# Welfare status of Lucy the Elephant

An Investigation into the Welfare Status of the Elephant Lucy in Valley Zoo, Edmonton, Canada

Surendra Varma

**Elephants in Captivity: CUPA/ANCF - Occasional Report. 10**

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# Preface

I was invited by the International Congress of Zookeepers (ICZ) and the American Association of Zoo Keepers (AAZK), organizers of the symposium "One World, One Zoo" held in Seattle, in September 2009, to make a presentation on captive elephants and their keepers. After this meeting I had planned a tour of some elephant facilities in North America in the month of October 2009. These visits were made possible by the support of a number of conservation organizations (including WWF International) and elephant researchers at various US Universities. Visits to these elephant facilities enabled me to continue my work on using an assessment/evaluation framework devised in India to assess the welfare status of particular elephants based on a number of parameters that characterized the physical conditions under which they were housed and the manner in which their biological, social and psychological needs were met. This quantitative analytical framework is superimposed on qualitative judgments stemming from my own experience with researching elephants in the wild and in captivity for the past twenty years to produce an overall assessment of the 'welfare status' of the animal(s).

Meanwhile one animal welfare organization, Zoo Check Canada Inc, asked if I would visit Edmonton Zoo, and examine the welfare status of Lucy, the well known zoo elephant whose situation in the zoo was a matter of some controversy between the zoo authorities and animal welfare groups. I agreed to visit Edmonton and visit the Valley Zoo to take a look at Lucy. I made clear to Zoo Check that I would try to carry out an unbiased assessment and would not be a party to any campaign for or against the continued presence of the elephant at Valley Zoo. Given the sensitivity surrounding Lucy's existence at the zoo it would have been difficult to explain my mission to the Valley Zoo authorities and expect them to cooperate in an evaluation that they never asked for in the first place. I therefore observed the elephant myself for a period of 2 full days and relied on Valley Zoo's detailed and informative website for information on the physical conditions of the elephant, its medical records and the routines it was put through in the course of its day to day existence. After completing the field work I brought back the data gathered to India and wrote a draft report of Lucy welfare status, later I consulted other zoo veterinarians and elephant experts for their critical opinion on the findings and the conclusions arrived at.

The details of the methodology for the assessment of welfare status of captive elephants like Lucy are outlined on pages16, 17 and 19. The fundamental consideration on which the assessment is based is the closeness of the environmental, social and psychological conditions of the target elephant to the conditions of a similar elephant in the wild. The greater the deviation of the conditions in which the target elephant is made to exist from those of its counterpart in the wild the poorer the welfare status of that target elephant. The report has four sections: the first section is an executive summary that provides concise information on Lucy's welfare status along with major findings; the second is a comparison of Lucy's captive conditions with those observed in the wild, the third section deals with the actual observation and results. This is followed by specific observations and recommendations.

## Acknowledgements

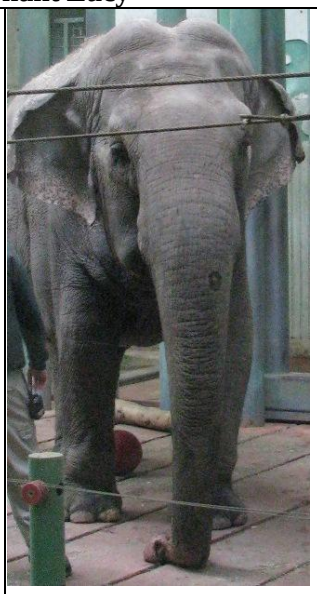
After attending and giving a presentation on Welfare Status of Elephant Keepers in India, at ICZ and AAZK meeting, I travelled across different elephant facilities in October 2009. My trip from India to attend the meeting and the visit to some of elephant facilites was possible through the support provided by WWF-International and some of my former colleagues, friends and well wishers, particularly, Dr. A. Christy Williams, WWF Asian Elephant and Rhino Program, Nepal, Ms. Eileen Weintraub from Seattle, Dr. Rani Muthukrishnan, and Dr. Suresh Iyer from Pullman and Dr. Khwaja Hussain from Boston, USA. The supports provided by Zoo Check, Canada, and Voice for Animals Society, Edmonton are also very much appreciated

I wish to thank Prof. R. Sukumar, Centre for Ecological Science, Indian Institute of Science, Bangalore for his valuable inputs. Dr. T.N.C Vidya, critically reviewed an earlier version of the report. Dr. Roshan K Vijendravarma, Post Doctoral Researcher, Department of Ecology and Evolution, University of Lausanne, Switzerland provided critical inputs and suggested that I compare the welfare status of Lucy with other zoos. Dr. E.K. Easwaran, Forest Veterinary Officer, Forest Veterinary Office, Pathanamthitta District, Kerala, southern India, and Dr. Kushal Konwar Sarma, Associate Professor, Department of Surgery and Radiology, College of Veterinary Science, Assam Agricultural University, Guwahati, northeast India, Dr. N. Kalaivanan, Forest Veterinary Surgeon, Mudumalai Elephant Camp, Theppakadu, Nilgiris, Tamil Nadu, southern India and Dr. Susan K. Mikota DVM, Director of Veterinary Programs and Research Elephant Care International, USA reviewed the section of health status and veterinary care and suggested valuable changes.

Dr. C.Arivazhagan, Conservation Biologist, Care Earth, Chennai, southern India, provided support in processing data and also notable photograph of a female (of elephant Lucy's age) and her calf from their natural habitat for a comparison of Lucy's life in relation to her counter parts in the wild. My sincere thanks are due to Mr. Thomas Mathew, the Executive Director, Asian Nature Conservation Foundation for his perspective on the goals of this study and on the accurate application of the methodology for rating welfare parameters for captive elephants

## Profile of Elephant Lucy

| | |
|---|---|
| **Name of elephant** | Lucy (Skanik) |
| **Age (yrs)** | 34 |
| **Sex** | Female |
| **Tush (visible/not visible)** | Not visible |
| **Current Location** | Edmonton Valley Zoo |
| **Province** | Alberta |
| **Country** | Canada |
| **Source of the animal** | Orphaned and transferred to Zoo |
| **Location of the source** | from the wild in Sri Lanka |
| **Age/Height when orphaned and transferred** | Orphaned in 1975 (was 2 years) and transferred in 1976 |
| **Reason for orphaned** | Not known |
| **Type of shelter** | Open and closed |
| **Type of flooring** | Mud and concrete |
| **Source of water** | Tanks |
| **Interaction with elephants/Number** | No |
| **Hours/day** | NA |
| **Personality** | Calm |
| **Number of people killed/injured** | Nil |
| **Stereotypic behaviour** | Yes |
| **Type of work/enrichments** | Display for public; painting; blowing the harmonica; hide and seek and tug of war |
| **Hours/day** | 9 am to 6pm (summer); 10 am to 4 pm (winter) |
| **Source of food** | Stall fed |
| **Type** | Different types of hay, grasses, herbivore pellets, vegetation, tree browse, vegetables and fruits |
| **Occurrence of heat cycles** | Not known |
| **Calves born till date** | Nil |
| **Medical Problems** | Rheumatoid arthritis, foot abscesses, toe nail cracks, foot pad problems, abscess in hip region, chronic respiratory problems in the form of trunk discharge, breathing from the mouth, blocked nostrils, wheezing, obesity |
| **Permanent medical problems** | Arthritis, breathing from the mouth, obesity |
| **Veterinary doctor availability** | Yes |



# Section 1:
# Executive Summary

Lucy is a 34 year old, female Asian elephant kept at the Valley Zoo, Edmonton, Alberta, Canada. This area of Alberta is characterized by low temperatures with average maximum ranging from $23^{o}$ to $-8^{o}$C and average minimum ranging from $10^{o}$ to $-19^{o}$C. The region experiences snowfall for at least six months of the year.

Campaigns by the public, NGOs and others highlight the fact that Lucy lives alone and suffers from arthritis, obesity, respiratory problems and chronic foot ailments. They recommend shifting her from Edmonton and its long winters to a more suitable location in a warmer climate, with more space, suitable substrates and as near-natural a living environment as possible.

The Valley Zoo's rebuttal is that Lucy's quality of life in the zoo is good; however, they also say she is not healthy enough to be moved and that doing so would pose an unacceptable, possibly lethal, risk to Lucy. They say her health problems require her to remain in Edmonton with keepers who know her. The zoo also asserts that some elephants prefer to be alone because they have bonded with their human keepers.

In these circumstances, an unbiased but critical review of Lucy's welfare status at the current location in terms of her physical and psychological wellbeing is mandatory. Lucy's welfare has to be assessed objectively from an elephant's point of view, by examining the deviation from natural processes that all elephants in captivity experience when they are kept in an artificial human environment.

This investigation aims to assess the welfare status of the Asian elephant Lucy. Direct observations of Lucy were made during October 2009 and specific data was extracted from websites of both the Valley Zoo and animal welfare organizations. Welfare status 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 a group of experts, studying Asian Elephant, in the wild, veterinary care of both wild and captive animals, managing wildlife habitats, and captive animals and their facilities and working on animal welfare.

Experts' Rating (E-R) represents the relative significance of a particular parameter s when compared to all other parameter affecting elephant welfare. This is arrived from ratings given to given parameter by a set of experts who rated given parameter based on their knowledge and experience. The Mean Rating (M-R) denotes welfare status of existing conditions for the particular parameter, which arrived based on the data obtained by observing elephant or extracting from the sources related to the ground investigation. The difference between E-R and M-R indicate the extent of deviation from the acceptable standards as suggested by experts.

A total of 39 parameters and sub-parameters were considered for data processing, for these parameters comparison of deviation across E-R and M-R was made. In addition, Lucy's welfare status were also compared with elephants in other zoos and a forest camp, for which data and results are available, this was done to establish her welfare status in relation to other captive condition. Unlike, elephants from begging, circus, temples

industry, the zoos and forest camp considered for comparison do not expose elephants for any work.

Lucy was reportedly orphaned in the forests of Sri Lanka, indicating her non-captive origin. She was transferred out of the country when she was only 2 yrs old; M-R for origin of elephant under this situation is 3.0 indicating a deviation of 50% from E-R.

The elephant, Lucy, has been provided two kinds of shelter/enclosure: one is an open enclosure with sand/ mud as flooring. The other is a closed indoor enclosure with concrete flooring. The animal reportedly spends 25% of her time in the open shelter and 75% in the closed shelter, regardless of the time period for which, the barn door is kept open. Overall M-R for shelter is 5.3 implying a deviation of 33.4% from E-R

Lucy did not have access to perennial sources such as rivers/streams. Water source was tap/ tank in close proximity. Bathing place was the barn (closed shelter) wherein water was sprayed through hose pipes onto the elephant for duration of 15-20 min. M-R for water related parameter is 1.6 indicating a deviation of 77.1% from E-R

Lucy was allowed to walk, accompanied by keepers, out of her primary enclosure and the nature of terrain was concrete with some grassy areas. The official website of the zoo mentions walks in the adjacent area with natural vegetation and substrates. Keeper records for 2008 reveal that Lucy was not taken out of her enclosure on 63 days due to weather and her ill health. M-R is 9.0 for opportunity to walk and 2.0 for time period of walk. Percent deviation from E-R is 0% and 75%, respectively for each of the sub-parameters.

Lucy has been kept singly, with no opportunity for social interaction with other elephants. Social interaction is a significant factor in maintaining the health and psychological well-being of elephants, especially for females, and M-R is 0.0 indicating a deviation of 100% from E-R.

There was no opportunity to range free in natural conditions; M-R is 2.7 implying a deviation of 66.7% from E-R

Lucy was provided only stall feed; there was no free-ranging foraging opportunity. The zoo states that the elephant is allowed to browse/ graze in the adjacent forest. This activity is restricted, however, by two factors: prevailing low temperatures for most of the year and the focus on making the elephant walk when such an opportunity is available. M-R was 0.0 for food provisioning type and 1.5 for number of food items given with percent deviation from E-R being 100% and 83.3% respectively.

Lucy is not involved in any physical work. The Valley Zoo does make Lucy paint pictures and put on a show for children a few times a week when school classes come to the zoo. The zoo's official website suggests that Lucy also 'plays soccer'. Other activities include blowing the harmonica or recorder, hide and seek and tug of war. Although all of these activities may constitute a type of moderate exercise, they are not part of an elephant's natural repertoire of behaviour. The M-R is only 4.0 with 50% deviation from E-R.

Lucy has been largely kept alone. It was twice exposed to males; however there were no reports of pregnancy/calf birth for this animal. M-R is 1.6 with a deviation of 77% from E-R.

Lucy was diagnosed at an early age with rheumatoid arthritis; foot abscesses, toe nail cracks, foot pad problems and an abscess in hip region have been reported. Chronic respiratory problems in the form of trunk discharge, breathing from the mouth, blocked nostrils and wheezing have also been reported. Weight measurements for different years show tendency towards obesity.

Data regarding Lucy's medical condition available from Feb 1980 to June 2009, showed more than twenty types of problems involving various parts of the body. The disease/ injury reported over the years involved almost all parts of the body, from the eyes, face, trunk to the rectum and the tail.

The data revealed predominance of three types of problems: Stiffness/ soreness/ inability to move easily followed by occurrence of abscesses and respiratory problems. Among all the diseases/ injuries, irrespective of nature of the problem, maximum occurrence involved the foot region, followed by leg, hip and knee. Toe problems such as nail cracks, skin development, swollen toe, pus were observed 32 times for the elephant Lucy. The studies show, inadequate exercise and consequent poor wear and tear may lead to foot problems.

M-R for health related problems is 1.8 with a deviation of 77.4% from E-R. The elephant was treated by a veterinarian who appeared to have limited experience in treating elephants. M-R is 4.0 implying a deviation of 48.8% from E-R.

If welfare of captive elephants are assessed based on rating scale of 0 to 10 with zero representing bad welfare condition and ten representing satisfactory welfare condition, Lucy receives an overall M-R of 3.1 indicating a deviation of 60.9% from a satisfactory welfare status.

Fifty eight percentages of the observed parameters showed deviation of 70% or more from conditions considered acceptable by experts implying predominance of bad conditions for the elephant.

When percent deviation of welfare of Lucy is compared with elephants from two zoos and a forest camp across specific parameters, the occurrence of deviations of 50% or more was maximum for Edmonton Zoo, followed by Byculla. Bannerghatta zoo and Mudumalai forest camp. The difference were significant for Forest camp and Edmonton zoo, and between Bannergatta Zoo and Edmonton Zoo and the difference were not significant between Byculla Zoo and Edmonton, suggesting the mean percentage deviation of welfare was high for Edmonton and Byculla zoos.

Among the parameters, the three parameters that need immediate attention are: social isolation, existing cold temperatures and health of the elephant (obesity, arthritis and

chronic respiratory problem). These three major welfare issues are interlinked; the underlying causes of these issues are consequences of one other.

Keeping a tropical animal in cold conditions makes it mandatory to keep the animal in a closed environment. As Lucy has to spend more time in the indoor enclosure during cold months, she is forced to use the concrete floor for long periods of time. This environment severely restricts the opportunity and ability to exercise, and any attempt to introduce new enrichment or an exercise regime, especially for animals suffering from obesity and arthritis, would only aggravate existing strains.

Unlike cold regions, in a warmer region, elephants can be exposed to a number of outdoor-based exercise regimes, including regular walks that are easier and less aversive to the elephant. A warm and dry climate would be more conducive to the wellbeing of an elephant with arthritis. .

As Lucy becomes older (she is only 34 years and potentially has half a life remaining), her chronic health conditions could become a more severe. Many of her current problems, even ecological and medical, could be ameliorated if she is shifted to a location which provides her with the necessary space, stimulus to use the space, the potential to create an unfragmented exercise regime, scope for socialization with other elephants (positively/negatively), and suitable weather conditions.

# Section 2:
# Assessing the Status Lucy's Living Conditions in Comparison with Elephants in the Wild

Elephants are recognized for their long-lasting social association in the wild. Females establish groups which may last across generations Figure 1 (Poole and Moss, 2008). In the wild, the average group size of elephants is around 6 to 10 (Sukumar, 2000); group sizes of 25, 36, 46 and a maximum concentration of 70 elephants (Figure 2) also have been reported (Arivazhagan, pers. obs). Group sizes of 20 to 30 frequently visiting waterholes have been also observed (Varma, pers.obs). Social

Figure 1: Stable family unit in the wild; females do not live alone

Figure 2: Rarely seen alone and the congregation may go upto 70/ more

interaction with other elephants is integral to the animal's well-being, as elephant society depends on inter-relations and knowledge provided by older and dominant females. Females and their calves form the core unit of elephant families (Figure 3). Females of all age classes stay in their group throughout their lives. The occurrence of such a long-lasting association, contact and information provided by older and dominant females assist younger and growing animals to learn many behaviour and skills (Kurt and Garai, 2007).

Figure 3: Congregation of groups, more females in number

High elephant density regions in southern India, for example, have temperature ranges from a minimum of 4.80°C to a maximum of 24.30°C. With this temperature range wild elephants are active for nearly 18–20 h/ day (75–83%) (Eisenberg, 1981). Free-ranging elephants (Figure 4) digest foods to a greater extent than captive elephants. Their walk is dominated by the forested and natural floor (Figure 5). Very rarely do they come in

Figure 4: Natural foraging in the wild, scope for stretching as exercise

Figure 5: Walking in group in the wild, note weight and gait of elephants

contact with concrete/ hard floors. The natural environment also provides adequate shade and cover (Figure 6&7).

Figure 6: Natural habitat with foliage and shade

Figure 7: Elephant in natural shade, source of good thermoregulation

Figure 8: Source of water, group inseparable while drinking

Depending on the forest type, food and other resources available, wild elephants walk about 8–12 km/ day in search of food and water (Figure89). Depending on the temperature and humidity of a given place, an elephant drinks more than 200 l of water a day (Sukumar, 2000); they need to bathe at least once a day (Shoshani and Eisenberg, 1982). Spraying of dust/wallowing seen among wild elephants helps in thermoregulation and acts as an insect repellent (Shoshani and Eisenberg, 1982).

Lucy's life in her human environment is in sharp contrast to what her counterparts in the wild are exposed to. She is alone, orphaned at a very early age, shifted from her natural home to be exposed to temperatures of average maximum ranging from 23$^{o}$ to -8$^{o}$C and average minimum ranging from 10$^{o}$ to -19$^{o}$C, and eventually forced to socialize with human keepers. Lucy has an unnatural closed indoor enclosure with concrete flooring (Figure 9 & 10). She reportedly spends only 25% of her time during the colder months in the outdoor, open mud floor based shelter.

Figure 9: Lucy's indoor enclosure, absence of any vegetation/ companion

Figure 10: Lucy's unnatural flooring in contrast to wild conditions

She does not have access to perennial sources such as rivers/streams. Water source is a tap/ tank (Figure 12). Lucy was allowed to walk, not with her own companions, but accompanied by keepers, and the nature of terrain was concrete with some grassy areas (Figure 10). Lucy was provided only stall feed, no free ranging opportunity. She appears to browse when she walks out to the woodlot area, only during warm weather. She is encouraged to engage in different activities, such as painting pictures,

Figure 11: Lucy's walk regime accompanied by keepers on concrete surface

Figure 12: Lucy's source of water within enclosure

playing soccer, blowing on a harmonica, and playing hide and seek and tug of war, which are not a part of the elephant's natural repertoire of behaviour. Unlike her counterparts in the wild (of her same age), she has a severe obesity problem, has never experienced pregnancy, given birth, or propagated her own progeny (Figures 13 & 14). If her welfare is assessed in relation to her wild counterparts, she receives a score of 3 out of 10.

Figure 13: Mother and calf walking, adult of Lucy's age in the wild

Figure 14: Lactating mother of Lucy' age, in the wild

# Section 3:
# Welfare status of Lucy

**Introduction**

Wild animals live and survive in habitats through an intricate network of interactions between themselves, other animals and their physical environment. An essential feature is the control exercised by the animals themselves in the way they eat, sleep, socialize/ reproduce. In captivity this is replaced by human presence and control.

Elephants cannot be considered to be domesticated (Lair, 1997; Kurt and Garai, 2007); they are wild animals living in captivity. The differences inherent in the day-to-day physical/social lives of captive elephants, especially when compared to their wild counterparts, may affect their biology and behaviour (Bradshaw, 2007) in the form of increased incidence of foot ailments, occurrence of stereotypic behaviours, heightened aggression, abnormal/ absent reproductive behaviours and shortened life-span.

Captivity is the sole reason for the occurrence of elephants in regions outside their range states. A 34y old, female Asian elephant named Lucy is being maintained in captivity in a zoo in Edmonton, Alberta, Canada. This region is characterized by low temperatures with an average maximum ranging from $23^{o}$ to $-8^{o}$C and average minimum ranging from $10^{o}$ to $-19^{o}$C (accessed online)[a]. The region is said to experience snowfall for at least six months of the year for at least a few days of each month. Edmonton can have snow on the ground continuously for about six months of the year.

Lucy was brought to Edmonton in 1977 from Sri Lanka. Initially kept singly, she was given an opportunity for social interaction when an African elephant was brought to the zoo. Two decades later, this elephant was shifted to another zoo, leaving Lucy alone again.

Campaigns by the public, NGOs and others to shift her from Edmonton Valley Zoo to a more suitable location with a warmer climate and availability of space with suitable substrate and a near-natural living environment have been initiated (accessed online) [b]. At the same time, the Valley Zoo maintains that Lucy is comfortable in her present location, having been imprinted on people and is not comfortable with other elephants. Her health issues were reported to be treated as per protocol (accessed online)[c].

With this background, an unbiased but critical review of Lucy's welfare status at the current location and implication of her being in the same location in terms of consequences on her physical and psychological wellbeing is mandatory. Lucy's welfare has to be assessed objectively from an elephant's point of view, by examining the deviation from natural processes and lifestyles that all elephants in captivity experience when they are kept in an artificial human environment.

Captivity, be it in elephant range states/or outside such regions, enforces living conditions which differ from those encountered in the wild state to various degrees and kinds. The ecological and behavioural needs of elephants have evolved in the wild state, such requirements maybe conspicuous by their absence in captivity. It is this deviation from the wild that is being assessed as an indicator of welfare status in captivity, irrespective of location.

The deviations existing in captivity may vary depending on a number of reasons, with some showing lesser deviation, implying relatively better welfare status for the elephants. Welfare status of Edmonton Zoo elephant also was compared with two Indian zoos (Bannerghatta biological park, Bangalore, Karnataka state and Byculla zoo, Mumbai, Maharashtra state) and a forest camp (Mudumalai forest camp, Tamil Nadu state) as a way of comparing captive conditions for elephants. It should be noted that forest camps are termed extensive systems (Poole and Taylor, 1999; Kurt and Garai, 2007) wherein elephants live in forests/ near natural environments under human control and for human use.

**Objectives**

The focus of this investigation is:

- To assess the welfare status of the Asian elephant, Lucy, through a study of existing physical, social and physiological parameters and also to assess the availability of veterinary personnel of suitable professional experience, as it can have an indirect affect on the health and welfare status of elephants

- To compare the welfare status of Lucy with the other elephants kept in two zoos and a forest camp in India

**Method**

Direct observations of Lucy were made during the first week of October 2009. The elephant was observed to know the different activity patterns it undergoes or is exposed to on a given day. Actual time spent for activities in both open and closed enclosure was noted. In addition, specific data was extracted from the websites of both the Valley Zoo and welfare organizations. In addition, an attempt was also made to interact with public as when they were encountered.

The welfare status of elephants has been assessed previously 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 is the welfare. Deviation from the wild state for the parameters observed was rated using a scale developed by elephant experts (Appendix 1 for mean and expert ratings).

In addition, Lucy's welfare status was also compared with that of elephants in two other zoos and a forest camp, for which data and results from a similar assessment were available. Unlike, elephants from begging, circus, temples institutions, the two zoos and the forest camp (semi-natural condition) do not expose elephants for any work.

**Data processing**

Background

Identifying welfare needs of elephants should be based on knowing what elephants' needs are. Institutions, for example zoos, could be good or bad for the animal. The criteria for such an assessment should be based on whether the institution has provided for the needs

of the elephant/s. Such needs can be judged from existing scientific and management knowledge which is available from experts working with/on elephants. With this knowledge, the relative importance of the needs can be identified by the experts and elephants' needs can be categorized under a number of parameters. A study on ecology and management of captive elephants (Varma, 2008) based on sampling 1200 elephants across different management regimes in 12 different states of India was the source of knowing existing ground situation of captive elephants and their keepers. This investigation, apart from attempting to provide detailed information on the population and management status, was used for identifying welfare parameters, based on specific data available for a given animal (Varma, 2008).

A parameter could be considered as a discrete feature that identifies welfare of the elephant by being integral to the elephant's biology and natural history. Parameters may be supported by sub-parameters that describe the occurrence of diverse types of features of a parameter. For example parameter 'Water" could have sub-parameters such as source, distance, number of times drinking/day, number of times bath/day, bathing place, duration, bathing materials. The parameter and sub-parameter could have various properties, for example, the source of water could be running water like river, stream or stream-lets, or lake, pond, tank, tap or hose pipe. The distance of the source of water could be within the enclosure or from a few meters to a km.

**The Rating Method**

A workshop to identifying and define parameters characterizing the welfare of captive elephants and their keepers was organized by a group of animal conservation and welfare organization under the auspices of Project Elephant, Ministry of Environment and Forests, Government of India. In this workshop, 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 mahout awarded ratings on a scale of 0 to 10 to different parameters and sub parameters in relation to their importance to the welfare of captive elephants and their keepers (Varma, 2008; Varma, et al., 2008; Varma and Prasad, 2008). A Summary of the purpose of their ratings exercise and the underlying logic is provided below.

- The experts rated a total of 114 welfare parameters (e.g. shelter) and sub parameters (shelter type, size, shelter hygiene etc) covering all major aspects of the management of captive elephants.
- Based on their knowledge and experience, the experts gave rating values to each of the parameters. Each expert rated each parameter on a scale of zero (unsuitable welfare conditions) to ten (suitable welfare conditions).
- Each expert rating of a given parameter indicated the significance of that parameter in comparison to the other welfare parameters. For example, for the parameter 'floor', each expert gave a rating that was within the scale of 0 to 10. If a value of 0 was given for the parameter "floor", it indicated that the expert considered the parameter 'floor' to have no welfare significance to elephants; on the other hand, if an expert gave the value 10, he or she considered the parameter

'floor' as most important to the welfare of elephants. This exercise showed a significant variation among the values given by each expert, the values for the parameter "floor" ranged from 5 to 10 and from this a mean Expert Rating (E-R) of 8.0 (SE= 0.5, N=29) was arrived at.

- Following a similar approach mean Expert Rating were arrived at for all (114) parameters considered for rating in the workshop.
- Variables that characterize 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 (during the day and night) in the shelter, shelter hygiene, all represent different aspects of the physical space provided to the elephant. Hence they are grouped together to form the parameter "Shelter".
- With this approach, for example, an elephant will be assigned a value of 8 for shelter type, 7 for shelter size, 8 for floor type during day, 8 for shelter during night and 9 for shelter hygiene and The mean Expert Rating is 8 (SE = 0.4, N = 5) for Shelter.
- While collecting data on elephant/s, depending on the actual ground situation, it may get a value 8 for shelter type, 2 for shelter size, 8 for floor type during day and 0 for shelter during night (whose E-R will be 8.0) and 9 for shelter hygiene. Thus, the Mean Rating (M-R) of 5.4 (SE= 2.04, N=5) is obtained by averaging across these sub-parameters.
- The difference between E-R and M-R indicates the extent of deviation from the acceptable standards as recommended by experts. The above example Shelter suggests that 0% deviation for shelter type, 71.4% deviation for shelter size, 0% deviation for floor during day, 100% deviation for shelter during night, 0% deviation for shelter hygiene resulting an overall deviation of 32.5% deviation for the parameter the "Shelter ".

**Ratings for Elephant Lucy, Valley Zoo, Edmonton**

Data on 39 welfare parameters for Elephant Lucy were available and mean rating for each parameter was calculated and the same was compared with the expert ratings (Appendix 1). The results have been presented comparing E-R and M-R to project the extent of deviation present. The difference between E-R and M-R (expressed as a percentage) indicates the extent of deviation from the acceptable standards as suggested by the experts (in all cases N* refers to number of sub-parameters for an observed parameter. N refers to the total number of parameters/sub-parameters observed). Appendix 2 indicates the values used for different parameters and their ratings.

The Computer program Statistica 5.5 (STATISTICA, 2001) was used to carry out to compare the results of Lucy with the forest camps and other zoos. Wilcoxon Matched Pairs Test was used to know the significance of the results across these institutions.

**Result**

**Source of animal**

Captive elephants existing outside their range states could have been sourced from different ownership types: e.g. from forest camps providing near-natural conditions or

private owners providing a range of husbandry facilities, in range states. Welfare implications arise when elephants are shifted to alien conditions in unnatural settings.

- Lucy was reportedly orphaned in the forests of Sri Lanka, indicating her non-captive origin. She was shifted out of the country when she was only 2yrs old.

M-R was 3.0 indicating a deviation of 50% from E-R, the reason for assigning the value of 3 is that, expert assigned a mean Expert Rating of 6.3 for source of animal, if animal is captive born (within the facility) it gets a value 6, and the following the rule of assigning only 50% rating suggested by experts for the source orphaned gets only 3 (see for details Varma et al., 2008) and the rating gradation used for other parameters related Lucy is given in Appendix 2.

**Purpose of keeping**

Maintaining a non-domesticated animal in unnatural living conditions for commercial exploitation has been given low rating.

- Lucy is maintained for display purposes.
- The official website of the Valley Zoo mentions using her to paint, the proceeds from sale of such paintings go to the zoo and partly towards elephant conservation funds (accessed online) [d]

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

**Shelter**

The amount of physical space provided to elephants impinges on other aspects of their captive life, both social and psychological. Studies show, depending on resource availability, the distribution home range size of wild elephants in India and Sri Lanka, ranges from 40 to 600 $km^2$ (Baskaran et al., 1995; Weerakoon et al 2004;Vidya and Sukumar, 2005; Williams, 2009) subject to ambient temperatures and vegetation/ water availability. Any kind of restriction on elephant movement affects the welfare of the same negatively (Varma et al., 2008). In captivity, hard substrates are considered to be a contributory factor to foot related injury/disease/ disorder (Mikota et al., 1994; Benz, 2005).

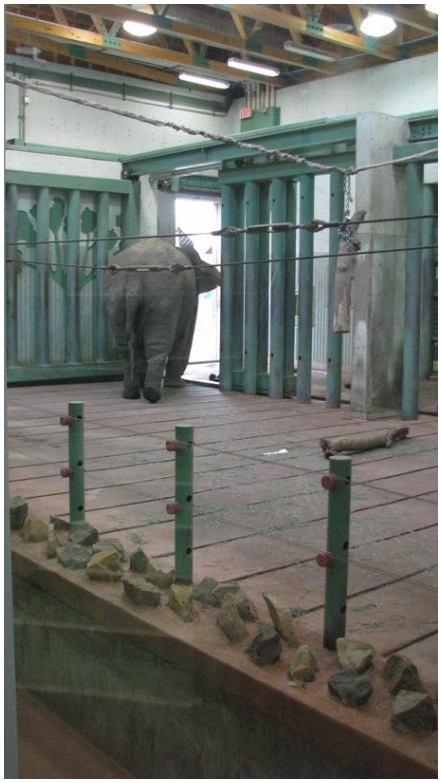


Figure 1a: Indoor shelter of Lucy; note concrete floor

- The elephant, Lucy, is provided two kinds of shelters/enclosure (Figure 1a, b and c): one is an open enclosure (around 0.5 acres in size) with sand/ mud as flooring. The other is a closed indoor enclosure (around 2000 $ft^2$) with concrete flooring.
- According to the zoo, the open yard has piles of sand for Lucy to play with or lay down if she wants to sleep outside; a mud pit is dug in the sand for her to play in

and a shade structure allows for putting up enrichment for play time. However for the period of the study Lucy was not observed using any of these facilities provided within the yard

- The animal reportedly spent 25% of its time in the open shelter and 75% in the closed shelter, regardless of when the barn door was open

Figure 1b and c: Outdoor shelter of Lucy; only a part of it used by Lucy

- Although more data has to be collected, it was observed that the effective area used by elephant in open area is about 20 to 25% and very often Lucy stays inside. When she is not being directed by her keepers she stands stationary and does not walk around the enclosure
- The enclosure is cleaned regularly

Overall M-R for shelter was 5.3 (SE= 2.1, N= 5) implying a deviation of 33.4% from E-R. Figure 2 and 3 give comparative rating and percent deviation from E-R respectively.

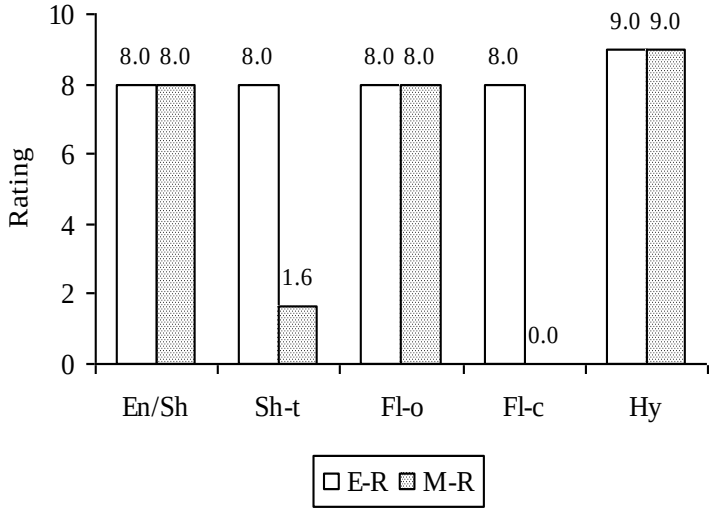
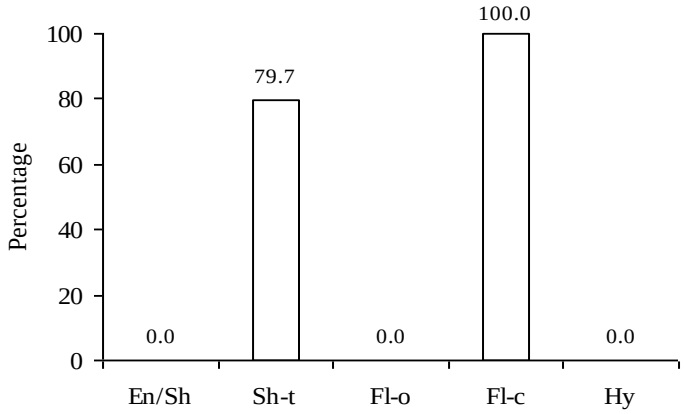



Figure 2: Comparison of E-R and M-R for shelter sub-parameters




En/Sh: Enclosure/ shelter availability Sh-t: Shelter type Fl-o: Floor type (open shelter) Fl-c: Floor type (closed shelter)
Hy: Hygiene maintenance

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

**Water**

Wild elephants have been observed to include a water source in their home range (McKay, 1973); drinking/bathing at least once a day (Shoshani and Eisenberg, 1982). Use of perennial running water sources reduces chances of contamination as compared to stagnant sources; perennial sources such as rivers/streams also provide suitable substrate for the elephants to engage in wallowing/ mud-bathing.

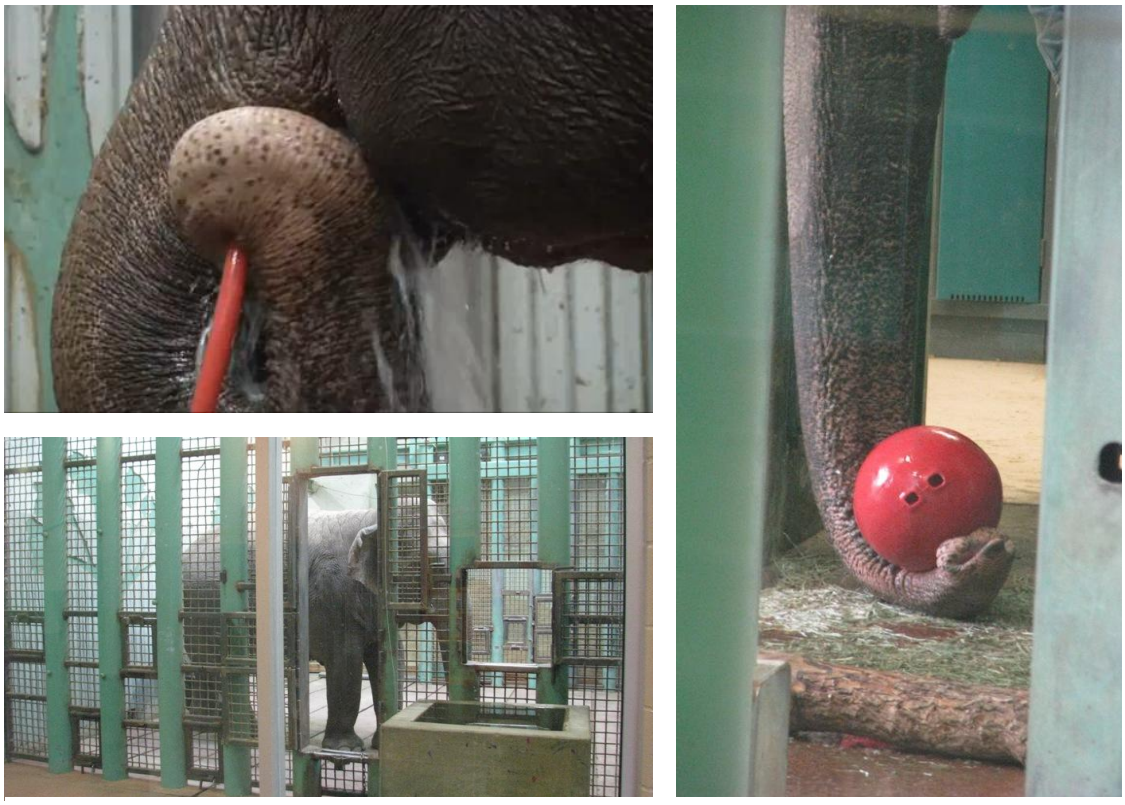


Figure 4a; b and c: Sources of water; a) water tank within the enclosure, b and c: water provided through hose pipe and a ball

- Lucy does not have access to perennial sources (Figure 4a, b and c) such as rivers/streams.
- Water source was tap/ tank in close proximity (Figure 4a)
- Elephant was observed to drink water once/day (Figure 4c)


Figure 5a and b: Bathing place and mode a; water sprayed through hose b; material used to scrub Lucy

- Bathing place appeared to be the barn (closed shelter) wherein water was sprayed through hose (Figure 4b) pipes onto the elephant for a duration of 15-20min.
- Although the zoo website suggests that they bathe and scrub (Figure 5a and b) her once in two days; the occurrence of the same was never observed during the investigation

M-R was 1.6 (SE= 1.2, N= 6) indicating a deviation of 77.1% from E-R. Figure 6 and 7 give comparative rating and percent deviation from E-R respectively.

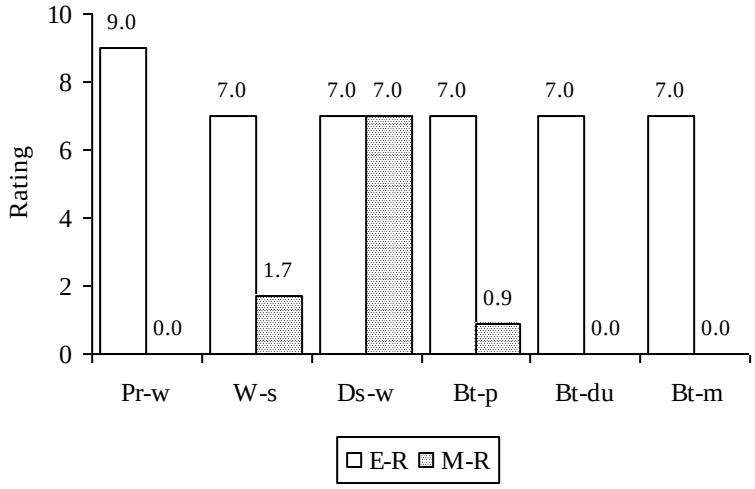
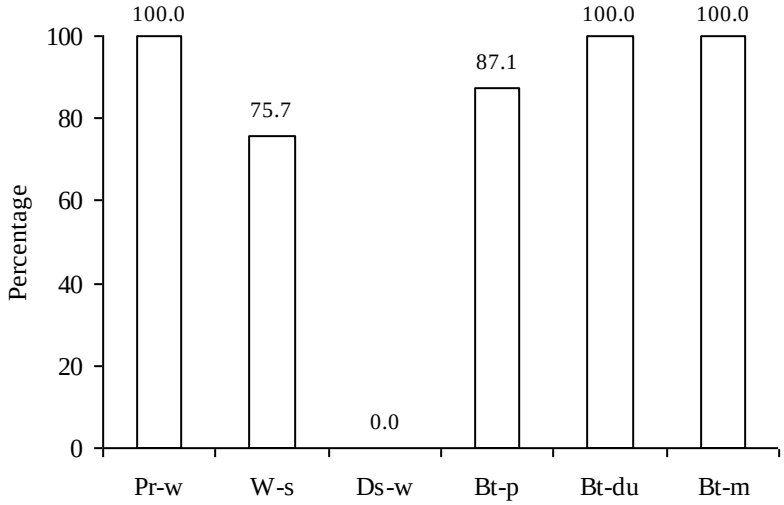



Figure 6: Comparison of E-R and M-R for water sub-parameters




Pr-w: Availability of perennial running water source W-s: Source of water Ds-w: Distance to water
Bt-p: Bathing place Bt-du: Bathing duration Bt-m: Bathing materials

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

**Sleep**

The sleeping location is an important part of a captive elephant's life as confinement within enclosures with unsuitable substrates or exposure to extreme weather conditions may be detrimental to their welfare. Elephants in the wild are known to modify their surroundings and substrates to enable comfortable sleeping positions (Kurt and Garai, 2007). Even when elephants are kept in closed or man-made environments, this influences their choice of their sleep and sleeping positions.

- The elephant's sleeping place (Figure 8a and b) and its enclosure/shelter were similar. It appears Lucy sleeps on the sand pile in the alcove behind the two stalls.
- Zoo's official website suggest that her bed time is usually around 10 pm and in the morning the keepers enter the building quietly (assumed to be 7 am) and wait to see if Lucy is awake or still sleeping.

Figure 8a and b: Sleeping location and position of Lucy

- This pattern suggests that the animal appears to be sleeping for a long period; but in the wild elephants spent about 18 to 20 hrs foraging and have a short duration of sleep (say about 3 to 4 hours). Over sleeping state of Lucy could be a reflection of her ill health

M-R was 2.0 showing a deviation of 75% from E-R.

**Walk and physical exercise**

Elephants are one of the few species that can walk while feeding (Kurt, pers.obs) and elephants in the wild are known to spend about 70 to 80% of their time per day for feeding. In addition elephants spend 5.4% (N = 185h) of their activity in walking alone (McKay, 1973). This does not include the combined activity of feeding and walking. Wild elephants have been known to walk a substantial distance in India and Sri Lanka, to fulfill their seasonally changing resource (Sukumar, 1991; Weerakoon, et al., 2004). The walking incorporated with feeding activity may keep the muscles and joints in healthy condition, prevent obesity and improve blood circulation.

Figure 9 Lucy walking; accompanied by a keeper; note walking surface is concrete

Figure 10: Keepers put considerable efforts to make Lucy walk

- Lucy was allowed to walk during the period 8 am. to 2 pm. accompanied by keepers (Figure 9)
- Nature of terrain was concrete with some grassy areas
- Duration of walk was 1.5 – 2.0h/ day.
- The official website of the zoo (accessed online)[e] mentions walks in the adjacent area with natural vegetation and substrates. Keeper records for 2008 reveal that Lucy was not taken out of her enclosure on 63 days due to weather and her ill health.
- During the entire walk, Lucy is controlled by her keepers (Figure 10) with the

bullhook, leaving her virtually no ability to make choices about her walk.

- The Valley Zoo suggests that because Lucy has lived in Edmonton almost all of her life, she is acclimatized to local weather and walking in winter is not an issue. However, this is contradictory to the statement that it is only in extreme weather that Lucy does not go for walk. Edmonton can experience snowfall during six months of the year; everytime it snows it should be considered cold for an elephant.
- The official website also shows Lucy walking within the snow covered open enclosure (Figure 11a and b), but its evident from the videotaped walking (on snow covered open enclosure) that Lucy was very keen on entering her indoor enclosure as her pace was quicker when she got closer to the entrance.

M-R was 9.0 for opportunity to walk and 2.0 for time of walk. Percent deviation from E-R was 0% and 75%, respectively for each of the sub-parameters.

Figure 11a and b: Lucy walking within the snow covered open enclosure

**Interaction**

Interactions are complex behaviours and an important component of learning. Learning is integral to the survival of a social species like elephants (Kurt and Garai, 2007). DNA based studies have shown the occurrence of related groups of individuals in the wild, for Asian elephants (Vidya and Sukumar, 1995); occurrence of groups of individuals of different ages (adults, juveniles, infants)/sex (McKay, 1973). Elephants' social and family kinship ties are complex and long lasting (Poole and Moss, 2008). Social interaction is a significant factor in maintaining the health and psychological well-being of elephants, especially for females (Kurt and Garai, 2007; Poole and Moss, 2008)

- Lucy has been kept singly (Figure 12 a and b), with no opportunity for social interaction with other elephants.
- Lucy was on her own for 12 years prior to the 1989 arrival of an African elephant and has been left alone since that elephant's transfer in 2007.
- According to the Valley Zoo, the elephants did not form a close bond in the many years the elephants were together.

- The Valley Zoo also suggests that Lucy seeks out human companions (Figure 26 c and d), forming a bond with her human companions.

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

Figure 12 a, b, c and d; a and b: Lucy lives alone; c and d; keepers try their best to become her companion

**Chaining and free ranging**

Captive elephants are usually chained as a means of controlling them and restricting their movement.

- Lucy was not chained
- There was no opportunity to range in natural conditions
- Lucy was allowed to range free, accompanied by keepers, in adjacent natural vegetated areas during summer (official website)

M-R was 2.7 (SE= 3.3, N= 3) implying a deviation of 66.7% from E-R. Figure 13 and 14 give comparative rating and percent deviation from E-R respectively.

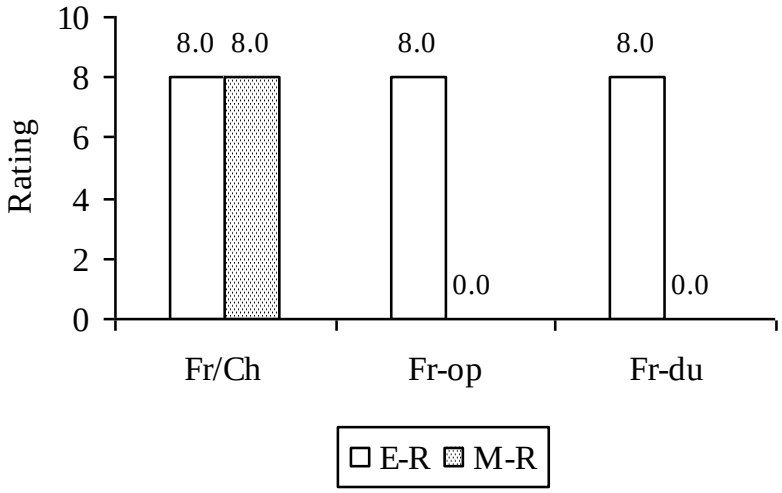
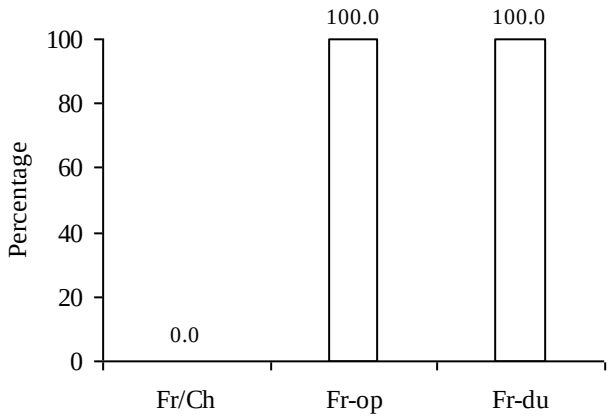



Figure 13: Comparison of E-R and M-R for chaining sub-parameters




Fr/Ch: Free ranging/ chained Fr-op: Free ranging opportunity Fr-du: Duration of free ranging

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

**Observed behaviour**

Ease of handling the elephant in terms of its temperament and incidents of aggression was rated. In addition, occurrence of abnormal behaviours, such as stereotypies, was rated. Studies have shown that elephants express stereotypic behaviour when they suffer from loneliness, boredom, lack of activity, constant harsh handling and trauma (Bradshaw, 2009).

- Lucy was described as quiet and reliable
- There were no publicized incidents of aggression towards people
- Lucy showed stereotypy of two types: rocking and stepping.

M-R was 5.8 (SE= 2.3, N= 4) showing a deviation of 28.1% from E-R. Figure 15 and 16 give comparative rating and percent deviation from E-R respectively.

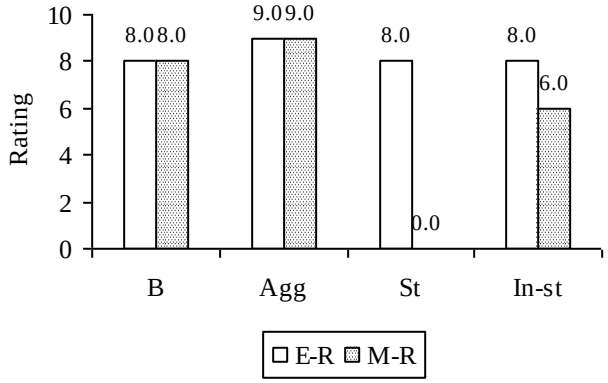
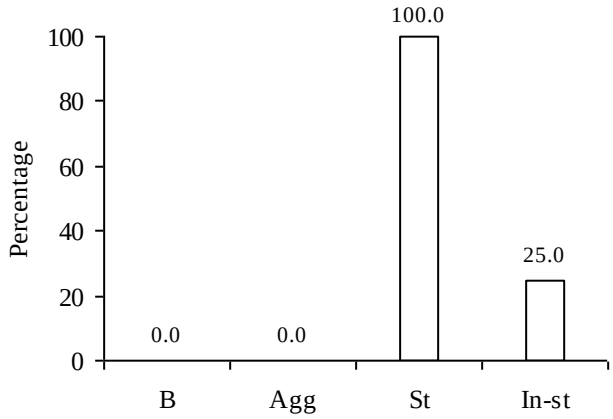



Figure 15: Comparison of E-R and M-R for behaviour sub-parameters




B: Observed behaviour Agg: Incidents of aggression St: Occurrence of stereotypy
In-st: Intensity of stereotypy

Figure 16: Percent deviation from E-R for behaviour sub-parameters

**Food provisioning**

Free-ranging elephants spend 40 to 75% of their time feeding on a wide variety of plants (Sukumar, 2003). Wild elephants are observed to be feeding on more than 75 species of plants (Shoshani and Eisenberg, 1982); the number and variety take care of nutrition, opportunity for exercise (Varma et al., 2008). This free-ranging and the associated benefits are impossible to achieve in captivity with only stall feed as an option. Learning opportunity regarding what-to-eat and how-to-eat, while foraging in groups, is also absent for single, stall fed animals (Kurt and Garai, 2007).

- Lucy was provided only stall feed (Figure 17), no free-ranging opportunity. Lucy appears to graze (Figure 18) when she walks out to the forested areas; however, as exposure to forested region is focused towards her walking, she may not have freedom to browse and it is noticed that the keepers constantly pressure her to complete her routine of walking.
- Feeding area was the barn (closed enclosure)
- Food type was: different types of hay, grasses, herbivore pellets, vegetation, tree browse, vegetables and fruits

Figure 17: Food provisioning: cut fruits/vegetables

M-R was 8.0 for food provisioning type and 1.5 for number of food items given with

Figure 18: Browses while walking predominantly during summer

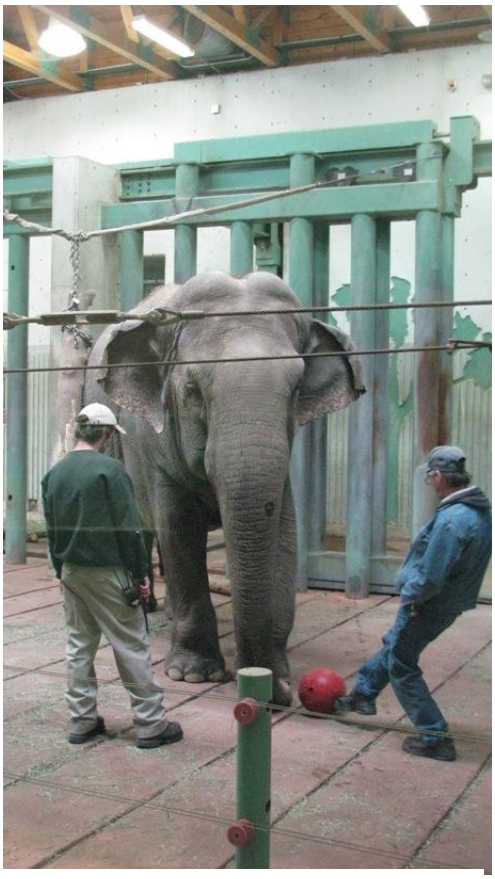


Figure 20: Keepers trying their best to engage Lucy in soccer

percent deviation from E-R being 100% and 83.3% respectively.

**Work and enrichment**

Work could be a form of exercise, but when the nature of work is not natural to an elephant's repertoire of behaviour it can also have harmful effects

- Lucy was not made to work. The zoo does make Lucy paint pictures (Figure 19) and put on a bit of a show for kids a few times a week when school classes come to the zoo.
- The Valley Zoo's official website suggests that Lucy also plays soccer (Figure 20), as well as other games,

including blowing the harmonica or recorder, hide and seek and tug of war.

Although all these activities may form a source of exercise, as they are not to elephant's natural repertoire of behaviour the M-R was only 4.0 with 50% deviation from E-R.

Figure 19: Lucy painting a picture

**Reproductive status**

Normal reproductive functioning in adult elephants is considered to be a sign of good physical health (Kurt and Garai, 2007), opportunity for exposure to individuals of opposite sex, absence of stressors (Clubb and Mason, 2002). Only elephants with optimal physical condition are capable of reproducing while its absence among the same may be related to non-social stress including loneliness and excessive body weight (Clubb and Mason, 2002).

- Lucy, an adult, 34y old female elephant was exposed to males from Calgary Zoo twice in 1986 and 1987, each time for a six month time period
- There were no reports of pregnancy/calf birth for this animal

M-R was 1.6 (SE= 1.8, N= 5) with a deviation of 77% being noticed from E-R. Figures 21 and 22 give comparative rating and percent deviation from E-R respectively.

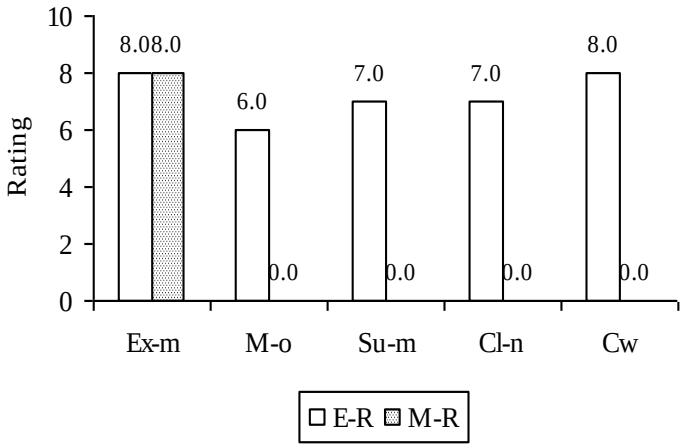
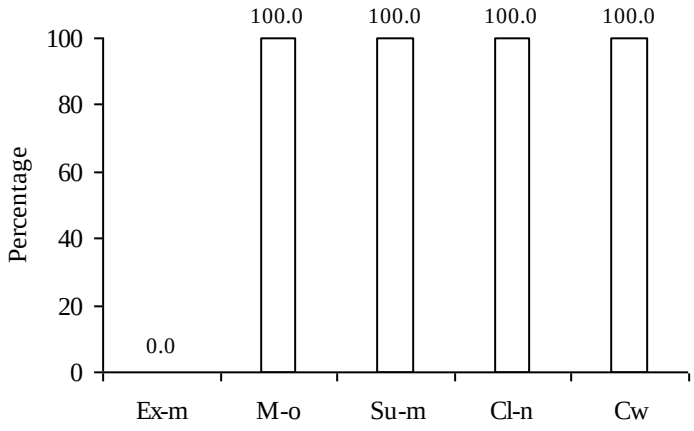



Figure 21: Comparison of E-R and M-R for reproductive status sub-parameters




Ex-m: Exposure to males M-o: Observation of mating Su-m> Successful mating
Cl-n: Number of calves born Cw: Presence of cows during calf-birth

Figure 22: Percent deviation from E-R for reproductive status sub-parameters

**Health status and record maintenance**

Captive conditions impose a number of alien/unnatural features on elephants with consequences for their health. Mikota et al., (1994) describe a number of diseases/ disorders noticed among captive elephants. Maintenance of records plays a very critical role in managing elephants in captivity as they help in identifying the treatment protocol, evaluating the success of the method and this process also has several associated benefits (Varma et al., 2008).

- The elephant, Lucy, was diagnosed at an early age with rheumatoid arthritis. It is known that cold temperature lowers peripheral body temperature and slows down the circulation of blood. The joints, if starved of good flow of blood, go unrepaired and painful to move.
- From the records available from 2002 to 2009, the following were recurring problems: foot abscesses, toe nail cracks, foot pad problems, abscess in hip region, chronic respiratory problems in the form of trunk discharge, breathing through the mouth, blocked nostrils, wheezing
- Treatments (Figure 23) for all the above issues were

Figure 23: Lucy's medical team and treatment

reportedly given.

- Lucy's weight was recorded intermittently over the years, showing tendency towards obesity (Figure 24), contributing to her arthritic condition.

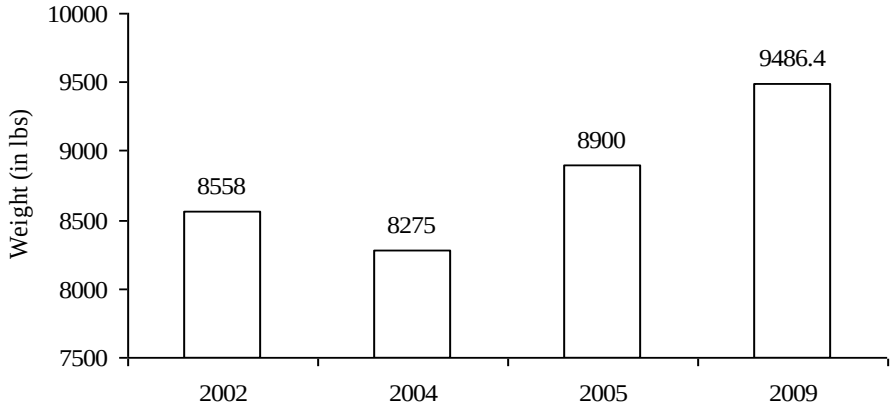



Figure 24: Weight of elephant Lucy

- Records were maintained up to July 2009 and no records were available for subsequent years. It is important to note that the records were more detailed in past years and they are now very sparse, describing medications and little else.

Data regarding Lucy's medical condition available from Feb 1980 to June 2009, showed more than twenty types of problems involving various parts of the body and some of them have been presented in the Table 1. The disease/ injury reported over the years (since 1980) involved almost all parts of the body, from the eyes, face, trunk to the rectum and the tail.

Table-1: Occurrence of disease/ injury/ill-health event

| S.No | Condition | No. of occurrence |
|---|---|---|
| 1 | Abscess (foot, tail, rectum, hip, toe, trunk) | 52 |
| 2 | Wound/ Cuts/ scrapes on leg/ trunk/ skin/ foot, other parts (face, stomach) | 35 |
| 3 | Toe problems: nail cracks, skin development, swollen toe, pus | 32 |
| 4 | Inability to move easily/ stiffness/ soreness (shoulder, leg, knee, elbow, hip, face, foot) | 55 |
| 5 | Swollen parts (knee, toe, foot, glands behind ear) | 24 |
| 6 | Ear infection, conjunctivitis | 7 |
| 7 | Respiratory problems: wheezing, trunk discharge, blocked trunk, open mouth breathing | 52 |
| 8 | Sinusitis, Not vocalizing | 3 |
| 9 | Off food/ sleeping more/ sleeping less | 14 |

| | | |
|---|---|---|
| 10 | Bed sores (face, hip, elbow) | 3 |
| 11 | Loose stool/ Diarrhoea/ mild colic/ salmonella | 8 |
| 12 | Other: colored lesions, lumps, infected parts (kind of infection not specified), temporal gland exudates, loose teeth problem, mouth blisters, urinary tract infection | 24 |

Veterinary experts feel (Eswaran and Kalaivanan, pers. comm.), the conditions listed in the table, the afflictions at serial 1 and 2 (abscess and wounds) may related to given the inappropriate flooring or use of sharp objects or instruments or unhygienic surroundings. Serial number 3 indicates insufficient and inadequate foot care and cold weather may be due to animal's exposure to snow covered open enclosures. Problems such as inability move easily/stiffness are related arthritis and exposed to cold.

The problem of swollen parts (no 5) may also be related to cold weather, ear infection and conjunctivitis may also be due to inappropriate flooring, particularly exposure to hard flooring. Lack of cleanliness, infection from keepers may be the cause of the respiratory problem (7) and loose stool/diarrhoea and related problems (11); issues such as off food/sleeping more or less are related to loneliness or mental or psychological problems.

Respiratory problems also related to improper ventilation or heating protocols within the closed enclosures may be responsible for this problem. Bed sores, loose stool, diarrhea, mid colic and salmonella (10 and 11) may relate to obesity, lack of micronutrients and exposure to cold. In cold conditions in extremities (tip of tails, toes, trunk or ear margin), tissue necrosis s known to be develop, from this sore, abscess may be formed.

According to Sarma (pers.comm.) who has extensive experience related to veterinary care of captive elephants, such high incidences of surface infections, arthritis, respiratory infections in one animal are extremely rare in normal conditions. Most of the problems reported for Lucy may have been results of extreme cold, lack of exercise and over feeding. May be the elephant is housed in a close enclosure during the extreme climates and lack of oxygen is compounding the problems.

In the light of Lucy's recurrent respiratory symptoms, Mikota (pers.comm.) suspects that Lucy may be infected with tuberculosis (TB) and increased surveillance for TB should be initiated for Lucy

The data revealed predominance of three types of problems (Figure 25): Stiffness/ soreness/ inability to move easily followed by occurrence of abscesses and respiratory problems, all of which occurred more than 15% of the time. Excluding respiratory problems and only considering those conditions that occurred more than 10% of the time, it was found 56% of total number of occurrences of medical/health problems involved abscesses, wounds and the mixed category 'inability to move' (includes stiffness and soreness).

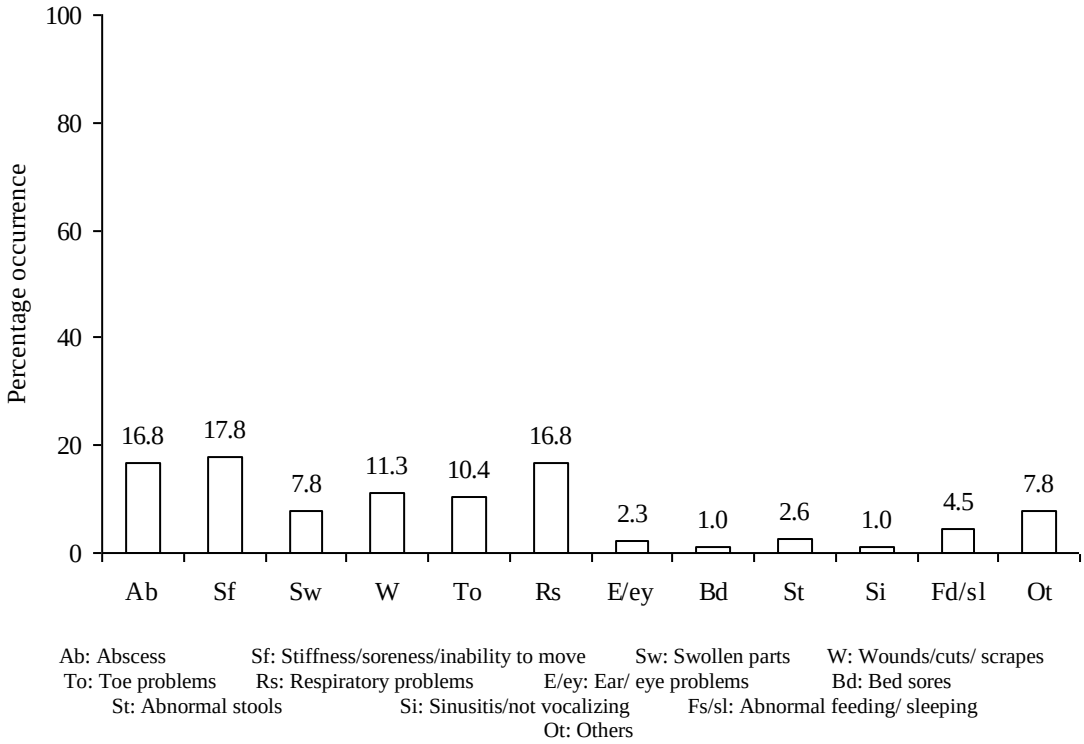



Figure 25: Percentage occurrence of different recorded health conditions

Percentage occurrence of abscess was maximum in the foot region (Figure 26). Among all the diseases/ injuries, irrespective of nature of the problem, maximum occurrence involved the foot region (71), followed by leg (21), hip (19) and knee (7). These incidents were abscesses, stiffness/ soreness/ inability to move, toe problems. Toe problems such as nail cracks, skin development, swollen toe, generation of pus were observed 32 times for the elephant Lucy. Mikota et al., (1994) report incidence of abscess among 68 of the 379 animals studied. Inadequate exercise and consequent poor wear and tear of pad may lead to foot problems; an occurrence of 50% of foot problems was observed in their study (Mikota et al., 1994).

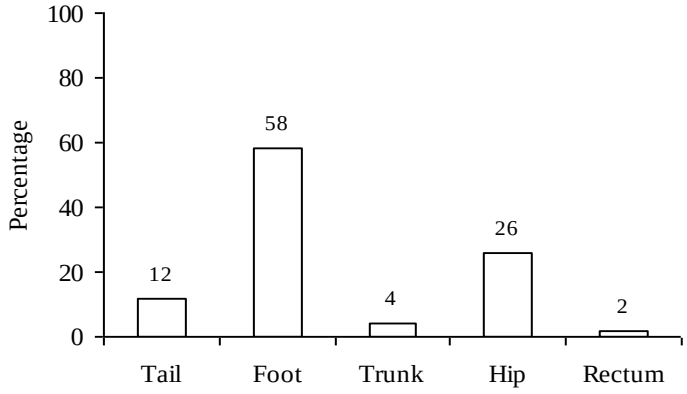



Figure 26: Occurrence of abscess in different regions

Respiratory problems such as trunk discharge/ wheezing/ open mouth breathing, blocked nostril, upper respiratory infection occurred 52 times in the period for which data is available. Mikota et al., (1994) report respiratory disorders were not common in their study population (nearly 400 zoo elephants). In tune with the elephant's arthritic condition, fifty-five recorded incidents of pain medication for arthritis/ stiffness was observed for the period. Mikota et al., (1994) quote the association between lameness (as a clinical sign for Rheumatoid arthritis) and cold weather/ periods of rest. M-R related to the health status including record maintenance was 1.8 (SE= 1.2, N= 4) with a deviation of 77.4% from E-R. Figure 27 and 28 give comparative rating and percent deviation from E-R respectively.

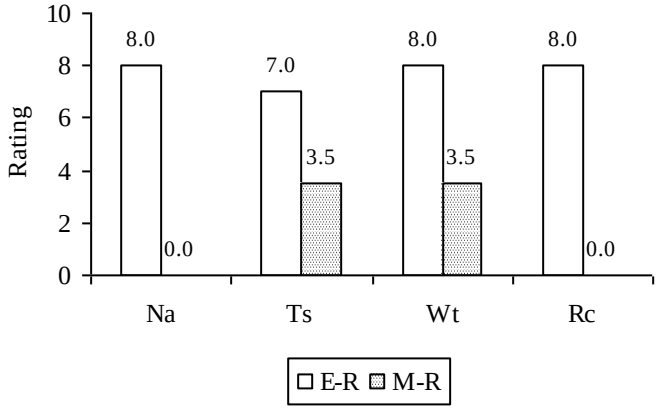
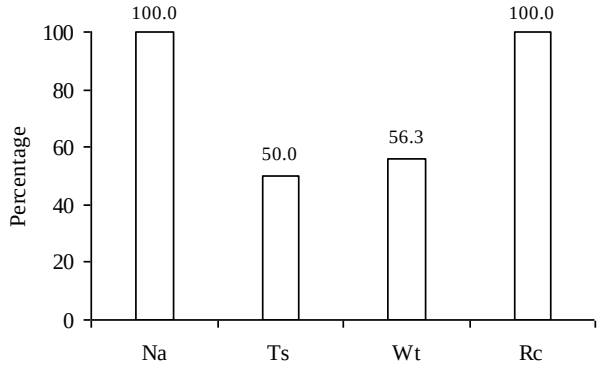



Figure 27: Comparison of E-R and M-R for health status sub-parameters




Na: Nature of disease/ disorder Ts: Tests of dung/ urine/ blood samples Wt: Body weight measurement
Rc: Maintenance of records

Figure 28: Percent deviation from E-R for health sub-parameters

**Veterinary personnel**

Captive elephants are vulnerable to a range of diseases and disorders that are due to their captivity and constrained lifestyle (Kaufman and Martin, 2009); given this, availability of

timely medical care is of utmost importance to them. Elephants' unique physiology, large body size and sensitivity to compatibility of drugs make them to be very exceptional animal. The veterinarian who has substantial experience in treating elephants is more valuable than someone who has not. .

- Lucy's primary veterinarian appears to have limited experience treating elephants. This is evident from the fact the zoo consults with other veterinarians from time to time and on occasion in the past decade another veterinarian was brought in to perform a trunk scope on Lucy.
- The primary veterinarian is an employee of the zoo
- No veterinary assistant was available

M-R was 4.1 (SE= 2.1, N= 5) implying a deviation of 48.8% from E-R. Figure 29 and 30 give comparative rating and percent deviation from E-R respectively.

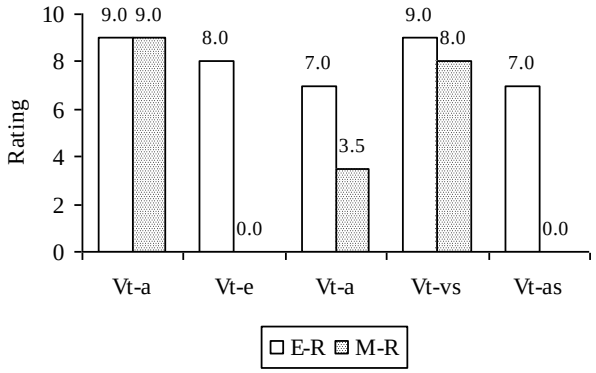
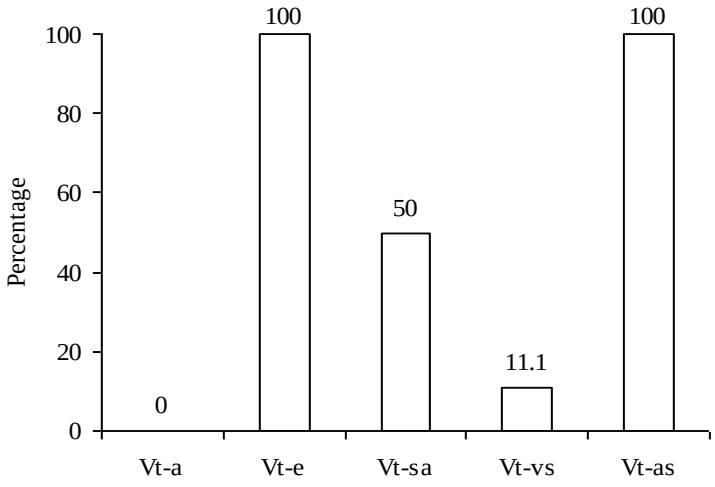



Figure 29: Comparison of E-R and M-R for veterinary personnel sub-parameters




Vt-a: Veterinary doctor availability Vt-e: Veterinarian's experience with elephants
Vt-sa: Veterinarian's experience with specific animals Vt-vs: Frequency of visits
Vt-as: Availability of veterinary assistant

Figure 30: Percent deviation from E-R for veterinary personnel sub-parameters

**Overall welfare status of Lucy**

If welfare of captive elephants are assessed based on rating scale of 0 to 10 with zero representing poor and unacceptable bad welfare conditions and ten representing satisfactory welfare conditions, then Lucy receives an overall M-R (considered across all observed parameters) of 3.1 (SE= 0.6, N= 41) indicating a deviation of 60.9% for her actual welfare status. The patterns of deviation from the Expert Rating (E-R) are given in the Figure 31. This shows the distribution of deviations from zero value to complete divergence (100%) from E-R. Fifty-eight percent of the observed parameters showed deviations of 70% or more from E-R implying that more than half the observed parameters showed deviations of nearly 70% or more from conditions considered acceptable by experts. These deviations were distributed across all the observed parameters, except for the single parameter: source of elephant.

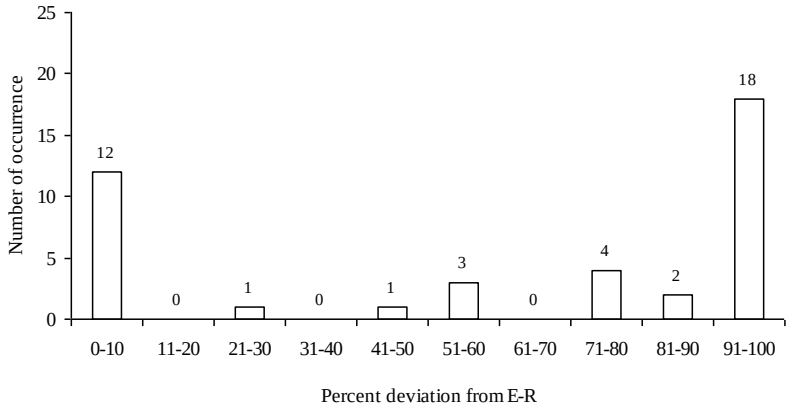



Figure 31: Distribution of percent deviation values

**Comparison of Lucy welfare with elephants from two zoos and a forest camp**
**Profile of Forest camp and the zoos**

**Mudumalai Forest Camp (MFC)**

The Theppakkadu Elephant Camp was established in 1972 in the Mudumalai Wildlife Sanctuary, the Sanctuary is situated at the tri-junction of Tamil Nadu, Kerala and Karnataka on the North Eastern Slopes of the Nilgiris part of Western Ghats. Currently

Figure 32 a and b: Forest cover around the Mudumalai Forest Camp (a) and elephant returning towards to the camp after free ranging (b)

the camp has 23 elephants, seven females (age ranging from 3 to 75 years) and 16 males (age ranging from 11 to 58 years). These elephants are let into forest for ranging, and brought to the camp for the routine stall fed and bathing

**Bannerghatta Biological National Park (BBP)**

BBB or Bannerghatta Zoo is about 22 km from Bangalore in Karnataka, situated at an altitude of 3375 ft., surrounded by the uneven terrain with dry mixed forest, interspersed with valleys, streams and other features. The biological park, houses various species of mammals, reptiles and birds. The BBP has 10 elephants, 9 females (age range from 1 to 48 years) and one adult male of 47 years. The elephants are kept for display at the zoo, however allowed to range free in the nearest forest during night hours.

Figure 33: Forest around the Bannerghatta zoo and the elephants returning to the zoo after free ranging

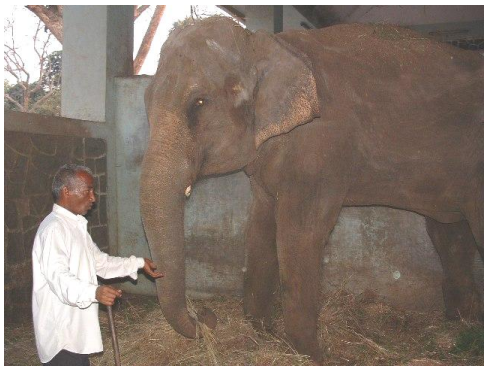


Figure 34: One of the adult females kept in Byculla zoo

**Mumbai zoo**

Known as Byculla Zoo, run by Brihanmumbai Municipal Corporation Location of Zoo Near Byculla Raillway. Station, Byculla East, Mumbai. Approximately over 250 animals & birds are presently kept confined in the zoo. There are 3 elephants in the zoo, the male elephant is around 20 yearr old and female elephants are around 50 years Old. In past 2 elephants were gifted to Japan by this Zoo. All the elephants were tied on front & back leashes during day time.

**Comparison of welfare status**

Figure 35 and 36 give the comparative welfare rating of each of these institutions; ratings averaged across parameters. Figure 32 is the mean rating arrived at using all available data for each location; Figure 33 is the mean rating obtained using parameters available for Edmonton zoo.

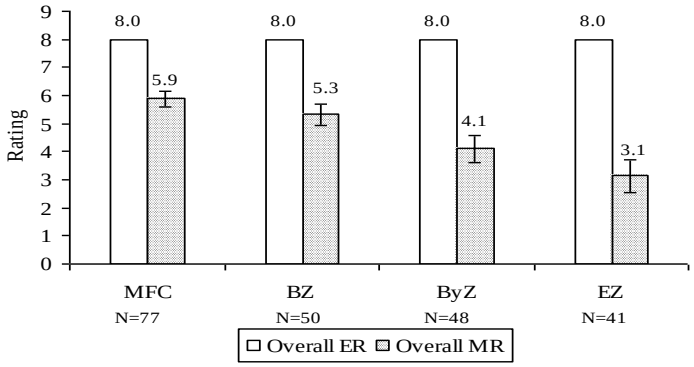
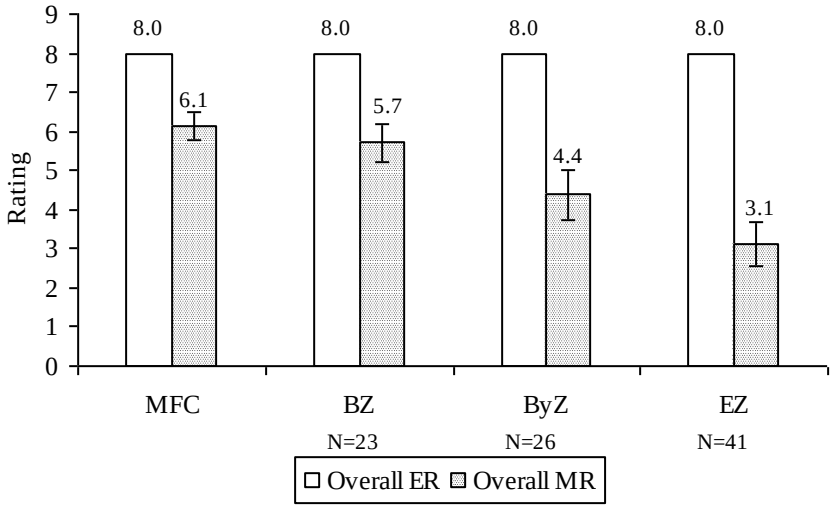



Figure 35: Comparison of rating across institutions




MFC: Mudumalai Forest camp BZ: Bannerghatta zoo (Biological Park)
ByZ: Byculla zoo EZ: Edmonton Zoo

Figure 36: Comparison across institutions using parameters common to Edmonton zoo

The percentage deviation is compared across specific parameters (Table 2), using only those common with those assessed for Edmonton zoo, the occurrence of deviations of 50% or more was maximum for Edmonton Zoo, followed by Byculla. Bannerghatta zoo and Mudumalai Forest Camp (MFC) had only one parameter with deviation greater than 50% ─Water and Behaviour─ respectively.

Table 2: Percent deviation from E-R for observed parameters across institutions

| S.No | Parameters | Mudumalai Forest Camp | Bannerghatta Zoo | Byculla Zoo | Edmonton Zoo |
|---|---|---|---|---|---|
| | | Percentage of deviation | | | |
| 1 | Shelter | 18.5 | 27.1 | 54.2 | 33.4 |
| 2 | Water | 3.1 | 57.8 | 52.2 | 77.1 |
| 3 | Sleep* | 37.5 | 0.0 | NDA*** | 75.0 |
| 4 | Walk** | 22.2 | 0.0 | 0.0 | 38.9 |
| 5 | Interaction* | 4.2 | 13.8 | 0.0 | 100.0 |
| 6 | Chaining | 38.8 | NDA*** | 100.0 | 66.7 |
| 7 | Behaviour | 52.8 | 12.7 | 44.4 | 28.1 |
| 8 | Work* | 33.6 | 20.0 | 0.0 | 0.0 |
| 9 | Food** | 33.6 | 35.1 | 85.0 | 91.7 |
| 10 | Female reproductive status | 16.7 | 0.0 | 65.0 | 77.1 |
| 11 | Health | 6.5 | 38.8 | 30.8 | 77.4 |
| 12 | Veterinary care | 0.0 | 0.0 | 23.0 | 48.8 |

*: data available for one sub-parameter only , **: data available for two sub-parameters, ***: No Data Available (NDA)

Conversely, at least five parameters showed a deviation of only 20% or less for Mudumalai FC and Bannerghatta zoo, whereas this amount of deviation was noticed for three parameters for Byculla zoo and only one for Edmonton zoo.

When mean deviations across these institutions were considered, Wilcoxon Matched Pairs Test shows that the differences were not significant for MFC and the Bannerghatta Zoo ($p<0.05$) and between Byculla Zoo and Edmonton ($p<0.11$) but they were significant between MFC and the Edmonton zoo, ($p > 0.01$) and between Bannergatta Zoo and Edmonton Zoo ($p> 0.01$) suggesting the mean percentage deviation of welfare was high for Edmonton and Byculla zoos.

In comparison to other captive locations, Edmonton Zoo show most deviations in parameters such as source of water, sleep, interaction, food, female reproductive status and health. It can be strongly concluded that, frequently occurring health issues of Lucy are related to the scope available to fulfill these important parameters at Edmonton zoo. As Lucy becomes older (she is only 34 years and potentially has half a life remaining), her chronic health conditions could become a more severe medical and management problem for her.

**Discussion**

The life of captive elephants is in complete contrast to that experienced by their wild counterparts. This is all the more conspicuous when captive animals are maintained outside their natural range states. The size, ecological needs and social organization of these animals makes them a difficult species to cater to in captivity (Veasey, 2006). Poole and Taylor (1999) write about the difference in the living conditions of zoo elephants in the western world and those in the wild. It is this divergence from the state of living conditions experienced in the wild that has been projected as an indicator of welfare of captive elephants using a scale developed by a team of experts.

The overall M-R for Lucy was 3.1 demonstrating a deviation of 60.9% from E-R. This means that when the captive condition is rated as a whole a difference of 60% is observed from the conditions experts consider as acceptable.

Parameters showing >70% deviation from E-R:

a. Purpose of keeping: while zoos may play a role in educating a lay public about the lives of exotic animals, the absence of any natural setting (physical/ social) may be detrimental to a better understanding of the lives of elephants.
b. Shelter type: even though Lucy was allowed access to an open enclosure with suitable sand/ mud substrate, she spent nearly 75% of her time indoors. The space provided within was not adequate (~2000$ft^2$) and the enclosure had unsuitable flooring. This enclosure also served as Lucy's sleeping location.
c. Lucy did not have access to water sources that simulated near natural conditions: flowing water/ large water-bodies with suitable substrate (opportunity for dust-bath or wallow)

d. Considering the complex social organization of elephants (Poole and Moss, 2008) and its role in meeting the biological needs of the animal, Lucy was kept in a state of social isolation. This could be a contributing factor to her failure to mate successfully (it was reported to be aversive to male/new elephants)
e. There was no opportunity for the Lucy to range free in near-natural conditions either as exploratory behaviour or to forage. Exercise was thus limited to a specified duration. In the absence of any work for the elephant, mental stimulation could be lacking as elephants are known to be active for most parts of a day, foraging and moving (Sukumar, 1991). Lucy was observed to exhibit two types of stereotypic behaviour
f. Food provisioning: lack of exercise and stall feed may act as potent combination in increasing Lucy's weight. Added to this, the previous medical history of rheumatoid arthritis and foot related problems may only complicate her health further. In this context, it should be noted that the elephant was said to walk on hard substrates with limited access to grassy areas
g. The medical records were more detailed in the past years and they are now very sparse, indicating only the medications and other aspects associated to it This could be deleterious to the animal's health considering her current health status and regular monitoring processes required

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# Section 4:
# Specific observations and Recommendations

Lucy's overall Mean Rating (MR) is 3.1, with more than half (58%) of observed parameters showing deviation of 70% or more implying predominance of bad conditions for the elephant. Among the parameters, the three parameters that immediate attention are: social isolation, existing cold temperatures and health of the elephant (obesity, arthritis and chronic respiratory problem).

These three major welfare issues are interlinked; the underlying causes of these issues are consequences of each other. It appears as though considerable sincere effort has been expended to take care of Lucy. However, prevailing and uncontrollable constraints, environmental conditions, along with an elephant's ecological needs and Lucy's specific traits do not permit the zoo to achieve a goal of good welfare.

This section of specific observations and recommendations is an attempt to review the pattern of linkage across these welfare issues:

The first thing that should be noted of Lucy is the structure and shape of her body. She is conspicuously obese, unlike wild elephants of the same age. Her neck and body separation are indistinct. If measurement of her neck girth and height is carried out and compared, the value of her neck girth may be more than her shoulder height. The neck girth of obese elephants is greater than their height.

If Lucy's body weight measurements are compared with captive elephants living in semi-natural conditions in southern India, the body weight of 34-36 year old free-ranging captive females are 5512 to 6482 lbs respectively and for Lucy, the differences are of the magnitude of 2763 to 3975 lbs and 1793 to 3000 lbs across the years (2002 to 2009).

When Lucy stands, no ear flapping is observed and tail/trunk movement is absent. She often appears to be trying to support herself by leaning against a wall or object; which may be due to her leg problems, arthritis and/or obesity. Lucy walks slowly, unlike the majestic walk seen in elephants in the wild. Lucy's off-exhibit walk appeared to be controlled by keepers; on an average two keepers were seen with her while she walked. It was obvious that the keepers make efforts to motivate or "force" her to walk, meaning it is not necessarily performed voluntarily.

The outside (open) enclosure has mud floor, sand in a corner, small wallowing place and an exclusive enrichment site, it was noted that these facilities were hardly used by Lucy. Effective area used within the open enclosure would not be more than 20%.

The pattern of being dull, inactive, relatively disinterested in any form of physical activity and using only a small proportion of her open enclosure may be in contrast to what Lucy does during the warmer summer weather. This is evident from the visuals provided by the zoo administration itself which, if taken at face value, seem to indicate that Lucy is more enthusiastic physically and psychologically.

Keeping a tropical animal in cold conditions makes it mandatory to keep the animal in a closed environment. As Lucy has to spend more time in the indoor enclosure during cold months, she is exposed to the concrete floor for long periods of time. This environment

severely restricts the opportunity and ability to exercise, and any attempt to introduce new enrichment or an exercise regime, especially for animals suffering from obesity and arthritis, would not be long lasting and stimulating.

As an indoor game, enrichment or exercise, the keepers play soccer with Lucy. She did not seem interested in playing and it was obvious that Lucy responded primarily to the commands from the keepers. Her obesity and arthritic condition may have prevented her from being more agile. The prevailing cold weather and current health status of Lucy make these efforts, to engage her, fragmented and of limited value.

The visuals posted on the zoo website may give an impression that Lucy is habituated to live in cold conditions, such as snow covered substrates. Even if an elephant enjoys or is habituated to living or walking in snow, it is important to remember that the elephant's feet are in direct contact with the snow whereas the accompanying keepers' feet are covered. Making Lucy walk outdoors involves persistent exposure to very low temperatures. This would have an effect on her existing health conditions such as arthritis, which appears to be a chronic problem.

It is known that cold temperatures lower body temperature and slows down blood circulation. The joints, if starved of good blood flow, may become numb and painful to move. For elephants diagnosed with arthritis, keeping them in cold conditions may slow down their recovery and/or aggravate the problem

Elephants with arthritis may feel better in a warm and dry climate, and their life can be easier in such weather conditions as they do not have to struggle with ice and snow. Unlike cold regions, in a warmer region, elephants can be exposed to a number of outdoor-based exercise regimes, including regular walks that are easier and less aversive to the elephant.

In terms of a social life, Lucy appears to be attached to keepers; it was noticed that she started making rumbling sounds when the keepers moved away from her for a short while. In the evening she is conditioned to be alone, while her daytime life is dominated by the presence of keepers. On average, two keepers are with her in the morning.

There is a very clear keeper-based intensive management regime that Lucy is subject to. She appears to obey only for reward, not out of interest. Lucy keeps opening her mouth when keepers approach her. This could have two effects:
a) Intensive human presence that leads to the animal being exposed only to keepers; the elephant becomes increasingly imprinted.
b) The other is the constant reward-based feeding may worsen her obesity problems

The Valley Zoo keepers try to provide Lucy with at least some social life and they do their best to entertain her and provide an exercise-based lifestyle. But Lucy's responses towards the zoo's efforts are negative and are not rewarding from a health perspective, as some of her health problems are long lasting and chronic.

Even though she has lived alone all these years and did not form a close bond with the other elephant she was exposed to, Lucy should have companion/s of her own kind. Female elephants even when not developing a bond or expressing conflict among themselves, do not live alone. Socialization can be a form of exercise and psychological stimulation.

The zoo has made some effort to consult with veterinarian(s) with elephant experience, in addition to their existing staff. The fact that the zoo is consulting with specialist doctors is an indication that Lucy's health is problematic. While consulting with a specialist shows good intentions on the zoo's part, it is recommended that the zoo puts its best effort toward understanding the underlying cause of the problems Lucy is currently experiencing.

As observed in the visual material from the zoo website, during summer Lucy appears to spend more time in the open area and appears to be more active. With the existing care regime provided and other elephants to interact with, Edmonton might have been a suitable location for Lucy. Unfortunately, Edmonton is characterized by low temperatures for a good portion of each year and the region can experience snowfall for at least six months making it unsuitable for elephants.

The Valley Zoo should now critically review their keeping of Lucy in an environment of continued imposition of a solitary life for a social animal, exposure to cold conditions, an alien living environment for elephants and conditions that are, in all likelihood, the cause of her chronic health problems, including arthritis and obesity.

The challenge for the Valley Zoo is to increase Lucy's welfare rating by providing for her species-specific ecological needs and by addressing the many interlinked issues which are conspicuous, difficult to solve and that are causing her problems. In her present location, these issues cannot realistically be resolved.

As Lucy becomes older, her chronic health conditions could become a more severe medical and management problem for her. All of her current problems, both ecological and medical, can be solved if she is shifted to a location which provides her with the necessary space, stimulus to use the space, the potential to create an unfragmented exercise regime, scope for socialization with other elephants (positively/negatively), and suitable weather conditions.

**Appendix 1: Number of parameter available for assessing welfare status of Elephant Lucy and their mean and expert ratings**

| S.No | Parameter | Mean rating | Expert Rating |
|---|---|---|---|
| 1 | Origin | 3 | 6 |
| 2 | Purpose | 0 | 8 |
| 3 | Enclosure/ shelter | 8 | 8 |
| 4 | Shelter type | 1.625 | 7 |
| 5 | Flooring open shelter | 8 | 8 |
| 6 | Flooring for closed shelter | 0 | 8 |
| 7 | Shelter hygiene | 9 | 9 |
| 8 | Perennial water availability | 0 | 9 |
| 9 | Water source | 1.7 | 9 |
| 10 | Distance | 7 | 7 |
| 11 | Bathing place | 0.9 | 7 |
| 12 | Bath duration | 3.5 | 7 |
| 13 | Materials used | 3.5 | 7 |
| 14 | Sleeping place | 2 | 8 |
| 15 | Walk | 9 | 9 |
| 16 | Time of walk | 2 | 8 |
| 17 | Interaction | 0 | 8 |
| 18 | Chained | 8 | 8 |
| 19 | Free ranging opportunity | 0 | 8 |
| 20 | Free ranging duration | 0 | 8 |
| 21 | Observed behaviour | 8 | 8 |
| 22 | Attacking people | 9 | 9 |
| 23 | Stereotypic behaviour | 0 | 8 |
| 24 | Intensity of stereotypy | 4 | 8 |
| 25 | Work | 4 | 8 |
| 26 | Food provisioning | 0 | 9 |
| 27 | Food items | 1.5 | 9 |
| 28 | Exposure to male | 8 | 8 |
| 29 | Successful mating | 0 | 7 |
| 30 | Calves born | 0 | 7 |
| 31 | Nature of disease/ disorder | 0 | 9 |
| 32 | Blood/dung/ urine tests | 3.5 | 7 |
| 33 | Body wt. Measurements | 3.5 | 8 |
| 34 | Record maintenance | 8 | 8 |
| 35 | Veterinary doc availability | 9 | 9 |
| 36 | Vet. Exp. with elephants | 2 | 9 |
| 37 | Exp. with specific animals | 3.5 | 7 |
| 38 | Vet. visits | 8 | 8 |
| 39 | Vet. Assist | 0 | 7 |

## Appendix 2: Parameter, sub-parameters and their properties and the rating scale used for assessing the welfare status of Lucy, the Elephant

**Origin (Source) of elephant**:

| Property | | Rating |
|---|---|---|
| 1 | Captive born (within facility) – | 6 |
| 2 | Orphaned/rescued | 3 |
| 3 | Purchased/received/transferred/unknown | 1.5 |
| 4 | Captured (from wild) | 0 |

**2. Purpose of keeping**

| Property | | Rating |
|---|---|---|
| A | In semi-natural state, and not working for commercial interest | 8 |
| B | In semi-natural state for patrolling | 4 |
| C | In semi-natural state for kunki | 2 |
| D | As a status symbol in natural conditions | 1 |
| E | For commercial use in natural conditions | 0.5 |
| F | Unnatural and for commercial use | 0 |

**3. Enclosure/shelter**

| Property | | Rating |
|---|---|---|
| A | Free ranging —natural shade | 8 |
| B | Free ranging within a man-made enclosure made with: | |
| i | Thatch/clay tiles with grass | 4 |
| ii | Concrete | 2 |
| iii | With tin/ plastic sheet/ asbestos | 1 |
| C | Shelter as a structurally enclosed space* | 0.5 |
| D | No natural conditions + no man-made structure | 0 |

* Structurally enclosed space: an open space with a boundary wall enclosing the animal/s or the space provided by the chain length with which the animal/s are tied.

**4. Enclosure/shelter size**

| Property | | Rating |
|---|---|---|
| A | Free ranging in semi-natural conditions | 8 |
| B | 5000 sq m (=1.25*4047) | 4 |
| C | 3750 | 3 |
| D | 2500 | 2.25 |
| E | 1250 | 1.7 |
| F | Less | 0 |

**5. Flooring –Day**

| Property | | Rating |
|---|---|---|
| A | Completely earthen floor | 8 |
| B | Concrete/any hard material | 0 |

**6. Flooring –Night**

| Property | | Rating |
|---|---|---|
| A | Completely earthen floor | 8 |
| B | Concrete/any hard material | 0 |

**7. Overall enclosure hygiene**:

| Property | | Rating |
|---|---|---|
| A | Cleaning daily | 9 |
| B | Cleaned once in two days | 4.5 |
| C | Cleaned once in three days | 1.25 |
| D | Cleaned once in 4 days/once a week | 0.625 |
| E | No cleaning | 0 |

**8. Perennial water availability**

| | Property | Rating |
|---|---|---|
| A | Yes | 9 |
| B | No | 0 |

**9. Water source**

| Property | | Rating |
|---|---|---|
| A | Availability of running water (river/ streams) | 9 |
| B | Large lakes/reservoirs/water holes | 4.5 |
| C | Smaller water bodies like tanks, ponds | 2.25 |
| D | Tap water (provided to the elephant through pipes/ water-troughs) | 1.125 |
| E | Buckets, pots, etc. | 0.5625 |
| F | No water | 0 |

**10. Distance to source of water**

| Property | | Rating |
|---|---|---|
| A | 0 –500 m | 7 |
| B | 500 –1000 m | 3.5 |
| C | Above 1 km | 1.75 |
| D | Above 2 km | 0 |

**11. Bathing place**

| | Property | Rating |
|---|---|---|
| A | Rivers/Flowing water | 7 |
| B | Large lakes/reservoirs/water holes/Artificial tank (30 x 30 feet) with drain | 3.5 |
| C | Tap water (Running)/Spray shower | 1.75 |
| D | Smaller water bodies like tanks, ponds | 0.875 |
| E | Buckets, pots, etc. | 0.0.487 |
| F | No water | 0 |

**12. Bath duration**

| | Property | Rating |
|---|---|---|
| A | 2–3 h | 7 |
| B | 1 h | 3.5 |
| C | 30 min | 1.75 |
| D | < 30 min | 0 |

**13. Bathing materials**

| | Property | Rating |
|---|---|---|
| A | Natural materials like Mundakai (Pandanus spp.)/coconut husk | 7 |
| B | Hard material (plastic brush, stone) | 3.5 |
| C | No material | 0 |

**14. Sleeping place**

| | Property | Rating |
|---|---|---|
| A | Sleep (natural conditions) | 8.0 |
| B. | Man-made enclosure | |
| | 1. Man-made enclosure with thatch/clay tiles + grass | 4.0 |
| | 2. Man-made enclosure with concrete roof | 2.0 |
| | 3. Man-made enclosure with tin/asbestos/plastic roof | 1.0 |
| C | Single leg (hind) chained—10-m long chain | 0.5 |
| D | Hind and fore leg chained—10-m long chain | 0.25 |
| E | Two more legs chained with short chain or hobbled | 0.125 |
| F | Tied in a manner where it cannot lie down | 0.0 |

**15. Walk**

| | Property | Rating |
|---|---|---|
| A | Natural/free range | 9.0 |
| B | Limited walk | 4.5 |
| C | No walk | 0.0 |

**16. Time of walk**

| | Property | Rating |
|---|---|---|
| A | Early morning + evening hours + natural terrain | 8 |
| B | Early morning + early evening, but hard surface | 4 |
| C | Late morning + early evening + hard surface | 0 |

**17. Interaction**

| | Property | Rating |
|---|---|---|
| A | Yes | 8 |
| B | No | 0 |

**18. Chained**

| | Property | Rating |
|---|---|---|
| A | Yes | 0 |
| B | No | 8 |

**19. Free-ranging**

| | Property | Rating |
|---|---|---|
| A | Yes | 8 |
| B | No | 0 |

**20. Duration of free-ranging**

| | Property | Rating |
|---|---|---|
| A | 20h | 0 |
| B | 15h | 1.75 |
| C | 10h | 3.5 |
| D | 5h | 5.25 |
| E | 0h | 7 |

**21. Behaviour**

| | Property | Rating |
|---|---|---|
| A | Quiet/docile/calm | 8 |
| B | Predictable | 4 |
| C | Undependable/unpredictable | 2 |
| D | Aggressive | 0 |

**22. Injured/killed a human**

| | Property | Rating |
|---|---|---|
| A | Yes | 0 |
| B | No | 9 |

**23. Stereotypy**

| | Property | Rating |
|---|---|---|
| A | Yes | 0 |
| B | No | 8 |

**24. Intensity of stereotypy**

| | Property | Rating |
|---|---|---|
| A | Low | 8 |
| B | Medium | 4 |
| C | High | 0 |

**25. Work (yes/ no)**

| | Property | Rating |
|---|---|---|
| A | No work + free ranging | 8 |
| B | Patrolling | 4 |
| C | Kunki for human–animal conflict mitigation | 2 |
| D | Safari | 1 |
| E | Timber | 0.5 |
| F | Standing/blessing for pooja (devotional service)/Walking for blessing and begging purposes/ Procession | 0 |

**26. Food** Provisioning

| | Property | Rating |
|---|---|---|
| A | Free ranging + stall fed | 9 |
| B | Only stall fed | 0 |

**27. Type of food (Number of items)**

| | Property | Rating |
|---|---|---|
| A | Forest food with supplement | 9 |
| B | Forest food only | 4.5 |
| C | No forest food, only varieties * | n/2 |

*: refers to number of stall fed items

**28. Has female elephant been exposed to male?** :

| | Property | Rating |
|---|---|---|
| A | Yes | 8 |
| B | No | 0 |

**29. Successful mating**

| | Property | Rating |
|---|---|---|
| A | Yes | 7 |
| B | No | 0 |

**30. Has the female given birth?**

| | Property | Rating |
|---|---|---|
| A | Yes | 7 |
| B | No | 0 |

**31. Disease/injuries/medical problems**:

| | Property | Rating |
|---|---|---|
| A | Yes | 0 |
| B | No | 9 |

**32. Blood/dung/urine tests (frequency of sampling)**

| | Property | Rating |
|---|---|---|
| A | Regularly (on prescription) | 7 |
| B | Irregularly (when occasion arises) | 3.5 |
| C | Never | 0 |

**33. Body weight measurement (frequency of measurement taken)**

| | Property | Rating |
|---|---|---|
| A | Regularly (once a year) | 7 |
| B | Irregularly (once every 2–3 years) | 3.5 |
| C | Never | 0 |

**34. Record maintenance**

| | Property | Rating |
|---|---|---|
| A | Yes | 8 |
| B | No | 0 |

**35. Veterinary doctor availability**

Based on these criteria, welfare aspects can be assessed using the following:

| | Property | Rating |
|---|---|---|
| A | Yes | 9 |
| B | No | 0 |

**36. Veterinarian's years of experience**

| | Property | Rating |
|---|---|---|
| A | >30 years | 9.0 |
| B | 20–30 | 4.5 |
| C | 10–20 | 2.25 |
| D | 1–10 | 1.125 |
| E | <1 | 0.5625 |
| F | No experience | 0.0 |

**37. Veterinarian's experience with specific animals**:

| | Property | Rating |
|---|---|---|
| A | Elephants/Wildlife veterinarians | 7.0 |
| B | Horses | 3.5 |
| C | Cattle + sheep + dogs | 1.75 |
| D | Poultry | 0.0 |

**38. Frequency of veterinary visits**

| | Property | Rating |
|---|---|---|
| A | Daily | 9.0 |
| B | Weekly twice | 4.5 |
| C | On Call | 2.25 |
| D | Irregular | 1.125 |
| E | Never | 0.0 |

**39. Veterinary Assistant availability**

| | Property | Rating |
|---|---|---|
| A | Yes | 7 |
| B | No | 0 |

**About the author**

Surendra Varma is working as a Research Officer at the Asian Elephant Research and Conservation Centre (AERCC, a division of Asian Nature Conservation Foundation), based at the Indian Institute of Science, Bangalore, south India. He is also a member of the IUCN/SSC Asian Elephant Specialist Group. He has extensive experience in carrying out studies and surveys in India, Myanmar and Vietnam on elephant and other large mammal population, habitat and distribution. He is actively involved in carrying out capacity building in elephant census methods, habitat mapping and survey techniques for numerous participants from India and other Southeast Asian countries. He is also involved in developing conservation technology tools as well as a comprehensive study on the captive elephant population, their welfare and management in India.

**Compassion Unlimited Plus Action (CUPA)** is a non-profit public charitable trust that was registered in 1991 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 whatever is required to alleviate their suffering at the hands of humans. CUPA does not differentiate between pet, stray or wild animals, since all require assistance and relief from cruelty, neglect and harm. The organization's objective has been to design services and facilities which are employed fully in the realization of these goals.

**Asian Nature Conservation Foundation (ANCF)** is a non-profit public charitable trust set up to meet the need for an informed decision-making body to address 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 issues relating to conservation of natural resources and biodiversity, endangered flora and fauna, wildlife habitats and environment, including forests and wetlands. It participates in, and disseminates the acquired information, knowledge and inferences at, professional, academic and public forums.

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

Photo credit: Section 2: Figure 14, C.Arivazhagan, Section 3: Figures 4a, 5a, b, 8b, 11a, b, 12c,d, 17,18,19,23 and back cover, a: Edmonton Zoo (From Zoo websites); 34, Ashok Kumar, 35, Nilesh Bhanage, all other photographs; Surendra Varma

Lucy, female, 34y old, is kept alone in captivity in Valley Zoo, Edmonton, Alberta, Canada. This area is distinguished by low temperatures (maximum from 23$^{o}$ to -8$^{o}$C and minimum from 10$^{o}$ to -19$^{o}$C) and experiences snowfall for at least six months of the year for a few days of the month. This investigation aimed to assess the welfare status of Lucy. Welfare status of the 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.