

## EASTERN TARSIER IN CAPTIVITY, PART I: ENCLOSURE AND ENRICHMENT

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### ABSTRACT

Tarsiers have never formed successful breeding colonies in captivity, and the survival of tarsiers is presently dependent on *in situ* conservation. Five tarsiers were used to found a colony at a facility on the outskirts of Jakarta in October 2001. Four of these survive. One animal died after 14 months in captivity. The colony includes one mated pair that has produced 4 offspring, the most recent, born on July 25<sup>th</sup>, 2004, survives. The others died after 32 days, 2 days, and seven months, respectively. These results indicate to us that our cage design is effective for the captive maintenance of adult animals. We are hopeful that we will soon have captive born animals that survive and reproduce. Tarsier populations are threatened by habitat loss, and there will be a persistent threat that this will lead to the extinction of some tarsier taxa, and we will be powerless to stop it until such time that *ex situ* tarsier conservation methods are developed.

**Keywords:** *Tarsius tarsier*, *Tarsius spectrum*, captive environment, enclosure, enrichment, *ex situ*, conservation.

### INTRODUCTION

We use the term Eastern tarsiers for tarsiers from Sulawesi and surrounding islands. Hill (1955) classified these animals as *Tarsius spectrum* and accepted several subspecies. The current trend is to recognize that these animals are probably a cluster of related taxa with a confused taxonomic history (Groves 2001, Brandon-Jones *et al.* 2004). Groves *et al.* (This volume) recognized *T. tarsier* as a senior subjective synonym of *T. spectrum*, both with a type locality of Makassar, a large city in southern Sulawesi from which there are no known existing museum specimens, no field surveys, and no known tarsier populations (see Shekelle 2003, Brandon Jones *et al.* 2004).

Fitch-Snyder (2003) reviewed the history of tarsiers in captivity, an endeavour so fraught with failure that she commented that her work was a 'documentation of the extinction of captive tarsier populations in North America and Europe since the first known import in 1850'. Thus, any published reports of tarsier husbandry need to be treated with the caveat that the effort failed. These failed efforts

to maintain captive populations of tarsiers have been disproportionately weighted toward Philippine and Western tarsiers. Fitch-Snyder reported only ten Eastern tarsiers having been kept in captivity outside of their country of origin. Six of the captive tarsiers listed by Fitch-Snyder date from the 1990's at the Night Safari in Singapore. The other four are much older, and, without further evidence, it is not likely that they were Eastern tarsiers, as the use of *T. spectrum* in older reports is ambiguous and rarely refer to Eastern tarsiers (see Shekelle 2003; Groves *et al.*, this volume). In consideration of the record of failure in North American and Europe, Fitch-Snyder (2003) recommended that *ex situ* conservation be targeted primarily at keeping colonies within habitat countries

The opportunity to pursue Fitch-Snyder's recommendation arose when reference material for new tarsier taxa were needed. Rather than collect and sacrifice these animals, one of us (M.S.) applied for permits to trap and cage the necessary animals. We are unaware of any published data on enclosure and enrichment for Eastern tarsiers. Establishing husbandry methods has been a process of research,

intuition, and experimentation. Basic parameters, such as minimum cage dimensions can only be guessed at, such as by comparisons with related species. The following recommendations were used as guides in the design of our colony:

“Effective tarsier husbandry requires the resolution of a wide variety of problems. Cage environment must be optimum for both the animals and their prey. Cage furniture must be designed so that animals are able to effectively forage, rest, socialize, reproduce, sleep, and escape/hide from both caretakers and conspecifics. Observant and patient caretakers must be able to monitor each animal’s health individually and recognise and take action to correct potential problems. Tarsiers in captivity cannot survive without effective foraging skills, and weak or sick animals very quickly die. An understanding of the animal’s ecological niche is essential in designing adequate caging, particularly if behavioural research is to be carried out. The closer the captive habitat matches the animals’ natural habitat in terms of climatic conditions and provisions of choices for social interactions and foraging the more content the animals will be in their captive environment.” (Wright *et al.* 1989)

#### **Prior Efforts at Captive Tarsier Colonies**

Previous tarsier enclosures were of the following constructions. Wharton (1950) kept two Philippine Tarsiers for two months outside in a box measuring 0.61 by 1.6 by 0.46 m. Evans (1967) enclosed *T. syrichta* in mobile wooden cages with a mesh side measuring 1.3 by 0.8 by 0.8 m with a nest box measuring 0.45 by 0.1 by 0.1 m. Schreiber (1968) housed three *T. syrichta* in a steel box 0.58 by 0.86 by 0.68 m. Haring and Wright (1989) records the Duke University Primate Centre cage measuring 2 by 2 by 3 m containing a variety of bamboo and vine substrates of varying dimensions and angles. A 5-year study on a pair of *T. bancanus* was carried out in an enclosure measuring 5.1 by 3.6 by 4.5 m high. (Roberts *et al.* 1984; Roberts 1985; Roberts and Kohn 1993; Roberts 1994). The rooms had concrete floors, ceilings, and solid walls with a complex network of branches from floor to ceiling. Three types of nest boxes were provided to see if there were preferences. Wooden and fibreglass boxes 4 m high were never used by the tarsiers. Cardboard boxes with an open bottom with

vertical and horizontal bamboo inserted into the box were favoured.

#### **Current Captive Tarsier Populations**

Wright *et al.* (1987) observed that the ultimate measure of a healthy colony of nocturnal primates is a good rate of reproduction and low mortality (Wright *et al.* 1989). Unfortunately the three present captive populations of tarsiers described in ISIS (1998-2001) as follows have had no instances of breeding.

Until recently, Cleveland Zoo held a single female *Tarsius bancanus* born in 1988. This animal was the lone tarsier in all of North America and Europe. Since 1992 she had been housed in a low light, understory tropical rainforest exhibit along with five greater mouse deer (*Tragulus n. napu*). The exhibit was approx. 260 square ft of floor space and 10 feet high (approximately 23.9 m<sup>2</sup>, 3 m high). Ground cover of fine bark mulch, artificial rock (shotcrete), live fine stemmed bamboo plantings and cut bamboo stalks not more than 1.5 inches (approximately 3.8 cm) diameter the full height of the exhibit (Don Kuenzer pers. comm.). This animal died on April 25, 2006 at more than 17 years of age, a longevity record for tarsiers (Shekelle & Nietsch this volume)

Records from the Singapore Zoological Gardens Night Safari indicate that a male-female pair from North Sulawesi was donated by the Republic of Indonesia on 27 June 1996. Additionally, two confiscated males of unknown provenance that arrived on 2 July 1998 were both Eastern tarsiers. A lone male survives. The exhibit is an outdoor glass-fronted cage with wire mesh sides and ceiling measuring 10 by 5 by 8 feet high (approximately 3 x 1.5 x 2.4 m). The furnishings are natural substrates, shrubs and leaf litter that provide a variety of criss-crossing vertical and angled supports, as well as leafy cover for camouflage (Sim Siang Huat pers. comm.). Multiple nest boxes are provided at about 2.5 m. There have been no records of captive birth, which is unusual, since records in Fitch-Snyder (2003) seem to indicate that births are fairly common, even though infant survival is low. One of us (MS) was asked to investigate the cause of this and, in 2003, the three

surviving tarsiers at that time were all found to be male. Currently, a lone male survives.

The only other known population of tarsiers outside of habitat countries is at the Ueno Zoological Gardens in Tokyo, Japan. ISIS (1998-2001) shows the presence of one male and two female *Tarsius tarsier* (= *spectrum*). We have no information on the enclosure or husbandry methods. The source of this colony is puzzling since zoo records indicate they are captive born, and yet there are no records of successful tarsier breeding colonies of this species in Indonesia or elsewhere, nor could we locate records at the Indonesian Department of Forestry export permits were issued for this species. All zoos and research institutions outside habitat countries are urged to rigorously verify the source of any tarsier available for import.

## METHODS

Our tarsiers are housed at Biological Research Centre-Division of Zoology of the Indonesian Institute of Science at Cibinong, West Java, Republic of Indonesia; a colony founded in October 2001. They are housed in a building that contains twelve identical enclosures arranged in two rows of six with a large hallway for keepers between them. The enclosures are constructed of wire mesh on three sides with a cement floor and back wall. The ceiling is wire mesh, which in turn is covered by a permanent roof with a skylight. The entire enclosure is protected by rain, and natural sunlight falls only on the forward most portion of the cage.

The colony in question was housed in outdoor enclosures with a natural light cycle. The enclosures measure 2 by 3.5 by 3 m high. Ventilation, lighting and humidity are all at natural levels for lowland West Java, which varies only slightly from the tarsiers' capture localities in Sulawesi. There is a plywood nest box measuring 0.3 by 0.2 by 0.25 m mounted at 2 m on the back wall. Water and food are provided in plastic trays. The water tray measured 330 by 260 by 50 mm (see Dahang *et al.*, this volume for information on feeding). Maintenance of the

enclosures included sweeping every 2 to 3 days to remove droppings and prey remains, and rinsing the enclosure with water.

The following substrates were used:

- (i) 4 nutmeg trees planted in steel drums (0.38 m diameter, 0.5 m high); smallest tree 1.3 cm circumference, height 2.20 m; largest tree 2.1 cm, height 2.50 m, arranged in a square formation in the cage.
- (ii) Bamboo poles resting against the floor, walls, and steel drums angled from steel drums at various lengths and angles.

The animals were housed in two groups. Each group had two enclosures (described above) connected by a small door that was left open. One group was trapped from the wild as a mated pair from Pattanuang, about 40 km northeast of Makassar, which we classified as *T. tarsier*. The second group was an unnatural association that began as a subadult male and an adult male from Selayar Island (*T. sp.*, see Groves 1998, Nietsch and Babo 2001), together with a subadult male from Gimpu, Central Sulawesi (*T. lariani*, "Palu form" see MacKinnon and MacKinnon 1980, Niemitz 1984, Shekelle 2003, Merker and Groves 2006). By the conclusion of this study, the subadults had matured and the enclosure housed three adult males. Originally, the Gimpu animal was housed separately in a third enclosure, but this arrangement was abandoned after a few weeks when the colony manager sensed that the animal was stressed as a result of being caged alone.

## RESULTS

Five tarsiers were delivered to this facility. Four infants were born. Four founders and one infant survive.

On January 15, 2003, after about 14 months in captivity, the animal from Gimpu was discovered on the floor of the enclosure with traumatic wounds to the head and neck. The animal was treated intensively for three days, but was found dead on the morning of January 18, 2003. The cause of the injuries could not be determined from the necropsy, but intragroup aggression is a possibility.

The first infant was born on June 29, 2002 and died on July 30, 2002. Necropsy revealed massive trauma that could have come from a number of factors such as a fall, or from an attack by the adult male. About one week before the infant died, a major construction project began near the enclosure that seemed to cause the tarsiers stress.

During the construction, the tarsiers were moved to a temporary facility. At the temporary facility the tarsiers were spared the stress of the construction project, but the enclosures were unsuitable for long-term housing. Nevertheless, the tarsiers were required to remain there until December 20, 2002. The second infant was born on December 18, 2002, and died the next day from injuries suffered during a fall.

When the tarsiers returned from their temporary enclosures they were put in permanent enclosures that were nearly identical to their original permanent enclosures, except that the new enclosures were designed for parrots and the wire mesh was replaced with steel bars.

A third infant, was born on 25 June 2003 in the tarsiers' new permanent enclosure. Our prior experience prompted us to modify the enclosure. The cement floor was covered with dried leaves and grass to act as padding. The nest box was lowered to a height of one meter. The adult male was moved to an adjoining enclosure approximately two weeks before birth. The nest box was modified so that a hole in the back allowed the male to see the mother and infant in the nest box. Although Eastern Tarsiers live in family groups and males are known to provide some parenting (Gursky 1997), the precaution was taken to improve the chances of infant survival in the event that stress in a captive environment might lead the male to commit aggression where he would not in the wild. After slightly more than 7 months, the third infant was discovered dead with one leg missing. We suspect that a predator from outside the enclosure grabbed the tarsier while it was using the external wire mesh as a support. The tarsiers were moved again to a new facility, and double mesh was added to defend against predators. A fourth offspring was born on July 25<sup>th</sup> 2004, and this animal survives.

## DISCUSSION

Four founder tarsiers arrived at our facility in October, and a fifth in November of 2001. The animal that arrived in November died of massive trauma after about 14 months in captivity, possibly of intragroup aggression or by a predator that entered the enclosure. The four tarsiers that arrived in October have survived nearly 4 years in captivity. A mated pair have produced four offspring. The first three died after 32 days, 1 day, and 7 months, respectively. The fourth animal, born on July 25<sup>th</sup>, 2004, survives. Cage design was improved after each infant death to increase the chance of survival. Principal improvements were padding the floor to reduce injuries from falling, protecting the enclosure with a second mesh screen to prevent predation. These results indicate to us that our cage design is effective for the captive maintenance of adult animals. With steady improvement in the survival of offspring, we are hopeful that we will soon have captive born animals that survive and reproduce.

Tarsiers have never formed successful breeding colonies in captivity (Fitch-Snyder 2003), and the survival of tarsiers is presently dependent on *in situ* conservation. This fact is troubling given habitat loss across the extent of occurrence of tarsiers, coupled taxonomic subdivision within the tarsier species groups. Habitat loss is proceeding virtually unchecked throughout much of tarsiers' distribution, particularly in Indonesia where illegal logging is a massive problem. Thus, while total numbers of tarsiers may be very large for species groups (see MacKinnon 1986), individual populations within each species group could be under a high threat of local extinction. Given that the primary taxonomy of tarsiers is poorly understood and thought to be vastly underrepresented (Brandon Jones *et al.* 2004), it is likely that the extinction of local populations will, in some cases, lead to the extinction of tarsier taxa. Unless a solution is found for the problem of habitat loss, or a successful *ex situ* tarsier conservation program can be developed, nothing can stop the processes that are currently operating that will very likely lead to the extinction of one or more tarsier taxa.

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