# A Comparison of Stereotypic Behaviour in Asian Elephants at Three Different Institutions in Sri Lanka

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**Abstract.**  We assessed the level of stereotypic behaviour of captive elephants in three institutions in Sri Lanka. At each institution four animals were studied using focal animal sampling. The results showed that elephants at the National Zoological Gardens had significantly higher stereotypic behaviour than elephants at the other two institutions. The reason for this could be a higher level of stress consequent to the captive conditions at the National Zoological Gardens.

## Introduction

Captive elephants have been kept in Sri Lanka since the time of its first king Vijaya in 483 BC, for reasons such as warfare, exhibition and religious ceremonies (Geiger 1950; Canon & Davis 1995). Currently captive elephants are maintained in different facilities using different management systems. Conditions under which a captive animal is held have a direct influence on the extent of stereotypic behaviour (Schmid 1995; Elzanowsky & Sergiel 2006), which presumably also reflects their stress levels.

Factors increasing behaviours indicative of stress in captive animals include, high noise levels (Morgan & Tromborg 2007), high light intensity (Pollard & Littlejohn 1994), presence of odour of predators (Morgan & Tromborg 2007) confinement (Elzanowsky & Sergiel 2006), poor welfare conditions (Clubb & Mason 2002), barren enclosures (Elzanowsky & Sergiel 2006) and being chained for over 20 hours a day (Kurt & Garai 2001).

Stress levels experienced by captive animals can be assessed using behaviour, physiological parameters and the levels of stress hormones such as cortisol. In this paper we assess whether captive conditions at different institutions may influence the amount of stereotypic behaviour in elephants.

## Methodology

Three institutions holding captive elephants were chosen for the study. At the National Zoological Gardens (NZG) elephants are tethered by one fore foot and one hind foot for more than 18 hours a day and housed in an enclosure with a concrete floor. The animals are taken for a bath once a day to an artificial pond located about 80 m away from the enclosure and again once a day to an arena about 100 m away for the 'elephant show'. At the Pinnawala Elephant Orphanage (PEO) animals are allowed to walk about in the lawn for two hours in the morning and taken for baths twice daily to a nearby river approximately one kilometre away. There the animals are allowed to engage in social behaviour. Tethering is under coconut trees with soil and grass substrate and one hind foot is used to tether the animal. At the Millennium Elephant Foundation (MEF) animals are used for tourist rides within the premises from 8:00 h to 16:00 h daily. The number of rides per day varies depending on visitor arrivals. When tethered, it is done using one hind foot and the substrate is grass and soil under trees.

The study was conducted from May to August 2012. Four adult animals from each institution were used for the study (four females from NZG, four males from PEO, one male and three females from MEF). First, the animals of all three sites were observed for a period of one week and a

behaviour checklist prepared. This checklist was updated as the study progressed, if and when the animals showed a novel behaviour.

Focal animal sampling was used with a voice recorder to record events. Each animal in turn was sampled for 15 minutes at a stretch. Each sampling day, 3-4 h of sampling was done. Each site was sampled for 6 days giving a total of 22-25 h per site. The percentage time for each group per behaviour sub-category was calculated by using the formula:

$$\frac{\text{total time for behaviour sub-category}}{\text{total time of observation of the group}} \times 100$$

Minitab version 15 was used for the statistical analysis. The behaviour data were converted into square root values and a one-way ANOVA conducted. A post-hoc Tukey's test was performed to identify the groups responsible for significant differences.

All behaviours observed during the study were categorized into two main categories, 'non-stereotypic' and 'stereotypic (Table 1).

**Results**

The percentage time spent by study elephants showing each behaviour type in each of the three study sites is shown in Table 2.

**Table 1.** Non-stereotypic and stereotypic behaviours observed.

| Type | Name | Behaviour description |
|---|---|---|
| Feeding | Feeding | Depositing food item in mouth, chewing and swallowing |
| | Foraging | Searching and picking up food item using trunk |
| Comfort | Leaning | Leaning entire or part of body on another elephant or object |
| | Rubbing | Rubbing body or trunk on an object |
| | Trunk Resting | Placing trunk on an object or another elephant's body or holding trunk in mouth |
| | Dust bathing | Collecting dust and spraying over body |
| | Water spraying | Collecting water in trunk and spraying on body |
| | Ear flapping | Flapping of ears |
| | Scratching | Scratching self with either trunk or legs |
| | Fly swatting | Swatting flies with object such as twig |
| | Chain pulling | Pulling on the chain by either trunk or leg |
| | Urinating | Urinating |
| | Defecating | Defecating |
| Intra specific | Touching | Touching another elephant with tip of trunk |
| | Trunk sucking | Placing trunk in another elephant's mouth and vice versa |
| | Pushing | Pushing another elephant using the trunk |
| Standing | Standing still | Showing no movements, simply standing still |
| Walking | Walking | Moving from one point to another using feet |
| Recumbency | Lying down | Lying flat on either side of body |
| | Squatting | Moving into a seated position |
| Stereotypic | Weaving | Moving body from side to side or back and forth |
| | Head bobbing | Moving head in a vertical axis |
| | Trunk swirling | Moving trunk in a circular axis |
| | Number 8 | Head bobbing and weaving shown together |

**Table 2.** Percentage values for each behaviour type for the three study groups.

| Behaviour type | NZG | PEO | MEF |
|---|---|---|---|
| Stereotypic | 11.53 | 0.93 | 4.45 |
| Comfort | 8.17 | 5.24 | 3.89 |
| Feeding | 9.85 | 9.38 | 14.94 |
| Intra specific | 1.24 | 4.19 | < 1 |
| Standing | 60.58 | 57.81 | 41.64 |
| Walking | < 1 | 10.58 | 34.78 |
| Recumbency | 8.63 | 11.86 | < 1 |

A significant difference was shown (one-way ANOVA, F=16.78, P<0.05) for the stereotypic sub category. A post-hoc Tukey's test revelaed that the NZG group showed significantly high stereotypic behaviours compared to the other two groups (P<0.05). Intra specific behaviour was shown to be significantly different between the three groups (one-way ANOVA, F=4.38, P<0.05) and the post-hoc Tukey's test revealed that the PEO group showed significantly high amounts of this behaviour sub category than NZG and MEF groups (P< 0.05). The behaviour type recumbency was again shown to be significantly different (one-way ANOVA, F=145.33, P<0.05) with the MEF group showing the least amount (post-hoc Tukey's, P<0.05). Walking behaviour again was shown to be significantly different between the three groups (one-way ANOVA, F=176.60, P<0.05). The post-hoc Tukey's test revelaed that all three groups were significantly different from each other in this regard (P< 0.05).

Comfort behaviour was shown not to have a significant difference (one-way ANOVA, F=2.53, P>0.05) between any of the groups. This was also the case for feeding behaviour (one-way ANOVA, F=2.00, P>0.05) as well as standing behaviour (one-way ANOVA, F=2.36, P>0.05).

**Discussion**

The significantly high amount of intra specific behaviours displayed by the PEO animals (Figs. 1&2) can be attributed to their management conditions that allow for a diverse array of such behaviours with multiple animals. The significantly low amount of recumbency (Fig. 3)

shown by the MEF group is due to the fact that the animals aren't made to assume a recumbent position during the brief visits to the waterway during the rides. The PEO and NZG animals spend more time in the water and are instructed to assume a recumbent position for the convenience of the mahouts.

The results show that the animals of the NZG are significantly more stressed than the animals of PEO or MEF in terms of streotypic behaviours expressed. The NZG animals being tethered by one fore foot and one hind foot for more than 18 hours of the day would have contributed to the significantly high level of stereotypic behaviours displayed by them. Further the NZG animals show significantly lower walking frequency compared to the other two institutions as they are prevented form this behaviour, which may also have contributed to a high level of stereotypic behaviour. It has been clearly shown in previous studies that there is a high positive correlation between chaining elephants and the level of stereotypic behaviours shown by them compared to animals that are kept in an enclosed area allowing at least a small degree of free movement (Schmid 1995; Gruber *et al*. 2000). Further, elephants have large home ranges (Sukumar 2003; Fernando *et al*. 2008) and a highly mobile lifestyle in the wild. Therefore, the almost complete lack or absence of 'Walking' in the NZG elephants could indeed be a large stress factor, which could lead to the significantly higher amount of stereotypic behaviours.

Another reason could be that the NZG elephants are tethered in a barren enclosure with a concrete



**Figure 1.** PEO elephants showing 'trunk sucking' behaviour at the bath..

floor compared to the other two institutions where elephants spend most of the day on a natural substrate. A positive correlation between barren enclosures and stereotypic behaviours has been shown for elephants by Elzanowski and Sergiel (2006). The natural surroundings where the PEO and MEF elephants are tethered in (Fig. 4), allows for natural behaviours such as pulling on the vegetation with the trunk and digging with the foot, the barren enclosure where the NZG elephants are tethered in does not allow for these. In addition to the stress, the relatively smooth and hard floor on which the NZG elephants spend most of their time could have adverse effects on the condition of their soles. Weissengruber *et al*. (2006a) have reported that the heel pad of the elephant is highly sensitive. Further, Schmidt (2002) has demonstrated that heel pads of elephants wear unevenly through long term standing on smooth surfaces such as concrete, leading to diseases such as 'foot-rot' (Weissengruber *et al*. 2006b). Therefore, the current conditions of the holding area of NZG elephants could be a large contributory factor to stress. Even though the regular veterinary care administered would keep such diseases from manifesting, the continuous stress on the animals due to the discomfort cannot be neglected as a 'stressor'.

The percentage of observed stereotypic behaviour in the NZG (where it is highest) is much less than the 45% observed by Gruber *et al*. (2000) in chained circus elephants. It is also less than the 40-55% observed by Schmid (1995)



**Figure 2.** PEO elephants showing 'intra spcific' behaviour.



**Figure 3.** NZG elephants showing 'lying down' behaviour at the bath.

for shackled elephants. Therefore, the amount of stereotypes shown by the animals of the NZG has not manifested into a serious welfare issue yet.

When reviewing the results of this study there are quite apparent trends and correlations. The animals that had the least opportunity to walk and were chained most of the time showed the greatest amount of stereotypic behaviour. Therefore, these aspects should be incorporated in devising better management practices for elephants especially at the NZG. Making the animals walk within the zoo premises daily before the opening of the zoo and after the closing of the zoo and even during zoo hours with human interactions would be a positive stimulus. Such activity could lessen the stress and boredom due to living a sedentary life. This method would also be cost effective, as it does not require any equipment or other costly measures. Enrichment is another approach for relieving captivity-induced stress. Giving the animals an opportunity to interact with new objects could help their mental stimulation. Also adding a rubbing post for them to scratch their backs could be another method of enriching the holding pens (Clubb & Mason 2002). The flooring of enclosures, even though prone to be neglected, plays an important role in the management of animals. The NZG animals are housed in a concrete/smooth floor whereas both the PEO and MEF elephants are tethered in a more natural environment. Changing of the floor by using rubber matting (Clubb & Mason 2002), could improve the living conditions of the animals at the NZG. With regard to feeding, if a feeding apparatus can be used instead of presenting the
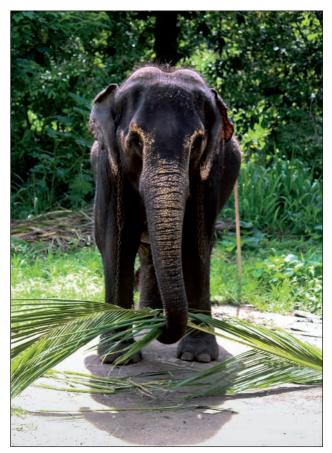
**Figure 4.** MEF elephant feeding tethered on a soil substrate.

entire ration of food to the animal at one go, it could increase the amount of mental stimulation the animal receives. Incorporating these recommendations into management of captive elephants generally and at the NZG specifically can positively influence their wellbeing.

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