# A multi-sensory enrichment program for ring-tailed lemurs (Lemur catta) at Auckland Zoo, including a novel feeding device

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**A multi-sensory enrichment program for ring-tailed lemurs (*Lemur catta*) at Auckland Zoo, including a novel feeding device**

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## Abstract

*In modern zoos, enrichment programs have become a standard part of animal care routines. Although 'higher' primates usually receive complex enrichment programs, encompassing many types of enrichment, these are less common for prosimians. These animals often largely receive food-based enrichment, as was previously the case at Auckland Zoo, where the ring-tailed lemur enrichment schedule contained only three different items, all food-related. Lemurs tend to be considered less curious and quick to learn than other primates, as well as being less manually dextrous, and for these reasons can be overlooked for complex enrichment. However, they have strong sensory abilities, in particular an acute sense of smell (Sauther et al 1999).*

*This paper describes an enrichment program designed for the lemurs at Auckland Zoo with the aim of stimulating all senses. It includes olfactory, auditory, occupational and feeding enrichment, consisting of 19 different items rotated over a monthly schedule. The lemurs are offered at least one form of enrichment daily, including non-food items at least twice weekly and occasional enrichment-free days. Olfactory enrichment includes browse from other non-primate exhibits, fresh herbs and flavours or spices mixed with water and sprayed in the exhibit. Auditory includes playing music and animal sounds, as well as presenting 'noise maker' devices the animals can manipulate (still in development). Visual enrichment is also in development, in the form of suncatcher devices. The other items encompass feeding and manipulatory behaviour, including water pools, leaf forage pits, stuffed pumpkins and watermelons, Kong toys, smears, pinecones, ice-blocks and dried fruit and nut ropes. The lemurs show the most interest in spice pastes, which they investigate as a group, then roll in and groom off; pinecones with mashed banana and raisins, which require fine manipulation to remove all food from within; and browse scented by other species, which they band together to investigate and which then triggers territorial behaviour such as scent marking.*

*Included in the program was the introduction of a novel feeding device, a T-Bar on which food is presented, which also proved to be extremely popular with the lemurs. A metal T-Bar is hung upside-down from branches in the exhibit and apples are threaded on to it, each apple pitted with holes in which small treats and honey are buried. This device encourages arboreal feeding, object manipulation and also grooming, when the honey sticks to the fur.*

*The new enrichment program has provided opportunities for Auckland Zoo's ring-tailed lemurs to explore a variety of new scents, sounds and objects and encourages natural behaviours such as scent marking, grooming and arboreal feeding.*

**Introduction**

Ring-tailed lemurs belong to the prosimians, known also as Strepsirrhines, a line of primates that also includes bushbabies and lorises, which diverged from their monkey and ape relatives around 50 million years ago. They are found only on the island of Madagascar, where they inhabit a variety of habitats, primarily dry, woodland districts. Unlike most lemurs, which are almost exclusively arboreal, ring-tailed lemurs frequently use terrestrial locomotion - however they are still strong climbers and also move through the trees (Mittermeier *et al* 1994).

They live in large multi-sex groups consisting of 3-25 individuals in which, unlike most primates, the females are the dominant sex. Social bonds between individuals are established through reciprocal grooming. The group is highly territorial and will use scent glands located on their feet, rump, wrists and chest to mark their home range (Sauther *et al* 1999).

In modern zoos, enrichment programs have become a standard part of animal care routines. There are many different forms of enrichment, including structural, social, object, sensory, occupational and feeding (Novak & Petto 1991). Although it is common for 'higher' primates (monkeys and in particular, apes) to receive complex enrichment programs, encompassing many types of enrichment, these are less common for prosimians. These animals often largely receive food-based enrichment, as well as passive social and structural enrichment arising from their grouping and enclosure.

Lemurs tend to be considered less curious and quick to learn than other primates, as well as being less manually dextrous (Sauther *et al* 1999), and for these reasons can be overlooked for complex enrichment. However, they are still an intelligent animal and have strong sensory abilities, in particular an acute sense of smell. Prosimians have a large area of their brain dedicated to olfaction (King 1978) and the wet nose of lemurs, similar to that of dogs, allows for improved olfaction. Olfactory investigation is found to appear quite early in the behavioural repertoire of young lemurs (Palagi *et al* 2002) and they are able to recognise individuals by scent alone (Pelagi & Dapporto 2006). There are varying reports as to the effectiveness of olfactory enrichment to elicit a response in ruffed lemurs (Butterfield 2006, Hutchings & Mitchell 2003). Lemurs also hear well, with mobile ears, and have greater aural sensitivity in the high frequency range than anthropoids (Gilette *et al* 1973, King 1978). They have good stereoscopic vision, including night vision, although limited eye movement. They also have more rudimentary trichromatic colour vision than anthropoids and appear to have lower visual acuity (King 1978, Sauther *et al* 1999).

Auckland Zoo's lemur group is made up of one (vasectomised) male and eight females, ranging in age from two to twelve years old. Although there have been problems with female aggression in the past, the current group appears quite harmonious. The animals reside in an open-air exhibit measuring 32 x 9 metres, connected by raceway to an indoor holding yard. Their exhibit is highly vegetated, planted with trees, shrubs and grasses; also containing added branching and ropes. Itoffers many varied travel routes, both

arboreal and terrestrial. The thick vegetation also provides the opportunity for the animals to escape public eye when they desire.

Previously at Auckland Zoo, the ring-tailed lemur enrichment schedule contained only three different items, all food-related – pinecones, dried fruit/nut ropes and hanging browse baskets. In comparison, the orang-utans' schedule consists of over 20 items rotated over six months, encompassing feeding, sensory and occupational enrichment; as well as daily keeper choice of object, social and structural enrichment.

**Multisensory Enrichment Program**

This paper describes an enrichment program designed for the lemurs at Auckland Zoo with the aim of stimulating all senses, as it was thought that their current enrichment schedule was not providing much variety or sensory stimulation. The program was designed using ideas from the keepers and from those used for other species elsewhere, and includes olfactory, auditory, visual, feeding and occupational enrichment, consisting of 19 different items rotated over a monthly schedule. The lemurs are offered at least one form of enrichment daily, including non-food items at least twice weekly, presented at varying times of day. They also have enrichment-free days throughout the month.

**Olfactory**

Olfactory enrichment includes browse from other non-primate exhibits, fresh herbs and flowers, and flavours or spices mixed with water and sprayed in the exhibit. Branches and nesting material are brought in from other exhibits, containing the scents of other species. Fresh herbs and flowers are picked from the garden and either scattered in the exhibit or placed in hanging baskets. Sacks are filled with hay and dabbed with essential oil, then tied up and hung in the exhibit. Liquid scents and flavours are diluted in water, then sprayed around the exhibit and on the furniture. Spices (such as nutmeg, cloves, allspice, paprika) are mixed with water to form a paste, then smeared throughout the exhibit.

Browse scented by other species causes the group to band together to investigate, as an intrusion into their territory. They then start territorial behaviour, such as scent marking, which increases bonding within the group. This also increases exhibit use, causing the lemurs to use the entire exhibit, rather than just the one end they usually prefer. Due to the potential risk of intra-group aggression arising from this heightened territorial state, this enrichment is only used once a month.Fresh herbs and flowers were one of the first items introduced and are one of the favourite non-food items - the lemurs foraging through, experiencing different scents and textures, and eating parts they like. Sacks with essential oils were trialled a few times but elicited no response and so were eventually removed from the schedule, to be replaced with items that will stimulate behaviours. Spice pastes are very popular (in particular nutmeg); they generate group investigation, rolling and grooming. Liquid flavours have a similar but lesser effect, but can be sprayed up higher to encourage arboreal behaviour and the lemurs will rub the scent onto their fur.

**Auditory**

Auditory enrichment includes playing music and animal sounds, as well as presenting 'noise maker' devices the animals can manipulate (still in development). There are

multiple sets of sounds used, and these are played softly from a speaker system set up behind the exhibit. The 'noise makers' will be sealed tubes containing small rocks or similar, and are intended to be hung throughout the exhibit, allowing the lemurs to manipulate them to generate sound.
In the beginning, lemur calls were played as audio enrichment, but this was stopped as it caused stress in the lemurs and given the history of aggression in the group it was considered that continuing may pose a risk of this recurring. They now get natural habitat sounds like running water or rainforest sounds, as well as soft classical music. Depending on the sounds and other stimuli present on the day, the lemurs may move to the far end of the exhibit away from the sounds (an area they do not commonly use), vocalise or group together and move forwards to investigate the sounds.

**Visual**
Visual enrichment in the form of suncatcher devices is also still in development. Reflective items will be hung in the exhibit, out of public view, where they will reflect the sunlight into the exhibit, creating multiple shifting light spots throughout the enclosure, which the lemurs will have the opportunity to watch and even stalk or chase.

**Feeding/Occupational**
The other items encompass feeding and manipulatory behaviour, including water pools, leaf forage pits, stuffed pumpkins and watermelons, kong toys, sticky logs/balls, pinecones, ice-blocks and dried fruit and nut ropes.

Water pools are small children's paddling pools filled with water and a small amount of floating leaves, grass or woodchip with some food treats, which the lemurs have to fish for. A leaf pit is a small pit dug in the exhibit then filled with leaf litter mixed through with treats such as dried fruit. Stuffed watermelons are whole watermelons with small holes cut into them, which are filled with dried fruit treats and then hung in the exhibit. Stuffed pumpkins are similar, except the pumpkin is hollowed out a little and refilled with an oat and fruit mix that the lemurs can access through holes. Kong toys are smeared with a little jam, honey or mashed banana inside and out, and rolled in coconut; then hung in the exhibit. Sticky logs/balls are exhibit logs or boomer balls smeared with syrup or similar, which has food stuck into it for the lemurs to pick out. Pinecones are smeared with mashed banana and raisins and hung throughout the exhibit. Ice-blocks are made up of multiple layers of different flavours and textures (yoghurt, juice, chopped fruit) and hung in the exhibit. Dried fruit and nut ropes are ropes strung with dried fruit or nuts and hung through the exhibit.

Most of the food items encourage investigation and object manipulation. The hanging ones also require balance and hand-eye coordination, and can be placed in more difficult to access areas of the exhibit to increase exhibit use. Items with syrup or honey increase grooming, as the sticky substances are transferred to the fur and need to be groomed off.
The stuffed pumpkin and watermelon were mostly ignored when first introduced, and had to be altered slightly to encourage use - the size of holes was increased, as the lemurs had trouble extracting food from the smaller holes. The pumpkin will occupy the group over an entire day, with the dominant females guarding it and the subordinates sneaking in

when they can. The watermelon has a scent the lemurs seem to like and they will lick the melon, something they do not do with the pumpkin.

The water and leaf pits encourage investigative and foraging behaviour. The water also provides a new sensation for them to experience, for although they have a moat at the front of their enclosure, they have not had reason to use their hands in the water before.

**T-Bar Feeder**

Included in this enrichment program was the introduction of a novel-feeding device, a T-Bar on which food is presented, which also proved to be extremely popular with the lemurs. A metal T-Bar is hung upside-down from branches in the exhibit and apples are threaded on to it, each apple pitted with holes of varying depths in which small treats and honey are buried.

The T-bar feeder was designed with the idea of encouraging a range of behaviours. As it is a new item, it leads to exploration and investigation. Hanging it on ropes or in trees increases arboreal feeding, in contrast to their usual feeds on the ground, and requires balance. The device can also be placed throughout the exhibit to encourage wider exhibit use and vary the difficulty of obtaining food. Extracting the food requires object manipulation and hand-eye coordination. After the food is consumed, the honey stuck to the fur leads to mutual grooming activity, which may help develop social bonds. It is also a device that can be used by the whole group at one time, as some of the raisins fall to the ground and the less dominant animals can forage down below while the moredominant animals work with the feeder.

The T-bar was deemed appropriate to introduce to the lemurs straight away, as it did not seem likely to cause risk to them. In the beginning, the ribbons tying up the device were kept short, to allow the lemurs a chance to grasp the concept of using it. Now they are aware of the rewards offered, the lengths of the ribbon are varied to increase difficulty and the lemurs will still work for the food when it is more difficult to do so.

On the first introduction, the group was monitored to ensure there were no problems with the device, particularly with group aggression. They were watched both before and after the introduction of the device, with no problems observed. The data collected indicates that the lemurs spent about 20 minutes interacting with the T-bars initially and returned to them continually throughout the watch. After finishing with the treats, they groomed one another sporadically for about 40 minutes. They were also observed to return to the T-Bars throughout the day and interact with them.

The T-bar is constructed from 10mm steel rod. They are cheap to make, only costing around NZ$10 each. They are hardwearing and easy to clean, and take up very little space in storage. The T-Bar device can also be used as a different way of presenting items from the daily diet, encouraging increased arboreal feeding and discouraging rodent activity.

## Conclusion

The new enrichment program has provided opportunities for Auckland Zoo's ring-tailed lemurs to explore a variety of new scents, sounds and objects, which were missing in their previous schedule. Although some devices are more popular than others in terms of the amount of interest shown in them, all are valuable in terms of providing variety and stimulating different behaviours. In particular, natural behaviours such as scent marking, social grooming and arboreal feeding were observed to occur in conjunction with the provision of this enrichment. Future studies comparing the frequency of behaviours occurring both with and without the enrichment may help to further reveal the exact effects of the enrichment program on the lemurs' behaviour.

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