

Welfare Assessment of Lucy the Elephant



**An investigation into the welfare status of Lucy the elephant,
Valley Zoo, Edmonton, Alberta Canada**

Preface
Acknowledgments
Executive summary
Specific observations and Recommendations
Status Lucy's life in relation to her counterparts in the wild
Welfare status of Lucy

Introduction
Objectives
Method
The rating method
Result
 Source of animal
 Purpose of keeping
 Shelter
 Water
 Sleep
 Walk and physical exercise
 Interaction
 Chaining and free ranging
 Observed behaviour
 Food provision
 Work and enrichment
 Health status and record maintenance
 Veterinary personnel
 Overall welfare status of Lucy
Discussion
References

Appendix 1
Appendix 2

Executive summary

Lucy is a 34y old, female Asian elephant kept at the Valley Zoo in Edmonton, Alberta, Canada. This area of Alberta is distinguished by low temperatures with the average maximum ranging from 23° to -8°C and average minimum ranging from 10° to -19°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 moving her from Edmonton and its long winters to a more suitable location in a warmer climate, with more space, suitable substrates and a near-natural living environment.

The Valley Zoo's rebuttal is that Lucy is healthy and her 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 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 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 world renowned elephant experts.

Experts' Rating (E-R) represents the importance attached to a parameter; the Mean Rating (M-R) denotes welfare status of existing conditions for the particular parameter; the difference between E-R and M-R indicate the extent of deviation from the acceptable standards as suggested by experts.

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 2 yrs old; M-R for origin of elephant is 3.0 indicating a deviation of 50% from E-R.

The elephant, Lucy, was provided two kinds of shelters/ enclosure: one was an open enclosure with sand/ mud as flooring. The other was 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 times when the barn door is 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 water sources such as rivers or streams. The water source was a tap/ tank in close proximity. The bathing place was the barn (closed shelter) wherein water was sprayed through hoses 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 is 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 of walk. Percent deviation from E-R is 0% and 75%, respectively for each of the sub-parameters.

Lucy is 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. She appears to browse when she walks out to the woodlot at one end of the zoo, but exposure to this region is ancillary to the focus on her walking; she may not have freedom to browse for more than a short period of time and it is noticed that the keepers constantly pressure her to complete her routine of walking. 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 has little meaningful enrichment and gets minimal exercise. The Valley Zoo does make Lucy paint pictures and put on a bit of 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, and other games, including blowing the harmonica or recorder, hide and seek and tug of war. Although all of these activities may constitute a type of moderate exercise, as 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 kept alone, but 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% being noticed 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. 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 and 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. 58% of the observed parameters showed deviations of 70% or more from E-R implying more than half the observed parameters showed deviations of nearly 70% or more from conditions considered acceptable by experts.

LUCY WELFARE ASSESSMENT, Edmonton Valley Zoo

MEAN RATING: 3.1 (out of a possible 10)

Specific observations and Recommendations

While Lucy's overall Mean Rating (MR) is 3.1 and 58% of the observed parameters showed deviations of 70% or more from the expert rating (E-R), the four primary welfare issues (social isolation, exposure to cold conditions, obesity and arthritis) are going to determine her overall physical and psychological well-being and will have a long term impact on her overall welfare status.

These four major welfare issues are interlinked; the underlying causes of these issues are consequences of each other. It is not clear whether it has been zoo's welfare policy or they have felt pressured to do so, but it appears as though considerable sincere effort has been expended to take care of Lucy. However, the 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 about 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 were 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 2763 to 3975 lbs and 1793 to 3000 lbs over 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.

Lucy uses only 15 to 20% of the total area of the outdoor enclosure. Although 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 and 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 outdoor 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 (indoor) 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 reportedly did not form a close bond with the other elephant she was exposed to, Lucy should have companions 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 veterinarians 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, during the summer Lucy appears to spend more time in the outdoor 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 were moved 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.

Status of Lucy's life in relation to her counterparts in the wild

Elephants are recognized for their long-lasting social association in the wild, females forming established groups which may last across generations (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 also have been reported (Ari, pers. obs). Group sizes of 20 to 30 frequently visiting waterholes have been also observed (Varma, pers.obs). Social interaction



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



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

elephant families; 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 be trained in many things (Kurt and Garai, 2007).

with other elephants is an integral part of the animal's well-being, as elephant society depends on inter-relations and knowledge provided by older and dominant females; and females and their calves form the core unit of



Congregation of groups, more females in number

High elephant density regions in southern India, for example, have temperature range from a minimum of 4.80°C and maximum of 24.30°C. With this temperature range wild elephants are active for nearly 18–20 h a day (75–83%) (Eisenberg, 1981), free ranging. Free-ranging elephants digest foods to a greater extent than captive elephants; their walk is dominated by the forested and natural floor; very rarely they come in contact with concrete/ hard floors. The natural environment also provides adequate shade and cover. Depending on the forest type, food and other resources



Natural habitat with foliage and shade



Elephant in natural shade, source of good thermoregulation



Walking in group, note weight and gait of elephants

available, wild elephants walk about 8–12 km/ day in search of food and water. 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 be bathed 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).



Source of water, group inseparable while drinking



Natural foraging, scope for stretching as exercise

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, moved from her natural home to be exposed to temperatures of average maximum ranging from 23° to -8°C and average minimum ranging from 10° to -19°C, and eventually forced to socialize with human keepers; She has an unnatural closed indoor



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



Lucy's unnatural flooring in contrast to wild conditions

enclosure with concrete flooring; reportedly spends only 25% of her time during the colder months in the outdoor, open mud floor based area. She does not have access to perennial water sources such as rivers or streams. Her water source was from a tap/ tank. Lucy was allowed to walk, not with her own companions, but



Lucy's source of water within enclosure



Lucy's walk regime accompanied by keepers on concrete surface

accompanied by keepers, and the nature of terrain was concrete with some grassy areas. Lucy was provided only stall feed, no free ranging opportunities; 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, playing soccer, blowing on a harmonica, and playing hide and seek and tug of war, which are not part of an elephant's natural repertoire of behaviours. 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. If her welfare is assessed in relation to her wild counterparts, she receives a 3 out of 10.



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



Lactating mother of Lucy' age, in the wild

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. This is replaced by human presence and control in captivity.

Elephants cannot be considered to be domesticated (Lair, 1997; Kurt, 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 stereotypes, 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° to -8°C and average minimum ranging from 10° to -19°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 moved to another zoo, leaving Lucy alone again.

Campaigns by the public, NGOs and others to move Lucy 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 necessary. 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.

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.
- 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

Method

Direct observations of Lucy were made during October 2009. The elephant was observed to understand the different activity patterns she undergoes or is exposed to on a given day. Actual time spent for activities in both outdoor and indoor enclosures were documented. In addition, specific data was extracted from the websites of both the Valley Zoo and animal welfare organizations. In addition, an attempt was also made to interact with public at the zoo.

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 and 2).

The Rating Method

A team of experts, from wildlife biologists to welfare advocates, rated different parameters of importance to the welfare of captive elephants (Varma, 2008; Varma, et al., 2008; Varma and Prasad, 2008). This rating was then used to assess the welfare status of elephants and elephant keepers:

- Experts from different fields rated a total of 114 welfare parameters covering all the major aspects of captivity
- The rating scale was from zero (unsuitable conditions) to ten (suitable conditions). With this logic experts invited to assess the welfare based on welfare parameters and their significance, used maxima based on their concept of importance of a particular parameter to an elephant. For example mean expert rating of 8.0 (SE= 0.5, N=29) for a parameter 'flooring' and 9.0 (SE=0.4, N=31) was arrived for source of water from the ratings suggested by each expert
- A mean rating for each parameter, across all the participating experts, has been used as the Experts' Rating (E-R) which represents the importance attached to a parameter i.e., for a parameter with 8.0 as the maximum value, only 2.0 (20%) deviation and parameter with maximum value 9.0 only 1.0 or 10% from the prescribed norm is considered acceptable.

- For example, if an elephant is exposed only to natural flooring, the animal receives a rating of 8 and for entirely unnatural flooring the value is 0; if animal is exposed to both natural and unnatural flooring, the value become 4 (as $8+0=8/2=4$). If an elephant is exposed to a natural water source, such as a river, it receives a value of 9; if the source of water is large lakes/reservoirs it gets 4.5, a value of 3.5 is assigned for small water bodies like tanks and ponds, tap water (running) gets 2.5 and if only buckets, pots, etc. and tankers the allocated value is 0.5.
- Therefore, using the maxima given by experts as a base, a rating scale, starting from zero to the particular maximum value for that parameter, has been used to rate welfare status. This forms the Mean Rating (M-R) denoting welfare status of existing conditions for the particular parameter.
- The experts rated 114 different parameters. In this investigation, variables which represent a common feature of the captive condition have been grouped to form a parameter. The variables have been termed sub-parameters. For example: the variables shelter type, shelter size, floor type in the shelter, all represent different aspects of the physical space provided to the elephant. Hence they are grouped together to form the parameter “Shelter” and each constituent variable is the sub-parameter. In this investigation, the E-R for a parameter (say, shelter) represents the mean of E-Rs across all related sub-parameters. Similarly for M-R also.
- The results have been presented comparing E-R and M-R to project the extent of deviation present in the sub-parameters observed. 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).

Result

Source of animal

Captive elephants outside their range states can be sourced from different ownership types: from extensive 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.

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. Wild elephants have been reported to have home ranges of approximately 100 – 300 km² (Sukumar, 1989; 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, was provided two kinds of shelters/enclosure (Figure 1a and b): one was an outdoor (open) enclosure (around 0.5 acres in size) with sand/ mud as flooring. The other was a closed indoor enclosure (around 2000 ft²) 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 can facilitate enrichment equipment for play time. However Lucy was not observed using any of these facilities provided within the yard.
- The animal reportedly spent 25% of her time in the outdoor enclosure and 75% in the indoor area, regardless of when the barn door was open.
- 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 was cleaned regularly.



Figure 1b and c: Lucy's outdoor enclosure; only a part of it used by Lucy

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.

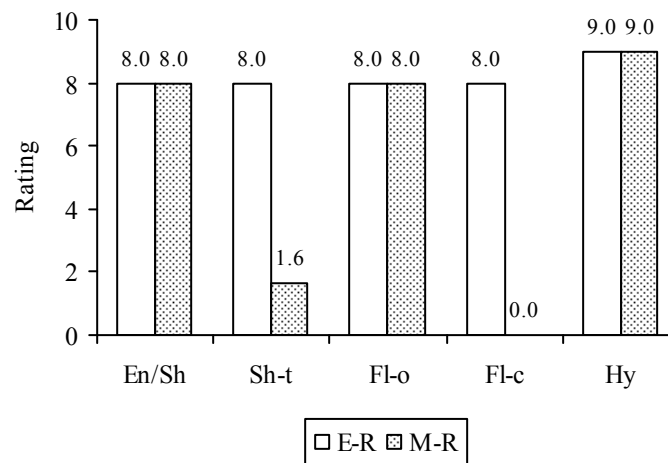
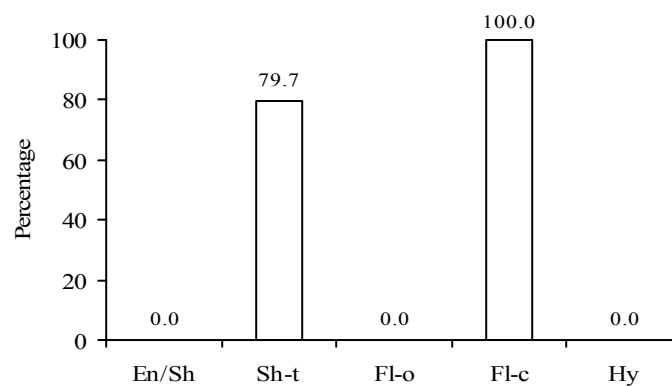


Figure 2: Comparison of E-R and M-R for shelter sub-parameters



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 typically include a water source in their home range (McKay, 1973); drink/bath 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 and streams also provide suitable substrate for the elephants to engage in wallowing or mud-bathing.

- Lucy did not have access to perennial water sources (Figure 4a, b and c) such as rivers or streams.
- Her water source was from tap/ tank in close proximity.



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 was observed drinking water once each day.
- The bathing place appeared to be in the barn (closed shelter) wherein water was sprayed through a hose (Figure 5a) onto the elephant for duration of 15-20min.
- Although the zoo website suggests that they bathe and scrub (Figure 5b) her once every two days; however, no bathing was observed during this investigation



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

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.

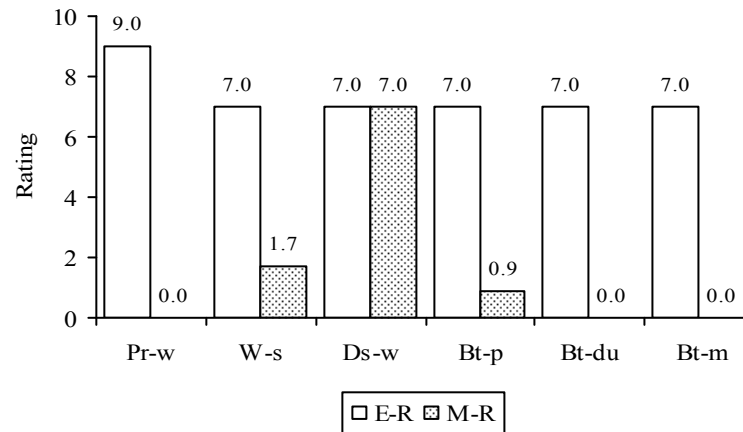
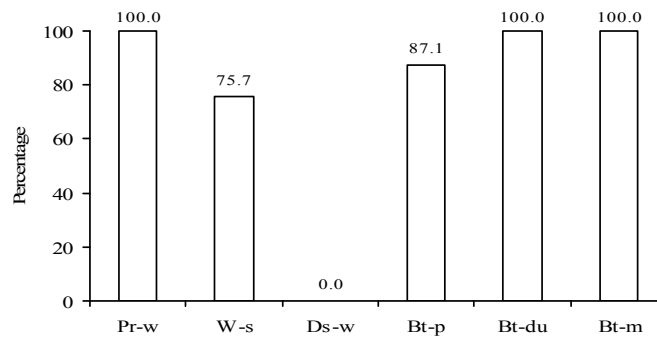


Figure 6: Comparison of E-R and M-R for water sub-parameters



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



Figure 8a and b: Lucy's sleeping area and position

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 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. Elephants have been observed to cover distances of 20-50km in the wild (Sukumar, 1991). 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

- Lucy was allowed to walk during the period 8 am. to 2 pm. accompanied by keepers (Figure 9)
- The nature of the 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 during 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, they appear to contradict their own statement when they say it is only in extreme weather that Lucy does not go for walk. Edmonton can experience snowfall during six months of the year; anytime it can snow should be considered cold for an elephant.



Figure 10: Keepers make considerable efforts to get Lucy to walk

- The official zoo website also shows Lucy walking within the snow covered outdoor enclosure (Figure 11a and b), but its evident from the videotaped walking (in the snow covered 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 in the snow covered 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 they were together.
- The Valley Zoo also suggests that Lucy seeks out human companions (Figure 12 c and d), that she is a "people elephant", she loves hugs, everyone gets a different type of hug and she has developed a special bond with all of her keepers



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

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

Chaining and free ranging

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

- Lucy was not chained
- There was no opportunity to range free in natural conditions

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.

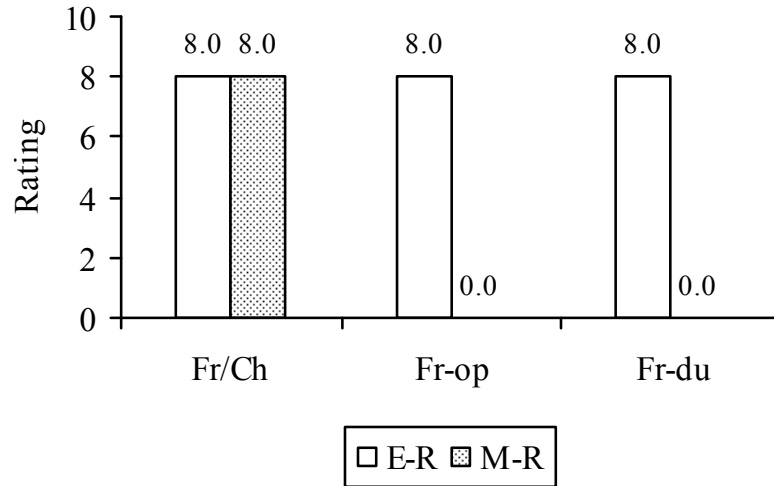
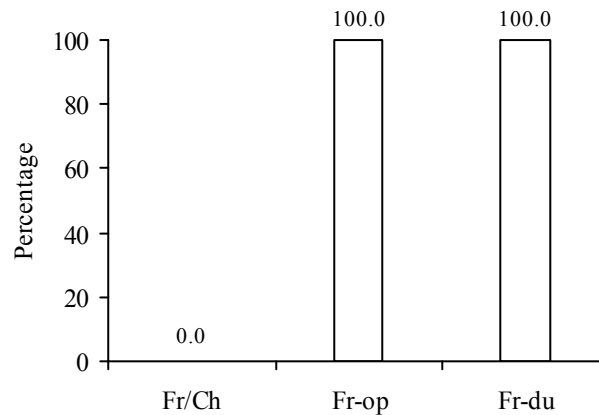


Figure 13: Comparison of E-R and M-R for chaining sub-parameters



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 stereotypes, 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. Lucy is managed for most of the hours when the zoo is open, it is reasonable to presume that her stereotypic behaviour increases when she is left alone.

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.

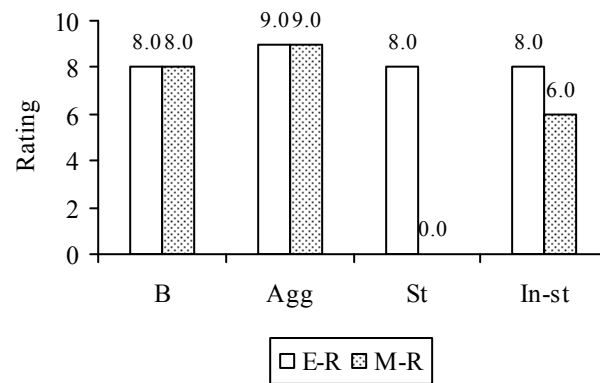
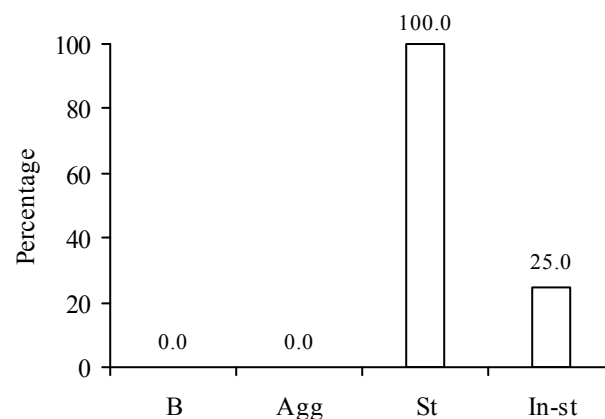


Figure 15: Comparison of E-R and M-R for behaviour sub-parameters



B: Observed behaviour

Agg: Incidents of aggression
In-st: Intensity of stereotypy

St: Occurrence of stereotypy

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

Food provision

Wild, free-ranging elephants are considered generalist feeders (Sukumar, 1991), eating a wide variety of plants. 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).



Figure 17: Food provision: cut fruits/vegetables



Figure 18: Browses while walking predominantly during summer

- Lucy was provided only stall feed (Figure 17), no free-ranging opportunity. Lucy appears to browse (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 was evident 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

M-R was 8.0 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.

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 is not a working elephant. 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.



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



Figure 19: Lucy painting a picture

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.

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. Figure 21 and 22 give comparative rating and percent deviation from E-R respectively.

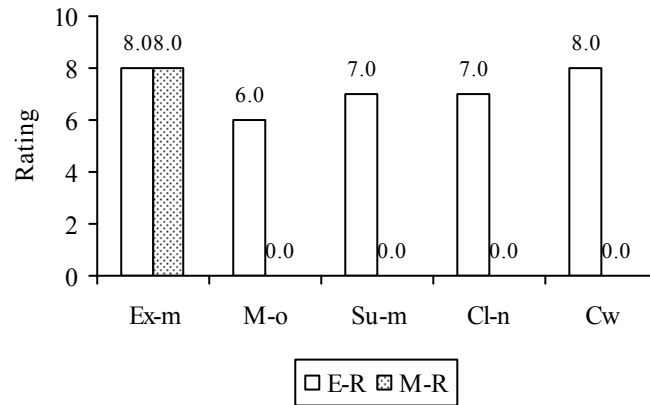
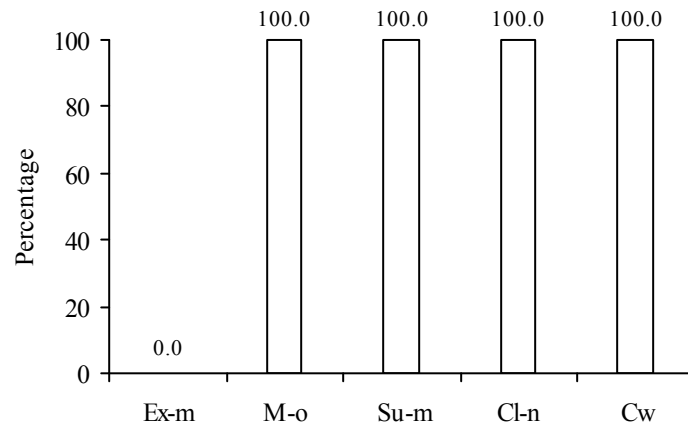


Figure 21: Comparison of E-R and M-R for reproductive status sub-parameters



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 for elephants with consequences on 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 body temperature and slows down the circulation of blood. The joints, if starved of good flow of blood, get numb 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 from the mouth, blocked nostrils, wheezing
- Treatment (Figure 23) for all the above issues were reportedly given.
- Lucy's weight was recorded intermittently over the years, showing tendency towards obesity (Figure 24)



Figure 23: Lucy's medical caregivers providing treatment

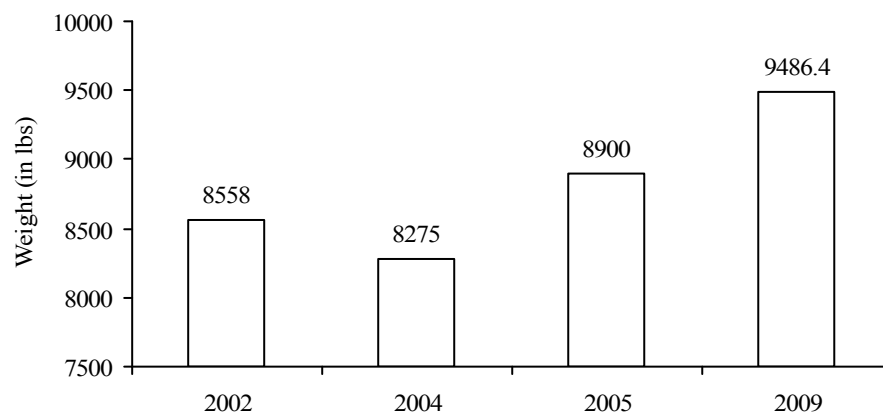


Figure 24: Lucy's weight

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

M-R was 1.8 (SE= 1.2, N*= 4) with a deviation of 77.4% from E-R. Figure 25 and 26 give comparative rating and percent deviation from E-R respectively.

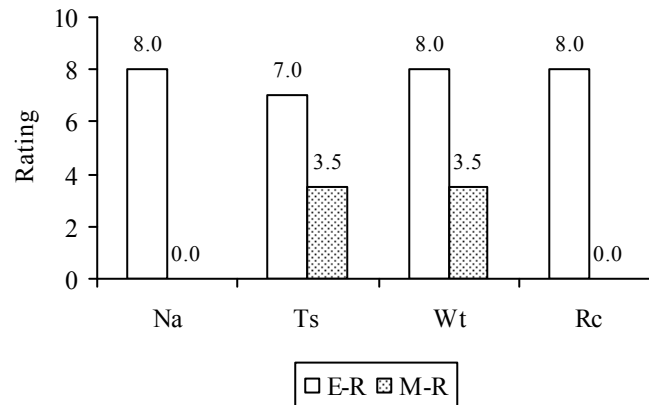
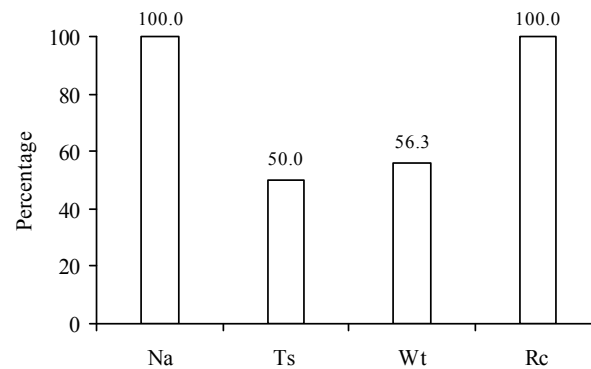


Figure 25: Comparison of E-R and M-R for health status sub-parameters



Na: Nature of disease/ disorder

Ts: Tests of dung/ urine/ blood samples
Rc: Maintenance of records

Wt: Body weight measurement

Figure 26: 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 27 and 28 give comparative rating and percent deviation from E-R respectively.

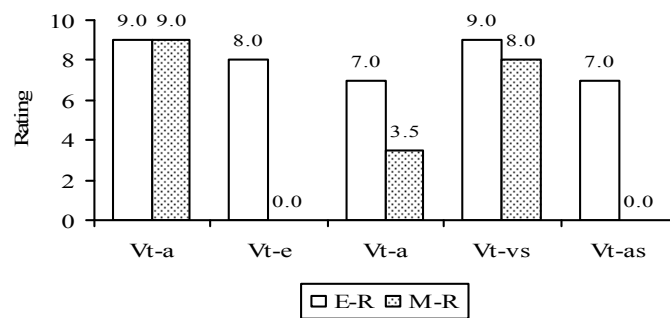
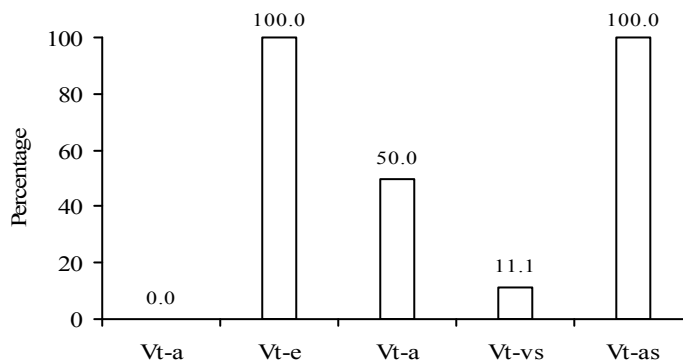


Figure 27: Comparison of E-R and M-R for veterinary personnel sub-parameters



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

Figure 28: 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 bad welfare condition and ten representing satisfactory welfare condition, 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 29. 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 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.

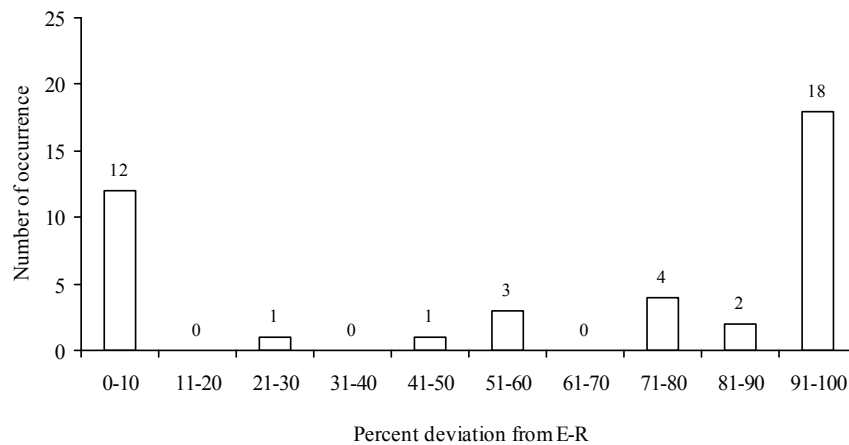


Figure 29: Distribution of percent deviation values

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 living conditions experienced in the wild that has been rated 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 implies, when the captive condition is rated as a whole considering all the parameters as a single entity, a difference of 60% is observed from the conditions experts consider as acceptable.

Features 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 outdoor enclosure with suitable sand/ mud substrate, she spends nearly 75% of her time indoors. The space provided within was not adequate (~2000ft²) and the indoor enclosure had unsuitable flooring. This enclosure also served as Lucy's sleeping location.
- c. Lucy did not have access to water sources that simulate 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 (Moss and Poole, 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 an 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 behaviours.
- f. Food provision: 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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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° to -8°C and minimum from 10° to -19°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.