

Evaluating the Effectiveness of the Behavioural Enrichment Plan for 2.2 Ring-Tailed Lemurs (*Lemur catta*) at the Toronto Zoo

By

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Introduction

The objective of any behavioural enrichment program is ultimately to improve the psychological and physical well-being of captive species through a variety of methods (Shepardson, 1989). The majority of these methods are aimed at promoting the range and frequency of species-specific behaviours (i.e., foraging, playing, etc.) characteristic of their wild counterparts, eliminating or reducing abnormal and/or stereotypic tendencies (i.e., pacing), and encouraging the positive use of exhibit space (Cipreste et al., 2010). Behavioural enrichment is particularly important for captive species of primates due to their enhanced cognitive abilities and complex behavioural repertoires, and therefore propensity for boredom, stress and expression of abnormal behaviour in environments that lack adequate stimulation (NRC, 1998).



In March, 2011 the Toronto Zoo received five (3.2) juvenile (approximately 1 year old) ring-tailed lemurs (*Lemur catta*) to be housed within a newly renovated and naturalistic exhibit. An enrichment plan was immediately put into place that included providing the lemurs with a minimum of two enrichments daily (e.g. scatter feeding and/or hiding of food throughout the exhibit, smearing fruit onto exhibit surfaces, various food treats suspended from ropes or tree branches, apple browse, hand feeding by keeper, training, and numerous other enrichment devices). However, it is necessary to observe and evaluate the effectiveness of an enrichment plan once in place to determine if enrichment goals are being met successfully and make appropriate alterations to the existing plan if necessary (Coe, 1992). In order to evaluate the effectiveness of the existing enrichment protocol for the ring-tailed lemurs at the Toronto Zoo, the following questions were investigated:

- What is the range and frequency of natural behaviours exhibited by the lemurs?
- Is their activity budget comparable to non-captive populations?
- How much time do the lemurs spend interacting with the different enrichment devices currently being provided?
- How are the lemurs utilizing their exhibit space?

In addition to the above research objectives, this study also sought to determine the degree of visibility of the ring-tailed lemurs to zoo visitors.

Methods

To answer these questions, behavioural observations were conducted between 22 June 2011 and 05 July 2011. Only four (2.2) of the five lemurs were observed during this time, the fifth lemur having been relocated prior to the beginning of this study. During the observation period the author and a team of six trained volunteers collected a total of 90 hours of observational data. Out of these 90 hours of observation, the author personally collected 34 hours of data from 0900-1400 and 1400-1900 hours on alternating days recording the behaviour and exhibit use of the lemurs; while the volunteers collected 56 hours of data from 1000-1600 hours daily documenting behaviour and degree of visibility. In order to reduce inter-observer error, comprehensive instructions were provided to each volunteer, including a detailed ethogram constructed by the author, and meetings were arranged prior to the observation period for all of the volunteers to review the methodology and behaviour of ring-tailed lemurs. In addition, the author frequently visited the volunteers during their observation shifts to briefly supervise their collection of data and answer questions.

Scan sampling was chosen as the method of data collection due to the difficulty in distinguishing among the four lemurs, and the ease at which subsequent data entry and analyses can be performed. With scan sampling, the observer scans a group of animals for a short period (e.g. 30 seconds) and records the number of individuals that are (1) visible, (2) engaging in each behaviour, and (3) present within each exhibit location (Altmann, 1974). This process was repeated at regular intervals, every two minutes for 30 minute blocks alternating with 10 minute breaks throughout the observation shift. By using the scan sampling method, one is able to get a sense of variation among individuals without having to be able to identify and distinguish among each individual lemur.

Eleven behavioural categories were designated as behaviours of interest in this evaluation: *forage*, *locomote*, *groom*, *play*, *interaction with enrichment device*, *scent mark*, *aggression*, *rest*, *sleep*, *abnormal*, and *other*. With the exception of *interaction with enrichment device* and *abnormal*, these behaviours were chosen because they are characteristic of wild populations of ring-tailed lemurs (Savage, 2005; Simmen et al., 2010). *Interaction with enrichment device* was defined as a lemur having any part of its body in contact with the device at the time of the scan (Abt, 2011). In addition to these behavioural categories, seven exhibit locations were defined: *horizontal* (mulch, logs, rocks,

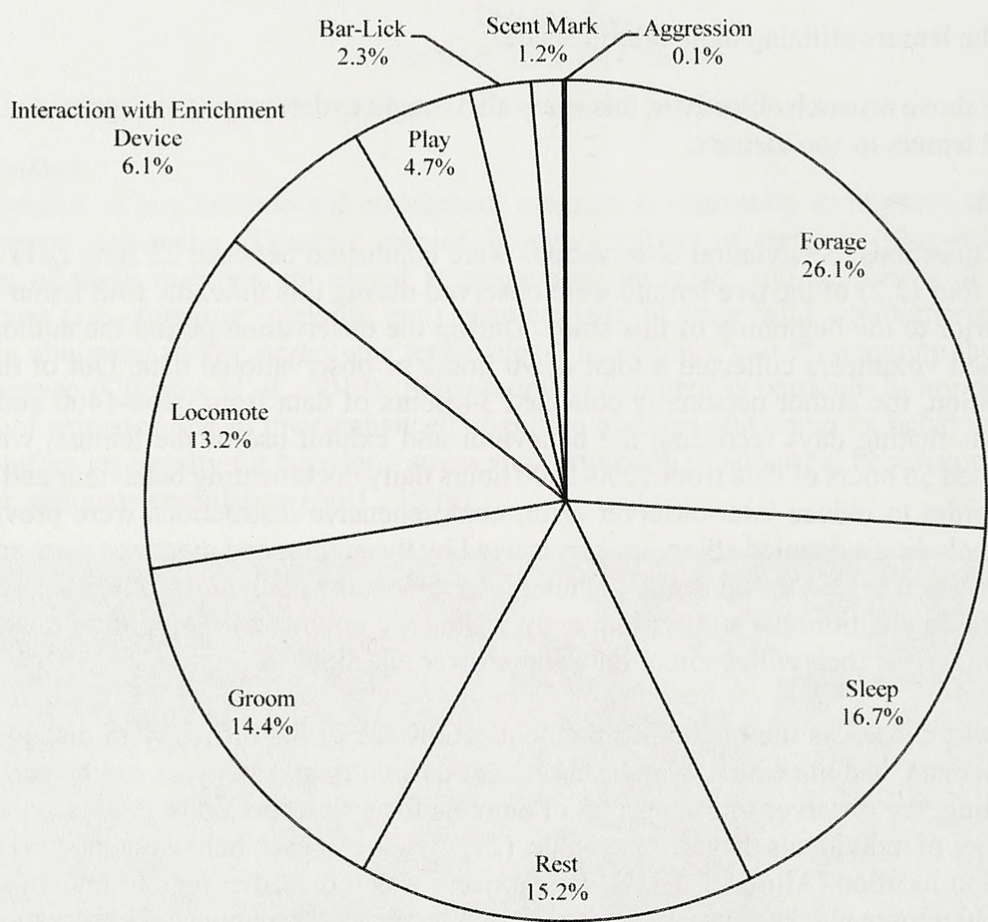
base of centre tree island), *vertical* (trees, pergola), *rope*, *window*, *fence* (perimeter of exhibit), *sand pit*, and *haybox*. Finally, visibility was defined in accordance with the visibility study performed at Disney’s Animal Kingdom (Kuhar et al., 2010), such that a lemur was considered “visible” if at least half of the lemur, including the head was visible at the time of the scan.

These data were then analysed using Microsoft® Office Excel to determine the average number of lemurs visible, the percent chance of observing at least one of the four lemurs, the proportion of lemurs engaging in each behaviour, and the proportion of lemurs located within each exhibit space per scan.

Results

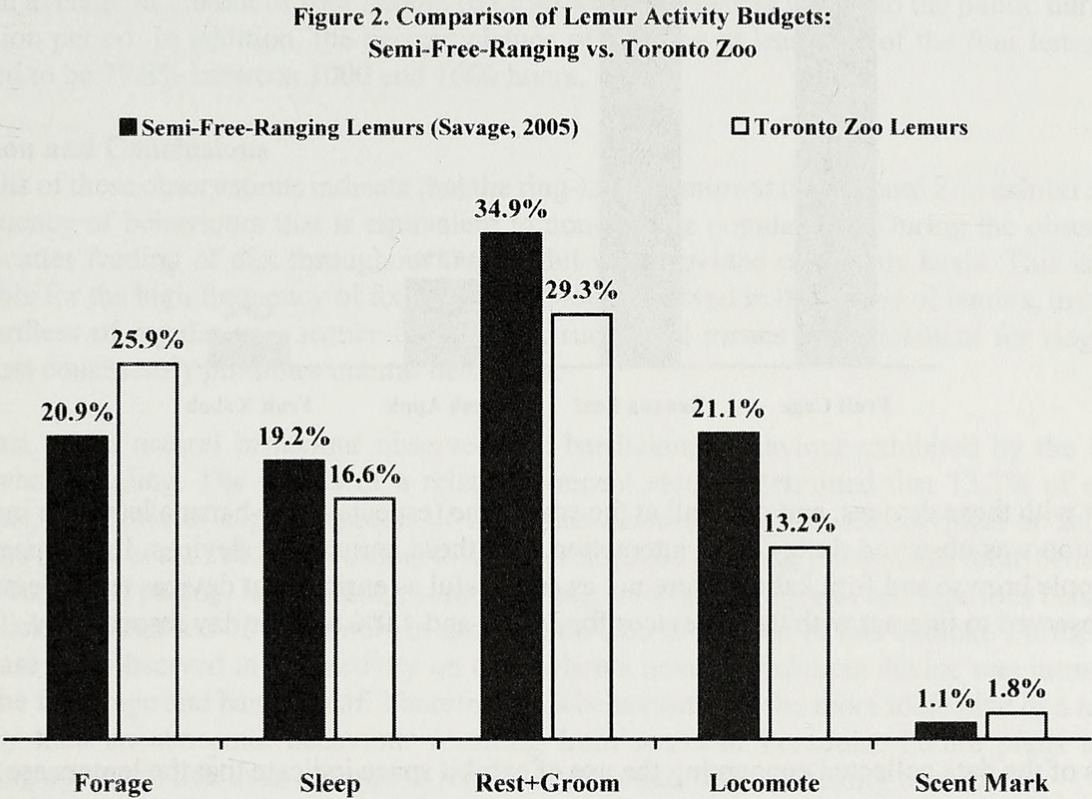
Using these results, an activity budget was constructed to describe the range and frequency of behaviours exhibited by the ring-tailed lemurs. According to the results of these observational analyses, the ring-tailed lemurs at the Toronto Zoo exhibit a natural range of species-specific behaviours. See Figure 1 below.

Figure 1. Daily Activity Budget of the Ring-Tailed Lemurs



Forage was observed to be the most frequent behaviour constituting 25.9% of their average daily activity budget, followed by *sleep* (16.6%), *rest* (15.0%), *groom* (self and other) (14.3%), *locomote* (13.2%), *interaction with enrichment device* (6.1%), *play* (4.7%), *abnormal* (bar-licking) (2.3%), *scent mark* (1.8%), and finally *aggression* (0.1%). As a result, 68.4% of the daily activity budget of the Toronto Zoo’s lemurs is spent engaging in active behaviour, defined as the sum of all behaviours subtracted by the sum of *rest* and *sleep*.

When compared to published reports of the daily activity budget of semi-free ranging lemurs on St. Catherine’s Island off the coast of Georgia, U.S.A. (Savage, 2005), the results of the analyses presented here indicate that the range and frequency of behaviours of the Toronto Zoo’s lemurs is notably similar to non-captive populations. Furthermore, results suggest that the Toronto Zoo’s lemurs spend more of their time foraging. See Figure 2 below.



Unlike non-captive populations of ring-tailed lemurs, the Toronto Zoo’s lemurs were observed to spend 2.3% of their day licking the chain-link fence enclosing their exhibit (referred to here as “bar-licking”). All four were observed engaging in this abnormal behaviour, and they most often engaged in this behaviour as a group.

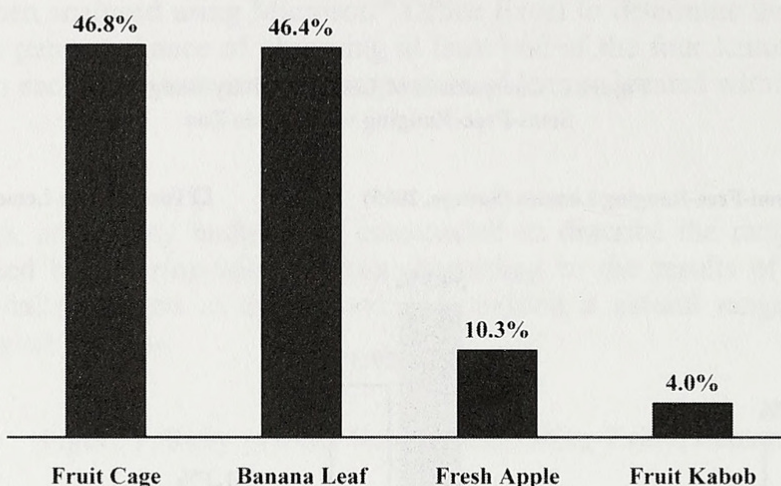
Apart from the frequent training, interaction with keepers, and daily scatter feeding that was observed; the following enrichment devices were also observed on exhibit during the observation period:

- Small cage with fruit locked inside (“fruit cage”)
- Variety of fruit kabobs
- Banana leaf
- Fresh apple browse

With the exception of the browse, all enrichment devices were suspended from the ropes hung throughout the exhibit.

The fruit cage and banana leaf were the most successful enrichment devices observed on their first day of use during the observation period. The lemurs spent 46.8% of their activity budget from 1000-1600 hours interacting with the fruit cage suspended from the rope, and 46.4% of their activity budget interacting with the suspended banana leaf. See Figure 3 below. All four lemurs were observed to

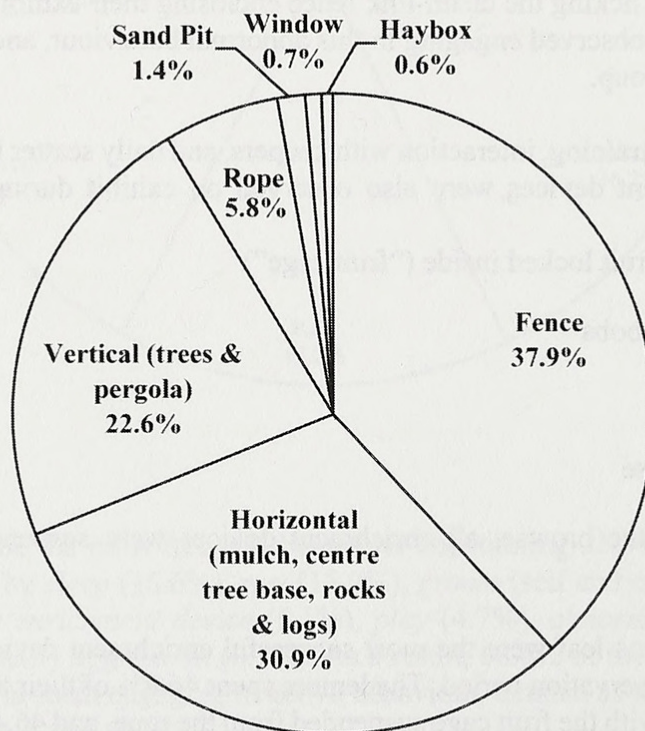
Figure 3. Percent of Ring-Tailed Lemur Daily Activity Budget Allocated to Interacting with Enrichment Device on its First Day of Introduction



interact with these devices, and often all at the same time (especially the banana leaf). No increase in aggression was observed during their interaction with these enrichment devices. In comparison, the fresh apple browse and fruit kabobs were not as successful as enrichment devices as the lemurs were only observed to interact with these devices for 10.3% and 4.0% of their day respectively.

Results of the data collected concerning the use of exhibit space indicate that the lemurs are utilizing

Figure 4. Average Daily Use of Exhibit Space of the Ring-Tailed Lemurs



all of the space available to them (See Figure 4, Page 79). However, they spent the majority of their time (37.9%) on or along the *fence* that encloses their exhibit. The amount of time spent along the *fence* was followed closely by the amount of time spent occupying the *horizontal* (30.9%), and *vertical* space (22.6%), and finally followed by the amount of time spent on the *ropes* (5.8%), in the *sand pit* (1.4%), and along the *window* (0.7%) and *haybox* (0.6%).

Lastly, an average of 2.6 out of four lemurs (65.9%) was recorded as visible to the public during the observation period. In addition, the percent chance of viewing at least one of the four lemurs was calculated to be 77.8% between 1000 and 1600 hours.

Discussion and Conclusions

The results of these observations indicate that the ring-tailed lemurs at the Toronto Zoo exhibit a range and frequency of behaviours that is equivalent to non-captive populations. During the observation period, scatter feeding of diet throughout the exhibit was provided on a daily basis. This is likely responsible for the high frequency of foraging behaviour observed in this group of lemurs, indicating that regardless of regular use, scatter feeding is a successful means of enrichment for ring-tailed lemurs that consistently promotes natural behaviour.

In contrast to the natural behaviour observed, the bar-licking behaviour exhibited by the lemurs is somewhat puzzling. The results of a relatively recent study determined that 13.2% of captive prosimians, and 6.4% of captive species of the genus *Lemur*, engage in stereotypical or abnormal behaviours (Tarou et al., 2005). According to Tarou et al. (2005), among prosimians, these behaviours typically consist of pacing, head tossing, somersaulting, over-grooming and self injurious behaviour. The bar-licking observed of the lemurs at the Toronto Zoo is unusual in this context. Furthermore, no decrease was observed in this activity on days when a novel enrichment device was introduced, such as the fruit cage and banana leaf. Therefore, this behaviour may be more indicative of a mineral deficiency than an abnormal behaviour resulting from stress or boredom. Future plans include introducing a mineral lick in an attempt to reduce or eliminate this bar-licking behaviour.

The lemurs spent a significant amount of their daily activity budget interacting with enrichment devices, particularly the suspended fruit cage and banana leaf. The low level of interaction with the apple browse is likely due to this form of enrichment having been used too frequently prior to the observation period, resulting in a loss of interest by the lemurs. In addition, the lack of time spent interacting with the fruit kabobs is largely a result of the length of time it required the lemurs to consume the suspended fruit (approximately two hours). In contrast to the kabobs, the fruit cage served as a simple barrier to the retrieval of the fruit and therefore increased the duration of time that the lemurs spent interacting with the device to achieve the same end. In addition, observations by keepers prior to this study indicate that the lemurs are not interested in food-related enrichment devices in which the food is not directly visible to them. Therefore, the fruit cage is an optimal enrichment device because it effectively illicit their attention due to the visibility of the fruit through the cage, and increases the duration of time spent interacting with the device before the fruit supply is exhausted.

Based on the standards set by Disney's Animal Kingdom, the ideal goal for animal visibility to zoo visitors is 80% (Kuhar et al., 2010). The slightly lower than ideal visibility of the lemurs is largely due to the amount of time they spent on or along the fence-line, an area where they are not easily viewed by the public. In order to increase the visibility of the lemurs at the Toronto Zoo, future adjustments to the existing enrichment protocol will include: focusing enrichment devices towards the centre of the exhibit or stationed directly in front of a window, introducing more living plants towards the centre of the exhibit to attract the lemurs, and finally the possible introduction of a heat lamp next to a window to increase visibility and encourage natural sunning behaviours.

Evaluating the effectiveness of enrichment procedures should be a mandatory component of any

behavioural enrichment program. Due to time constraints and resource limitations it is not always feasible to conduct extensive evaluations. However, the methods employed here can be easily modified and reduced in scale to be realistically incorporated into any existing enrichment protocol.

Acknowledgements

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