE = 2.2, N = 6) with such tests being done for three of the observed elephants.

Captive elephants are subject to the practice of oiling: as an insect repellent/ to maintain body temperature. Mean rating was 5.7 (SE = 2.0, N = 7) with oiling not done for three animals (Figure 18).

Ds/In: Nature of disease/ injury   Dw: Deworming status
Dw-Fq: Frequency of deworming   Vc: Vaccination status
Ol: Oiling done   Ts: Testing of samples
Bd: Body measurements taken

Figure 18: Ratings for health related parameters

- All the elephants had access to a veterinary doctor, with mean elephant experience of 10.7 yrs (SE = 4.9, N = 5)
- Visits were daily or weekly
- Veterinary assistant was available for two zoos

- All the zoos had access to a clinic

Accessibility to veterinary care includes availability of veterinary doctor with experience in treating elephants, with regular visits, availability of veterinary assistant, provision of clinic facilities and maintenance of records. Mean rating was 8.9 (SE = 0.7, N = 7) indicating satisfactory conditions (Figure 19).

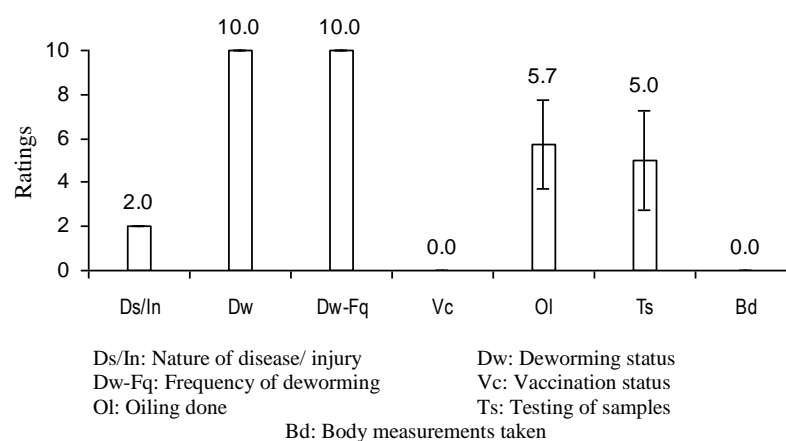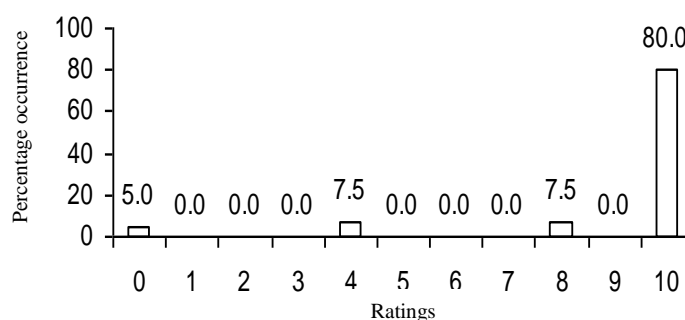

Figure 19: Percentage occurrence of ratings for veterinary care

All the zoos had access to a doctor, hence rating was 10.0 (SE =0.0, N =7). Mean rating was 5.6 (SE= 0.97, N = 5) with only one doctor said to have more than twenty years experience. The observed zoos were said to maintain records, hence rating (Figure 20) was 10.0 (SE =0.0, N =5).

Vt: Availability of veterinary doctor   Ex-E: Experience with elephants
Ex-N: Number of years of experience   Vs: Frequency of visits
Vt-A: Availability of veterinary assistant   Vt-C: Availability of clinic facilities
Rc: Record maintenance
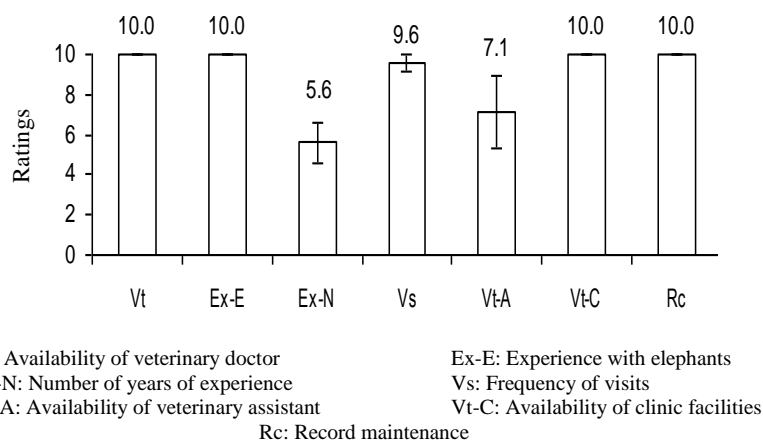
Figure 20: Rating value for veterinary care related parameters

Funds
- Overall fund required per animal was Rs. 1,07,143/- (SE = 8299.3, N = 7)

Mahout welfare status
Welfare of the mahout has been considered, as poor welfare conditions can be detrimental to the person's life and may be associated with poor handling/ apathy towards the animal. There were six handlers for the seven elephants observed. Ratio of elephant to mahout varied from 1:1 to 2:1 (Poona zoo). Mean age of mahout was 46 yrs (SE = 3.1, N = 6).

Overall mean rating for the mahout was 7.0 (SE = 0.5, N= 71) implying moderate conditions of welfare. The welfare status was rated across 15 sub-parameters (Figure 21).
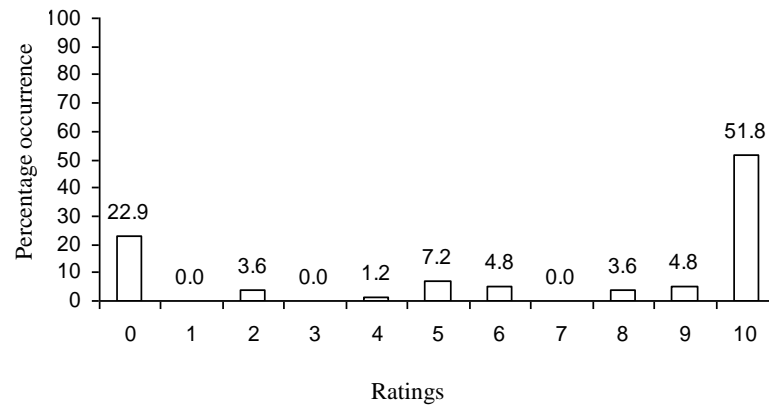
Figure 21: Percentage occurrence of ratings

Handlers with more than 50% experience were given high rating values. Experience was calculated as percentage duration in the job expressed in terms of his own age. Mean rating was 5.4 (SE = 1.6, N = 6). Years of experience with a specific elephant was calculated in terms of the animal's age. Mean rating was 8.4 (SE = 0.9, N = 5). Education is important to improve the handler's own welfare as well as to follow any prescribed medications for the animal. Mean rating was 7.5 (SE = 0.9, N=4).

All the handlers were permanent employees. Hence, rating was 10.0 (SE =0.0, N =5). Periodic health check-ups are important in the context of transmission of diseases across species (Mikota, in press). Mean rating was 5.0 (SE = 2.9, N =4) with two of the four employees not having had any health check-up. Availability of insurance in case of injury/ death is essential. Mean rating (Figure 22) was 10.0 (SE = 0.0, N=4).

Ex-A: Experience as % of his age
Ch: Reason for choosing this profession
Tr: Trained as mahout
Ed: Education status
Jb: Job status
Ln: Languages known
Tl: Use of tools

Ex-E: Experience as % of elephant's age
Rel: Having mahout as relatives
Fm-Oc: Family occupation
Sl: Salary
Acc: Accommodation availability
Cmm: Knowledge of commands
Hl: health check-up

Ins: Insurance cover
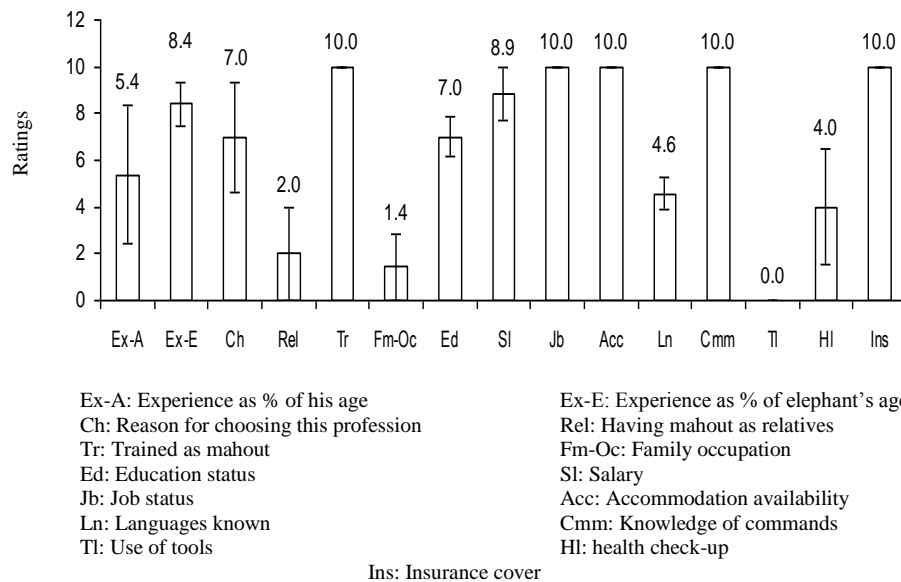
Figure 22: Ratings for mahout related parameters

Overall mean rating value per elephant
The overall mean rating, considering each rating across all parameters, was 5.7 (SE = 0.24, N= 322) with 43 % values getting a rating less than five (Figure 23). This value implies occurrence of moderate welfare conditions. However, this rating includes values derived from sub-parameters with only two possible scores: zero or ten. Such sub-parameters formed 42 % of all the parameters observed, contributing 28 % of scores of 'ten' to the total number of rating values. While the occurrence of such scores of 'ten' is indicative of satisfactory conditions, further details about such conditions could have provided greater insight into the actual situation. This was lacking at times.
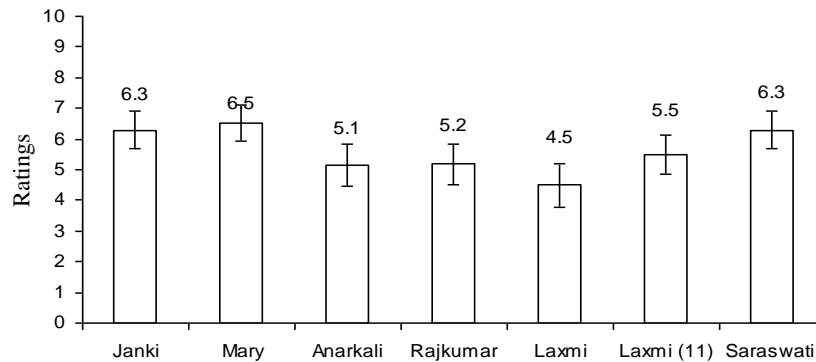
Janki and Mary: Poona zoo   Anarkali, Rajkumar and Laxmi: Mumbai zoo   Laxmi (11) and Saraswati: Aurangabad zoo

Figure 23: Overall mean rating per elephant

Discussion

There was variation in the conditions available to the elephants among the zoos. Thus, 45 % of the sub-parameters showed different ratings among zoos, while the rest indicated uniformity in captive conditions. This variation was distributed across all the sub-parameters observed. Wild elephants have been reported to be active for nearly 20 hours of a day (Sukumar, 2003), females engaging in activities related to foraging, socializing and defending young, and males associated in bachelor herds or singly, foraging or wandering in search of females (Poole and Moss, 2008).

The co-operation observed among wild elephants has been reported for unrelated captive Asian elephants also, in the context of allomothering and defense of young (Gadgil and Nair, 1982), stressing the role a family life for these animals.

Keeping this life history pattern in mind, the conditions experienced by the elephants in the three zoos was assessed.
- The zoos housed two to three individual elephants in semi-natural to man-made enclosures of varying sizes. Ignoring size variation, it is obvious that the elephants could not perform their natural activity of foraging as they were all stall-fed. Added to this deficiency, most animals except for two elephants at the Poona zoo, were not allowed to free range.
- The presence of limited number of elephants in each zoo implied lack of choice among the animals to form and establish social relationships. This all the more important in the context of learning— social skills, mothering, food preparation, establishing a hierarchy, etc., — which the animals acquire as they grow among group members in the wild (Kurt and Garai, 2007).
- The practice of chaining the elephants at night was prevalent among all the observed zoos. Kurt and Garai (2007) report of the adverse effects of chaining on the skin of the animals. Also, chaining has been negatively correlated with increased occurrence of stereotypy. Four elephants belonging to two zoos (two of the Aurangabad zoo and two of Mumbai zoo) were said to be restricted using spiked chains. Both elephants at Poona zoo were said to be shackled by both forefeet during free ranging.
- Of the three elephants for which data was available, two adult females were said to be either reproductively inactive or failed to conceive.
- Non- performance of species- typical behaviour has been linked with development of stereotypy. Five of the seven elephants among these zoos were said to exhibit this behaviour.
- Absence of suitable water sources with easy access to the elephants, for drinking/ bathing

Aspect of the zoos which could be considered suitable:
- The presence of mother-daughter pair in the same zoo (Aurangabad zoo)
- Provision of suitable veterinary care at all the zoos
- Maintenance of clinical records

Ratings for handlers was categorized as being moderately good (overall rating was 7.0) ranging from 5.0 to 9.0. Sixty percent of the values were given a rating between 8 and 10.

Some parameters which were given low rating values were:

- Health check-up: only two mahouts were said to have had a health check-up.
- Experience: Only two mahouts were said to have experience accounting for more than 50 % of their age.
- Tool use: all the observed mahouts were said to use tools to control their animal

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Section 8:
Zoo Elephants in Tamil Nadu

Executive Summary

The Arignar Anna Zoological Park in Vandalur, Tamil Nadu, covering 600 ha is home to diverse species of animals. Elephants form part of the captive set of animals housed in the zoo premises. Elephants and their handlers in the Zoological Park were observed and data collected to assess their welfare status. A team of experts, from wildlife biologists to welfare activists, rated different parameters of importance to the welfare of captive elephants. This rating referred as expert rating (E-R) was then used to assess the welfare status of elephants and mahouts/cawadis with the mean rating (M-R) obtained for given parameter and animal.

The zoo maintained six elephants: three females and three males. The group consisted of two adults, one juvenile male, two infant females and a calf and none of the elephants were related. Three of the six elephants were rescued while the adult female was captive born (Annamalai Forest camp) and the adult male had been captured following human-elephant conflict. M-R was 3.0 showing a deviation of 50% from E-R.

The purpose of the zoo was said to be related to conservation and rescue/ rehabilitation. M-R was 8.0 with 100% concurrence with E-R. Only one elephant had five different handlers. The infants had no change in their mahouts. M-R was 5.5 showing a difference of 31%.

All the elephants had access to a daytime enclosure of 30 acres of natural scrub forest which was walled and natural shade was available in the daytime enclosure. The night-time shelter consisted of a semi-open shelter (20'X20') with concrete floors. M-R was 5.5 indicating a deviation of 32% from E-R.

All elephants had access to a pond and tank water for drinking / bathing, and they were bathed twice a day, for duration of 2h each using a brush.

All elephants were allowed to interact with each other, interaction hours were through the day, but the animals were chained at night. The elephants ranged from adults to infants but all were unrelated with two adults being translocated from a forest camp to the zoo. M-R was 7.8 indicating 100% concurrence with E-R.

All elephants were allowed to browse/ graze in the adjoining 30 acre forest, stall feed provided was: Ragi (*Eleusine coracana*), Horse gram (*Dolichos biflorus*), Banana (*Musa* sp.), coconut (*Cocos nucifera*), Jaggery (sweet derived from sugarcane), cut grass, sugarcane (*Saccharum* sp.). M-R was 5.1 showing a deviation of 39% from E-R

The female elephant was said to have been exposed to captive males, no calves were born, the male elephant was said to exhibit musth; had mated with captive elephant, had not sired any offspring. M-R was 4.9 indicating a difference of 38% form E-R.
Deworming and oiling was done for all elephants; oiling with coconut or neem oil and dung/ urine tests were done, body measurements were taken once in three months. M-R was 6 indicating a deviation of 14% from E-R.

Two veterinary doctors were available, with experience in treating elephants; both the doctors visited the zoo daily as they were associated with the zoo and a veterinary clinic with good essential facilities was available in the zoo. M-R was 7.1 showing a deviation of 12% from E-R.

Mean age of handler was 30.3y, ranging from 26-34 yrs, mean experience in this profession was 7.6yrs, ranging from 6-8yrs, mean experience with a specific zoo elephant was 2yrs. M-R was 6.9 indicating a difference of 19% from E-R.

Family occupation was handling elephants for handlers and one was a daily wage employee. Mean salary drawn was Rs. 40,560/- annually, none of the handlers had insurance cover and none of the handlers had been reported for bad conduct; did not consume alcohol. M-R was 4.9 (SE= 0.9, N= 9) with a deviation of 32% from E-R

The welfare of the elephants in this zoo was evaluated by considering the deviation from the wild for the parameters observed. Overall M-R was 5.5 indicating a deviation of 31% from E-R. The provision of vast space of natural scrub forest in this zoo is a commendable feature, considering the limited space available to

most captive elephants. The occurrence of a group of elephants of diverse age and sex is also noteworthy, along with availability of veterinary doctors and good facilities. However, elephants undergo their captive situation as a complex interaction of various factors.

Introduction
The Arignar Anna Zoological Park in Vandalur, Tamil Nadu is home to a diverse species of animals. The zoo covers an area of around 600 ha of Vandalur Reserve forest (http://www.aazoopark.gov.in). Elephants form part of the captive set of animals housed in the zoo premises. The captive environment provided to elephants determines the state of well-being of the animals keeping the species-typical needs of the animals as a reference.

Objective
Elephants and their handlers (mahouts/ cawadis) in the Arignar Anna Zoological Park (Vandalur zoo) were observed and data collected to:
- Assess their welfare status through a set of physical/ social/ physiological features along with availability of veterinary care and facilities
- Assess the professional experience and socio-economic status of elephant handlers

Method
Notwithstanding their long association with people, elephants have not been domesticated (Lair, 1997; Kurt and Garai, 2007); the species-typical needs of the animals found in the wild cannot be met in captive conditions and this is likely to affect their well-being in captivity. This divergence has been used to assess the welfare of elephants: the greater the difference, the poorer the welfare. Elephants in Vandalur zoo were observed along with interview of relevant personnel, and data collected on different features: physical attributes (space/ food/ water), social, physiological and health aspects; management in the form of veterinary facilities. Data pertaining to professional experience and socio-economic status was collected through interviews with relevant personnel. The deviation from the wild state has been rated using a scale developed by elephant experts.

The rating method
A team of 31 experts including elephant biologists, veterinary doctors (studying wildlife disease and captive elephant disease), welfare personnel (working on wildlife conservation and welfare issues), wildlife managers (managing wild, captive elephants) and elephant mahouts rated different parameters of importance to the welfare of captive elephants (Varma, 2008; Varma, et al., 2008; Varma and Prasad, 2008). This rating was then used to assess the welfare status of elephants and elephant keepers:

- Experts rated a total of 114 welfare parameters covering all the major aspects of captivity
- The rating scale was from zero (unsuitable conditions) to ten (suitable conditions). With this logic, experts used maxima based on their concept of the importance of a particular parameter to an elephant. For example mean expert rating of 8.0 (SE= 0.5, N=29) for a parameter 'floor' and 9.0 (SE=0.4, N=31) for 'source of water' was arrived at from the ratings suggested by each expert
- A mean rating for each parameter, across all the participating experts, has been used as the Experts' Rating (E-R) which represents the importance attached to a parameter.
- For example, if an elephant is exposed only to natural flooring, the animal receives a rating of 8 and for entirely unnatural flooring the value is 0; if animal is exposed to both natural and unnatural flooring, the value is 4 (as 8+0/2= 8/2= 4). If an elephant is exposed to a natural water source, such as a river, it receives a value of 9; if the source of water is large lakes or reservoirs, it gets 4.5. A value of 3.5 is assigned for small water bodies like tanks and ponds. Tap water (running) gets 2.5 and if only buckets, pots, and tankers are in use, then the allocated value is 0.5.
- Data for an elephant or a group of animals was collected. With this data Mean Rating (M-R) was calculated for a given parameter, along with its sub-parameters. Thus the Mean Rating (M-R) denotes welfare status of existing conditions on the ground for the particular parameter.
- In this investigation, variables which represent a common feature of the captive condition has been grouped to form a parameter. The variables have been termed sub-parameters. For example, the variables shelter type, shelter size, floor type in the shelter; all represent different aspects of the physical space provided to the elephant. Hence, they are grouped together to form the parameter "Shelter" and each constituent variable is a sub-parameter. In this investigation, the E-R for a parameter (say, shelter) represents the mean of E-Rs across all related sub-parameters. M-R is also based on similar lines.
- E-R and M-R for each of the zoos here represent the average across related parameters observed for that zoo. For instance, E-R / M-R for a parameter "shelter" represent the average of related parameters (termed sub-parameters) such as type, flooring, size, and shade availability. Not all

related parameters will be rated for each of the zoos. The number of such related parameters varies for each zoo.

- Results have been presented comparing E-R and M-R as a means of comparing the extent of deviation present in the parameters observed. The difference between E-R and M-R (expressed as percentage) indicates deviation from the prescribed norm.
- For handlers, the difference between the maxima provided by experts (E-R) and existing status (M-R) has been used to indicate the professional/ socio-economic status of value to the handler and his elephant.
- N refers to number of sub-parameters for an observed parameter.

Result

The zoo maintained six elephants: three females and two males. The group consisted of two adults (male and female), one juvenile male, two infant females and a new-born calf. Age classification based on Kurt and Garai (2007). None of the elephants were related.

Source of elephants

Shifting of elephants from one location to another can be a source of stress (Clubb and Mason, 2002), leading to breakage of established bonds between resident animals (Kurt and Garai, 2007). Three of the six elephants were rescued while the adult female was captive born (Annamalai Forest camp) and the adult male had been captured following human-elephant conflict. M-R was 3.0 (SE= 0.53, N = 5) showing a deviation of 50% from E-R.

Purpose of keeping

Maintaining elephants in centers for rehabilitation/ rescue where commercial gain is not of paramount importance may lead to the elephants not being overworked/ badly managed. The purpose of the zoo was said to be related to conservation and rescue/ rehabilitation. M-R was 8.0 (SE= 0.0, N =5) with 100% concurrence with E-R.

Change of mahouts

Handlers associated with captive elephants may develop a bond with their animals. When such handlers are changed due to various reasons, it could result in stress for the animal. Only one elephant (male, juvenile) had five different handlers. The infants had no change in their mahouts. M-R was 5.5 (SE= 2.2, N=3) showing a difference of 31%.

Shelter

- All the elephants had access to a daytime enclosure of 30 acres of natural scrub forest which was walled.
- Natural shade was available in daytime enclosure
- Night-time shelter consisted of a semi-open shelter (20'X20') with concrete floors
- Shelter was cleaned daily for dung/ excess food waste

Wild elephants are known to be active, foraging across varied habitat, with studies reporting home range sizes of 100- 300 m^2 (Sukumar, 1991). Captive conditions maybe limited in their ability to duplicate such conditions. M-R was 5.5 (SE= 1.4, N= 7) indicating a deviation of 32% from E-R (Figure 1a and b).
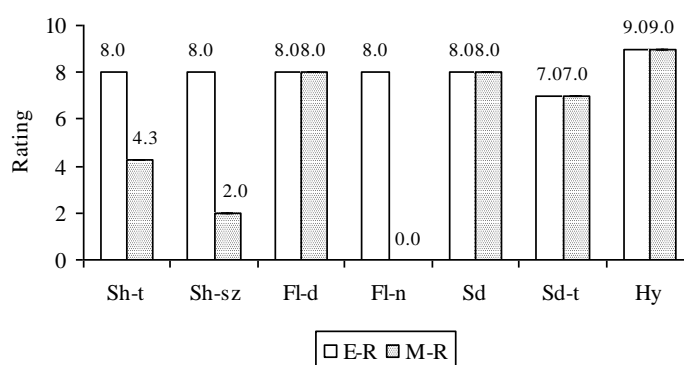

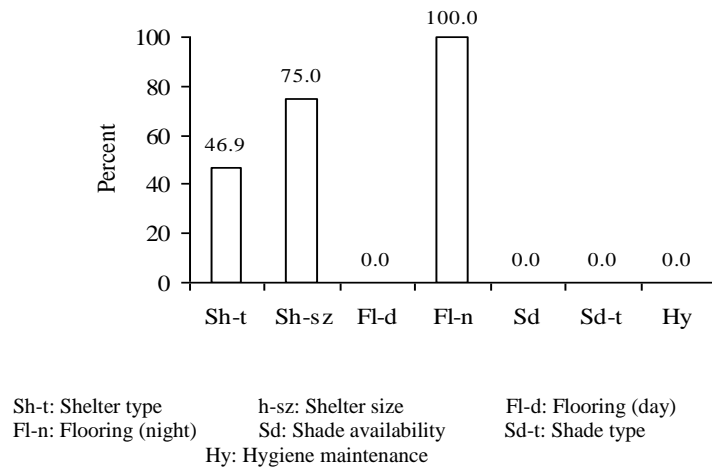Figure 1: Comparison of rating for shelter sub-parameters

Sh-t: Shelter type   h-sz: Shelter size   Fl-d: Flooring (day)
Fl-n: Flooring (night)   Sd: Shade availability   Sd-t: Shade type
Hy: Hygiene maintenance

Figure2: Percent deviation from E-R for shelter sub-parameters

Water and related features

- All elephants had access to pond and tank water for drinking / bathing within reach
- The elephants were reported to drink 24 litres per day
- They were bathed twice a day, for a duration of 2h each using a brush
- Water quality tests were not done

Elephants are reported to drink water at least once a day, subject to water availability (Sukumar, 1991). Bathing (the act of throwing water on their body or immersing themselves in water) followed by related activities such as mud-bath/ wallow are said to be important in maintaining good skin condition (Kurt and Garai, 2007). In captive situations, bathing the animal is usually done by mahouts/ cawadis. Hence, the material used, if any, has also been rated (Figure 2a and b).
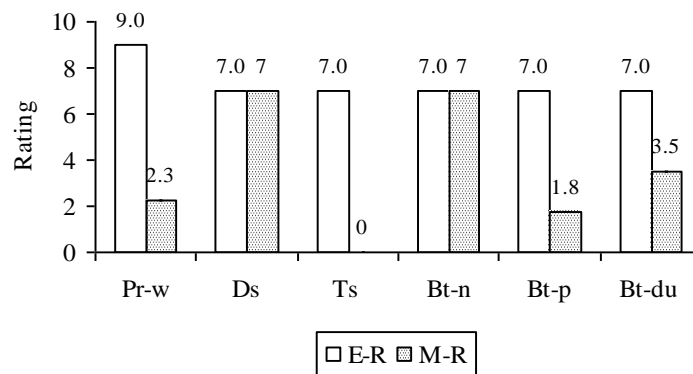

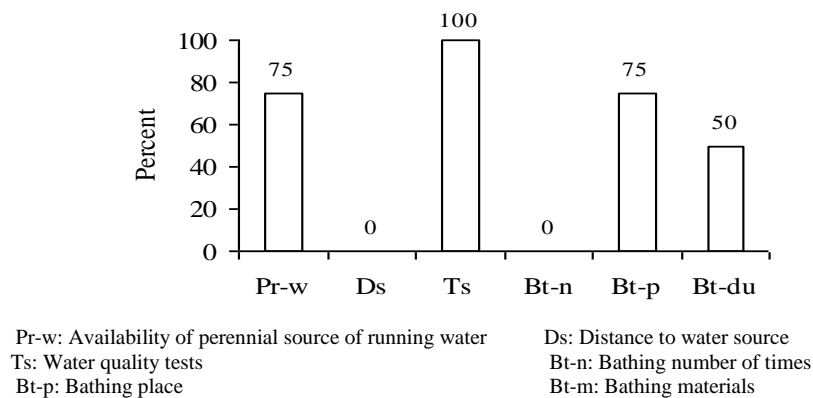Figure 2a: Comparison of rating for water sub-parameters

Pr-w: Availability of perennial source of running water   Ds: Distance to water source
Ts: Water quality tests   Bt-n: Bathing number of times
Bt-p: Bathing place   Bt-m: Bathing materials

Figure 2b: Percent deviation from E-R for water sub-parameters

150

Sleep

The elephants were chained in their night-time shelter. The animals were said to sleep for duration of 4 hours. M-R was 0.0 for the sub-parameter— 'sleeping place', showing 100% deviation from E-R.

Walk

- The elephants were allowed to free range in the adjoining forest from 6:30 a.m to 8:30 a.m

Elephants in the wild are on the move for most parts of a day, foraging/ searching for companions (Poole and Granli, in press). Restricted captive environments may not be able to provide opportunities to their elephants to move for suitable duration/ on appropriate surface. M-R was 9.0 (N =2) showing zero deviation from E-R for the sub-parameters observed.

Social interaction

- All elephants were allowed to interact with each other
- Interaction hours was through the day, but the animals were chained at night
- The elephants were said to be within reach of each other
- The elephants ranged from adults to infants, but all were unrelated with two adults being translocated from a forest camp to the zoo

The need to interact with others of the same species is paramount for a social species like the elephant. Bonds lasting across generations have been reported (Sukumar, 2003) with males said to disperse gradually from their natal herd (Poole and Moss, 2008), or form bachelor groups or associate with family groups while searching for mates (Kurt and Garai, 2007). M-R was 7.8 (SE= 0.3, N = 4) indicating 100% concurrence with E-R (Figure 3).
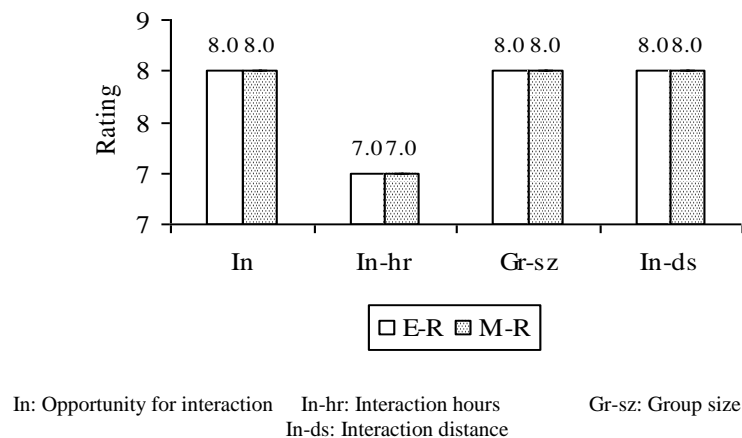

In: Opportunity for interaction   In-hr: Interaction hours   Gr-sz: Group size
In-ds: Interaction distance

Figure 3: Comparison of rating for social interaction sub-parameters

Chaining

- All the elephants were chained during the night
- Three elephants (all below 10 yrs) chained by one leg only
- Chain weight was 150 kg, Size—16 mm, and length 10m.
- Elephants were not chained when on display
- None of the elephants were allowed to free range at night

Constant chaining of the same region of the body results in the formation of pus filled wounds (Kurt and Garai, 2007); chaining has also been associated with increased frequency of stereotypy (Gruber, et al., 2000). M-R was 1.7 (SE= 1.5, N= 3) with a deviation of 79% from E-R (Figure 4a and b).
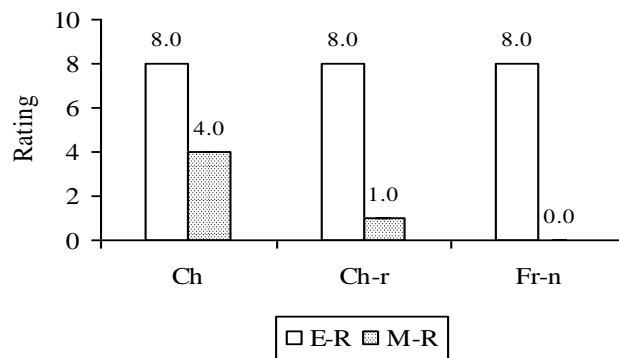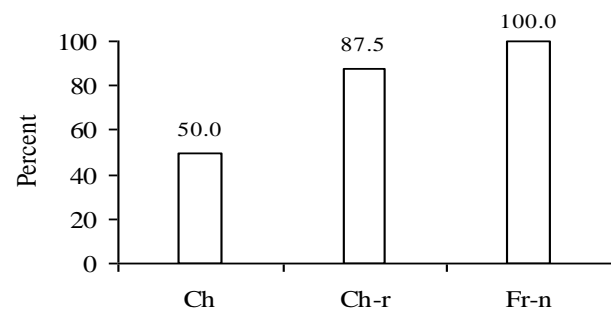
Figure 4a: Comparison of rating for 'chaining' sub-parameters

Ch: Chaining status   Ch-r: Region of chaining   Fr-n: Free-ranging at night

Figure 4b: Percent deviation from E-R for 'chaining' sub-parameters

Observed behaviour

- Two elephants were described as "frightened" while the others were "quiet" with a 2 yrs old being described as "playful."
- Three elephants were said to be aggressive towards people with the adult male having injured people; one infant was aggressive towards other elephants; the adult female not exhibiting any aggression
- One female infant and the adult female were said to exhibit stereotypic head bobbing of low to medium intensity respectively

Ease of managing the elephant along with occurrence of aggression/ stereotypy was rated. M-R was 4.7 (SE= 1.2, N = 4) showing a deviation of 41% from E-R (Figure 5a and b).
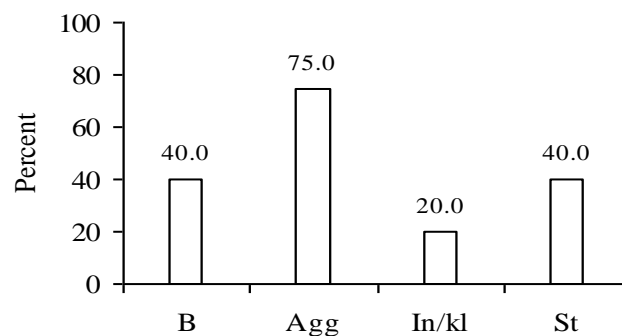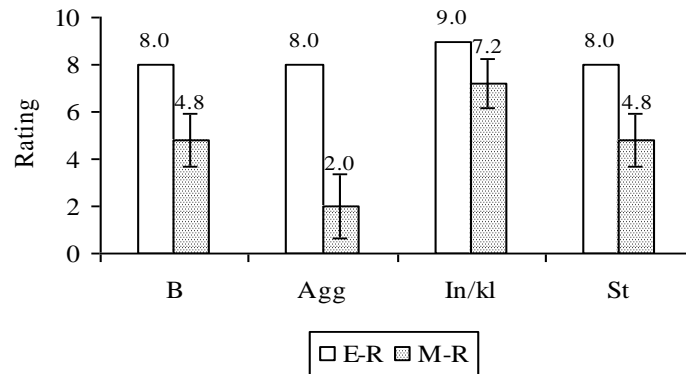

Figure 5a: Comparison of rating for behaviour sub-parameters

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B: Observed behaviour   Agg: Aggression towards people   In/kl: Incidents of injury/ killing
St: Stereotypic behaviour

Figure 5b: Percent deviation from E-R for behaviour sub-parameters

Food

- All elephants were allowed to browse/ graze in the adjoining 30 acre forest from 6:30 a.m to 8:30 a.m.
- Stall feed provided was: Ragi (*Eleusine coracana*), Horse gram (*Dolichos biflorus*), Banana (*Musa* sp.), coconut (*Cocos nucifera*), Jaggery (sweet derived from unrefined sugarcane), cut grass, sugarcane (*Saccharum* sp.).
- Mineral mix was not given; Ration chart was maintained, details included: food type, quantity and frequency
- Feeding place hygiene was good

Wild elephants spend 12-18 h in foraging/ feeding (Sukumar, 1991) on a variety of plants (McKay, 1973). This variety will be difficult to duplicate in captivity, given the constraints of space while free ranging or through stall feed. M-R was 5.1 (SE= 1.7, N= 6) showing a deviation of 39% from E-R (Figure 6a and b).
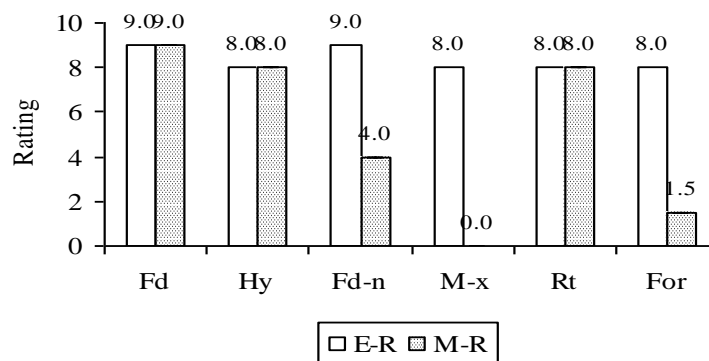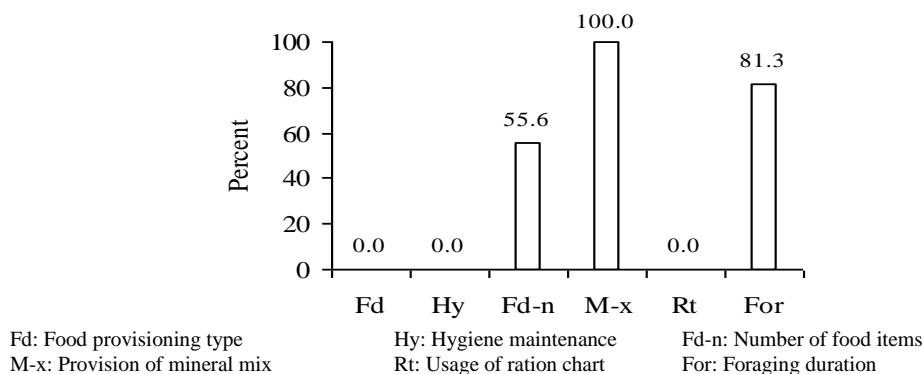

Figure 6a: Comparison of rating for food sub-parameters

Fd: Food provisioning type   Hy: Hygiene maintenance   Fd-n: Number of food items
M-x: Provision of mineral mix   Rt: Usage of ration chart   For: Foraging duration

Figure 6b: Percent deviation from E-R for food sub-parameters

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Work

None of the elephants were reported to be made to work. M-R was 8.0 (SE= 0.0., N= 5) showing 100% concurrence with E-R.

Reproductive status

- The female elephant was said to have been exposed to captive males, no calves were born
- The male elephant was said to exhibit musth; had mated with captive elephant, had not sired any offspring

Availability of individuals of opposite sex, normal reproductive functioning, opportunity to mate, birth of offspring, etc., are some features rated for this parameter. The occurrence of only two adult individuals entails restriction of reproductive features to these two elephants only. M-R was 4.9 (SE= 1.8, N= 6) indicating a difference of 38% from E-R (Figure 7a and b).
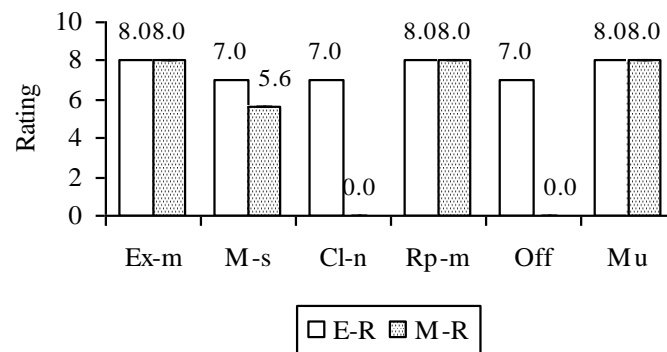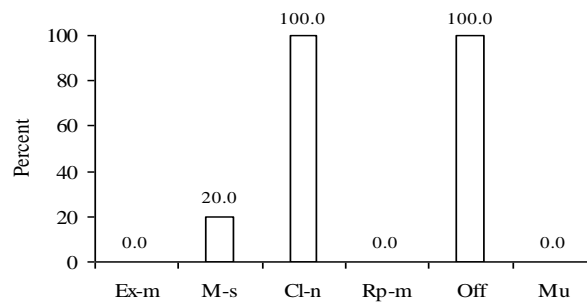

Figure 7a: Comparison of rating for reproductive status sub-parameters
(based on observations of two individuals only)

Ex-m: Exposure to males   M-s: Male source   Cl-n: Number of calves born
Rp-m: Male reproductive status   Off: Offspring sired   Mu: Musth occurrence

Figure 7b: Percent deviation from E-R for reproductive status sub-parameters (based on observations of two individuals only)

Health and veterinary routine

- Both adult elephants had leg wounds
- De-worming and oiling was done for all elephants; oiling with coconut or neem oil
- Dung/ urine tests were done
- Body measurements were taken once in three months

Captive conditions may predispose the elephant to diseases prevalent in the surrounding population.

Tuberculosis is a disease transmitted across species, capable of infecting elephants from their exposure to people/ cattle. Another common ailment is the occurrence of foot problems (Mikota, et al., 1994). Thus, the practice of following a set of prescribed veterinary routines such as vaccination/ tests of blood/ dung/ urine samples, body (weight) measurements, etc., gains importance. M-R was 6.0 (SE= 0.9, N= 10) indicating a deviation of 14% from E-R (Figure 8a and b).
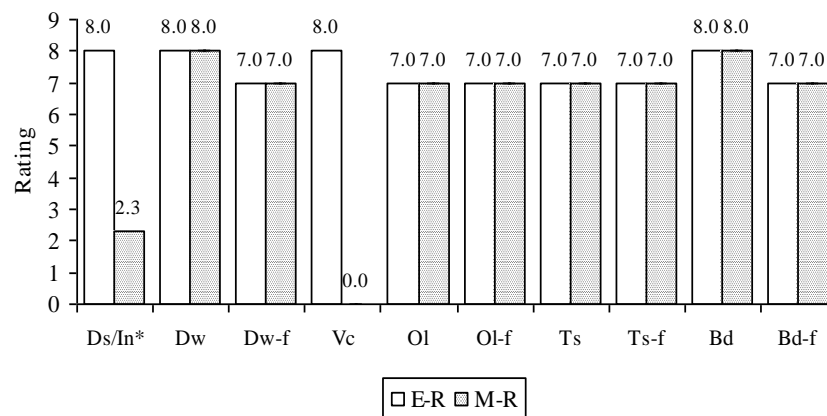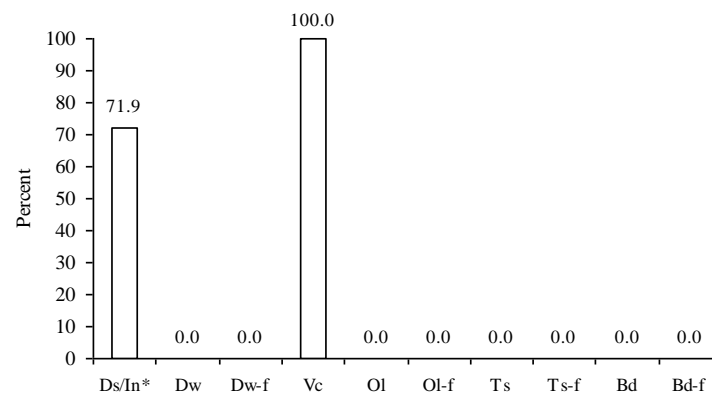

Figure 8a: Comparison of rating for health and veterinary routine sub-parameters

Ds/In: Occurrence of disease/ injury (based on two elephants only)   Dw: Deworming status
Dw-f: frequency of dewor   Vc: Vaccination status
Ol: Oiling   Ol-f: frequency of oiling
Ts: blood/ dung / urine sample tests   Ts-f: frequency of tests
Bd-f: Frequency of body measurements   Bd: Body measurements taken

Figure 8b: Percent deviation from E-R for health and veterinary routine sub-parameters

Veterinary personnel and infrastructure

- Two veterinary doctors were available, with experience in treating elephants
- Both the doctors visited the zoo daily as they were associated with the zoo
- A veterinary clinic with good essential facilities was available in the zoo
- Record keeping included individual history, treatment records, etc.
- Other facilities available were: staff quarters, cooking shed and vessels, food preparation hall, provision shed, camp site and other materials such as elephant chain, rope, etc.

Availability of veterinary personnel and good infrastructure are important in maintaining health and better management of the institution. M-R was 7.1 (SE= 0.7, N = 8) showing a deviation of 12% from E-R (Figure 9a and b).
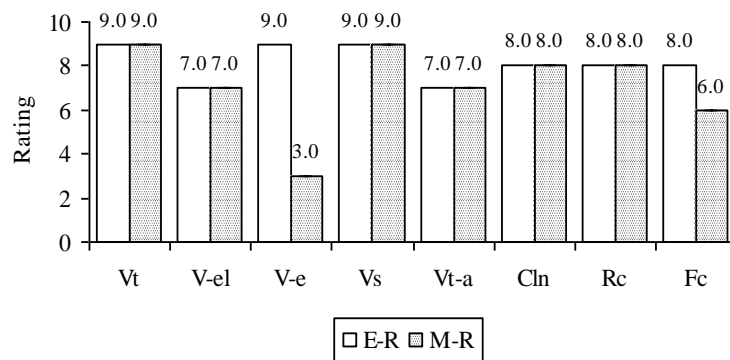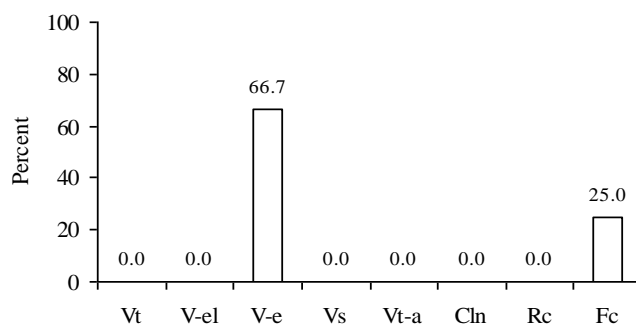
Figure 9a: Comparison of rating for veterinary personnel and infrastructure sub-parameters

Availability of veterinary doctor   V-El: Experience with elephants

V-e Years of experience   VS: Doctors visits

Vt-a: Availability of veterinary assistant   Cln: Clinic facility

Rc: Record keeping   Fc: Other facilities

Figure 9b: Percent deviation from E-R for veterinary personnel and infrastructure sub-parameters

Professional experience and socio-economic status of mahouts/cawadis

Handlers are integral to captive elephant environments which employ free contact with their animals. The professional experience of handlers has a direct bearing on elephant welfare. Socio-economic status is important in terms of handler welfare and indirectly may have an influence on the way elephants are handled. Mean age of handler was 30.3y, ranging from 26-34y (N=3).

Professional experience

- Mean experience in this profession was 7.6 yrs, ranging from 6-8 yrs
- Mean experience with a specific zoo elephant was 2 yrs (ranging from 1.5 – 2 yrs)
- Two handlers had joined out of interest while one person was chosen as he already had experience in handling elephants
- The handlers were trained by their experience of being with elephants
- Knowledge of commands was said to be good
- All handlers used sticks to manage their elephants

Experience in the profession coupled with an interest in this job is considered ideal for the handler as well as his/ her elephant. In addition, handlers' nature of training and knowledge of commands has been considered. M-R was 6.9 (SE= 0.6, N= 5) indicating a difference of 19% from E-R (Figure 10a and b).
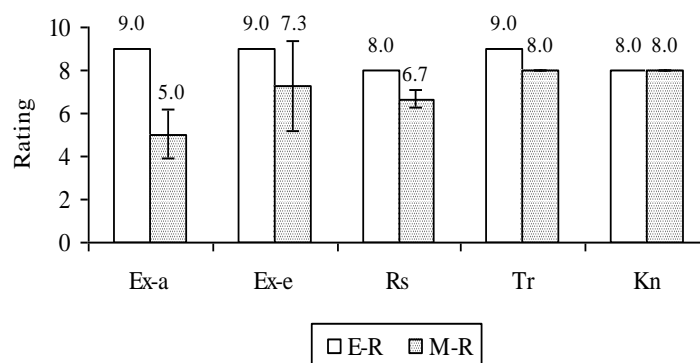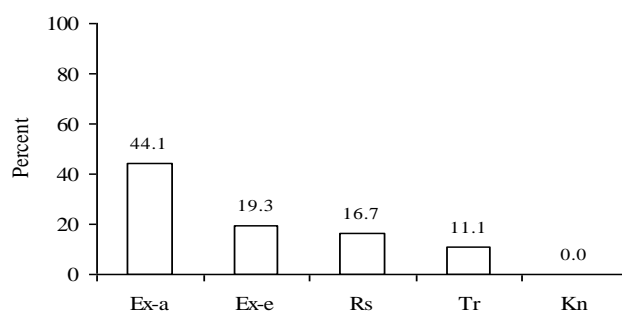
Figure 10a: Comparison of rating for handlers' 'professional experience' sub-parameters

Ex-a: Experience (as % of his age)　　Ex-e: Experience (as % of elephant age)
Rs: Reason for choosing this profession　　Tr: Training status
Kn: Knowledge of commands

Figure 10b: Per cent deviation from E-R for handlers' professional experience sub-parameters

Socio-economic status

- All handlers belonged to the Malasar community (known for their traditional knowledge of elephants).
- Family occupation was handling elephants for most handlers and one was a daily wage employee.
- Education varied from 1st standard to 9th
- Mean salary drawn was Rs. 40,560/- annually
- Number of children varied from 2-3
- Languages known ranged from one to three
- None of the handlers had insurance cover
- None of the handlers had been reported for bad conduct; did not consume alcohol

Handlers' family background, education status, income generated from this employment, insurance availability, etc., were considered. M-R was 4.9 (SE= 0.9, N= 9) with a deviation of 32% from E-R (Figure 11a and b).
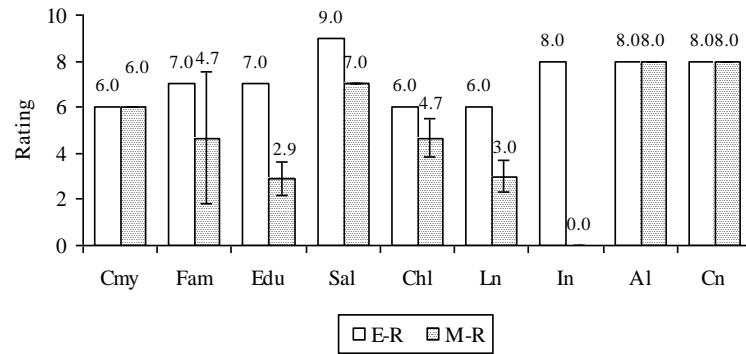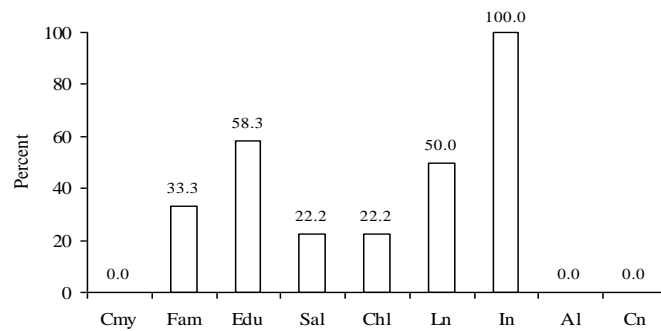
Figure 11a: Comparison of rating for handlers' socio-economic status sub-parameters

Cmy: Community   Fam: Family occupation   Edu: Education status
Sal: Salary drawn   Chl: Number of children   Ln: Languages known
In: Insurance availability   Al: Alcohol consumption   Cn: Reported bad conduct

Figure 11b: Percent deviation from E-R for handlers' socio-economic status sub-parameters

Overall Mean ratings for captive elephants in zoo of Tamil Nadu

The welfare of the elephants in this zoo was evaluated by considering the deviation from the wild for the parameters observed. Overall M-R (considering each rating across all elephants and sub-parameters) was 5.5 (SE= 0.4, N*= 55) indicating a deviation of 31% from E-R (Figure 12).
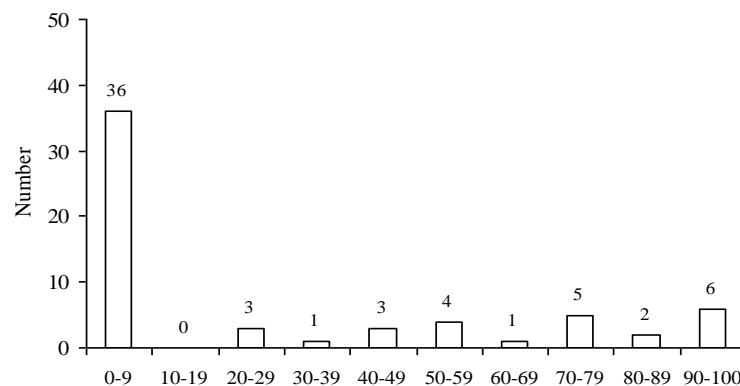

Figure 12: Percent deviation of overall M-R from E-R

Discussion

One reason, among many, given for maintaining wild animals in zoos is to popularise the concept of wildlife and conservation among lay people. This reason entails not only display of animals to the public but also conservation and display of natural behavioural repertoire in near natural settings, ensuring

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minimum deviation from the wild for the captive animals. Veasey (2006) notes the importance of keeping captive elephants by referring to their biological and habitat needs.

The provision of vast space (30 acres) of natural scrub forest in this zoo is a commendable feature, considering the limited space available to most captive elephants. The occurrence of a group of elephants of diverse age and sex is also noteworthy, along with availability of veterinary doctors and good facilities. However, elephants undergo their captive situation as a complex interaction of various factors. The presence of a large space maybe offset by an inability to use this space.

Features which were not conducive to elephants:
- The practice of keeping the elephants for display within their enclosure: even though space was available, the elephants were allowed to free range for only two hours a day. Poole and Granli (in press) state the need for elephants to move across varied habitat, anatomical structure of elephants making them unsuitable for standing in one place for long. At night the elephants were chained and made to sleep on concrete floors. Chaining restricts the ability of the elephants to express appropriate behaviour in the presence of conspecifics. Benz (2005) cites several authors reporting on the association between hard floors and occurrence of foot problems in elephants.
- The practice of restricted access to forage in the surrounding forest space meant availability of time for the elephants with "nothing-to-do". Wild elephants spend most parts of a day foraging. The cognitive capacities of elephants have been documented (authors cited by Poole and Moss, 2008); absence of psychological stimulation for most parts of a day may be undesirable in terms of welfare of the elephants.
- Non-availability of water-bodies with running water: stagnant water may act as a source of infection. Also, suitable sized water-bodies for the elephants to immerse themselves were not available as the elephants were reported to be bathed in enclosures measuring 20'×20'. Kurt and Garai (2007) report of the importance of provision of suitable water-bodies for captive elephants, with the animals indulging in social interaction/ play while making use of temporary rain-water puddles in a captive elephant institution in Sri Lanka.
- The shifting of two adult elephants from Annamalai FC to this zoo may not be desirable for the elephants considering that the male was captive born, with the mother also in the same camp. Breakage of established familial bonds or relationships has been associated with stress among elephants (Clubb and Mason, 2002). While the zoo is said to have had success in rearing orphaned young elephants (The Hindu, March, 2002) the policy of relocating elephants from the zoo to different institutions needs review keeping in mind the group structure of the elephants and providing for the elephants to choose their social partners.
- Both adult elephants were reported to be made to work by providing tourist rides: 9:30 a.m. -11:30 a.m. and 4:00 p.m. – 5:30 p.m., at the time of writing this report. The use of elephants for work involves two aspects:
   a. work conditions: time of work should ideally involve early morning or late evening and on natural terrain; provision of food/ rest/ water while working; maintenance of howdah
   b. elephant behaviour: work takes away the time an animal gets to spend with its conspecifics, providing no freedom to express its natural repertoire of behaviour

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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 them from suffering at the hands of humans. CUPA does not differentiate between pet, stray or wild animals, since all of them often require assistance and relief from cruelty, neglect and harm. The organisation's objective has been to design services and facilities which are employed fully in the realisation of these goals.

Asian Nature Conservation Foundation (ANCF) is a non-profit public charitable trust set 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 co-ordination with government 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 forums.

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 concern of CUPA and both organisations complement each other in their services. WRRC was established as a separate Trust in 1999.

College of Veterinary Science, of the Assam Agricultural University, under the Faculty of Veterinary Science, has celebrated its Golden Jubilee Year in 1998 and during its 50 years of existence the college has contributed immensely in the human resource development for not only the state of Assam but also for the entire North Eastern Region and the country as a whole. The faculty is contributing immensely towards the cause of conservation in the region by mostly taking care of the captive and free ranging elephant wealth of the region, rhino translocation etc. and also playing a pivotal role throughout the country in the training of manpower in handling wildlife healthcare and managerial issues.

Plant and Animal Welfare Society (PAWS) was established in 2001 by four youngsters with the mission to save urban wildlife, and help distressed domestic animals. The other activities of PAWS also include conducting awareness programs on animal rights, environmental conservation and tree protection. PAWS has , 200 volunteers, two ambulances for animal rescue and a team working tirelessly to help distressed animals and wildlife for the past seven years. In the first year PAWS helped around 600 animals. Now, PAWS helps more than 1,500 animals each year.

SAHYOG deals with mainly rescue of animals from illegal transportation, slaughter, and cruelty. SAHYOG pioneers in creating awareness among people about animal welfare laws and other details. In the past three years, SAHYOG has rescued more than 1000 snakes, cared for about 800 pigeons which were injured during the kite flying festival, and rescued several endangered wildlife species . SAHYOG has booked more than 50 cases against cow slaughter and prompted legal action against nearly 100 individuals, booked cases against approximately 500 lorry owners who were carrying animals violating animal welfare norms. SAHYOG was also able to close down all the three circuses operating in Hyderabad. Additionally the organisation is maintaining a rescue shelter. . SAHYOG has helped in sustaining a healthy population of peacocks in and around Hyderabad. Also, it has created awareness about animal welfare issues and has closed down all the illegal pet shops in Hyderabad .

Gujarat Society for Prevention of Cruelty to Animals (GSPCA) was founded in 1993 by Snehal Bhatt in Baroda, GSPCA works with the State Government and other agencies in issues relating to the rescue and rehabilitation of wild animals, trading and poaching of wildlife and other related issues. The organisation is very active in Gujarat and has been working for the last few years towards raising awareness on the plight of captive elephants in the State.

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

Photo credit: Figures 1a, 4 and 20b: Savitha Nagabhushan 1b, 7b, c, 13a, b, c, d, 15c, d, 20a, 22, 27a and b: Surendra Varma, 6c, Ashok Kumar, 6d, 21a, b, 27c and d: Nilesh Bhanage, 6a, 7a, 9a, b, 15b, Mahesh Agarwal 6b and 15a: Raj Bhavsar 9b, 18a and 20d: R. Thirumurugan,18c and 20c; K.K.Sarma, 6e and 13d: Easwaran

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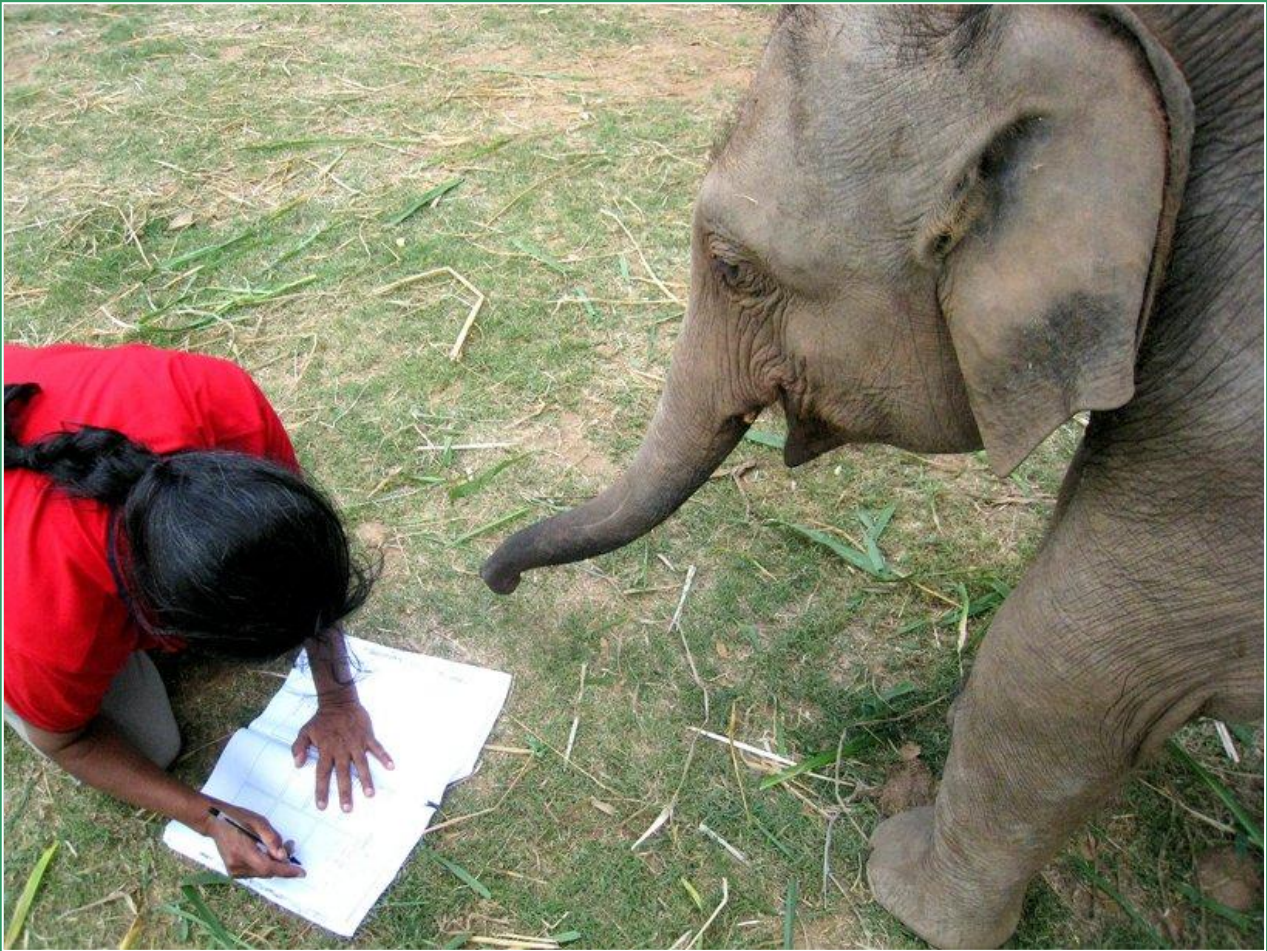
The zoos in India are home to a diverse species of animals and elephants that form a part of the captive set of animals. We sampled 49 elephants from 11 zoos covering seven States in India. Welfare of the elephants kept in these zoos have been assessed through a number of parameters which have been rated on a scale identified by a team of experts. The investigation and resultant document are the first detailed report dealing with population status, management and welfare on elephants in captivity in zoos sampled across India.