The status of domesticated elephants at the Pinnawala Elephant Orphanage, Sri Lanka

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ABSTRACT *The Elephant Orphanage at Pinnawala is an important centre for caring for elephants that have been rescued from the wild in Sri Lanka. It was established in 1975 and since 1978, it has been under the management of the National Zoological Gardens. It has a population of 63 elephants of both sexes and all age groups. From March to September 2000, a study was carried out at Pinnawala to document the care and management of these elephants. The population is composed of adult females (42.86%), adult males (17.46%), subadults (22.22%), juveniles (12.7%) and calves (4.7%). Tuskers make up only 3.17% of the bulls. Adult male:female sex ratio is 1: 2.45. The elephant orphanage plays an important role in the ex-situ conservation of the elephant by promoting its breeding in captivity. A total of 18 calves were born in captivity during a period of 16 years. Between 1998 and 2000 alone, 6 calves were born. Elephants in captivity are provided with good veterinary care and a balanced diet. During the day, they are free to roam about and interact with one another. The Elephant Orphanage spends about Rs. 15,118,300 (= US$ 101,577) per year on food and milk for the elephants. In return, it earns a revenue of about Rs 20,659,000 (=US$ 275,453) from visitors, especially foreign tourists. This paper deals with the care and management of elephants in captivity and makes some recommendations for the improvement of the Elephant Orphanage.*

INTRODUCTION

The Asian elephant *(Elephas maximus)* represents one of the most seriously endangered species of large mammals in the world. It is one of the few terrestrial megaherbivores extant in the world. It was declared a protected species in Sri Lanka in 1937, with the enactment of the Fauna and Flora Protection Ordinance No. 2. As Lair (1997) points out, "Despite their exalted legal status, domesticated elephants are de facto considered to be just the same as any other domestic animal, to be bought, sold, and cared for at the owner's whim". Sri Lanka has been a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1979.

In Sri Lanka, increasing human population and increasing agricultural land use have substantially reduced the area once available to the elephants in the wild. As a result of the conversion of forest to other land uses, elephant habitat has been shrinking steadily, and to day, the elephant finds itself with its back against the wall. Conversion of forests also serves to cut off certain channels of responses such as emigration and dispersion, available to the elephants, (Watson & Bell, 1969). The obvious result of a decrease in a species' range is a decrease in its resource base, and for elephants with their large body size and intemperate appetite, this means that their flexibility to buffer the effects of local resource depletion by moving out is lost (Croze *et al.*, 1981). Thus they become confined to patches of forest surrounded by human settlements. The long-term prospects for survival of such pocketed herds of elephants are grim (Seidensticker, 1984). Today, over large areas of Sri Lanka, there is no longer room available for elephants to move about and adjust their densities in response to changes in

the agricultural landscape. As Parker & Amin (1983) points out, "when elephants lose their range, they die". With the loss in forest cover and the expansion of human settlements, there is also increasing contact between elephants and cultivators. Elephants and agriculture are basically incompatible, unless the damage the elephants cause can be compensated (Child, 1995). Elephants spill over from even the largest protected area in Sri Lanka, and come into conflict with man. In Sri Lanka, the human-elephant conflict appears to have replaced poaching: annually over 100 elephants, mostly bulls, are killed in the conflict (Santiapillai, 1994), and hundreds more are shot, injured or orphaned by both irate farmers as well as inveterate poachers. It is to take care of such unfortunate elephants that the Elephant Orphanage was established at Pinnawala.

Distribution of domesticated elephants

It is interesting to note that the distribution of domesticated elephants and that of the wild elephants does not overlap (Fig. 1). The two appear distinct. The "ranges" of the two categories, as Lair (1997) points out, barely overlap: "where you find one, you do not find the other, although this separation is of recent origin". As far as the domesticated elephants are concerned, as Lair (1997) points out, virtually all of them occur in 14 out of 22 districts, in the south-west quarter of the island. In 1969, the majority of elephants lived in a central strip of the southwest, reaching from the coastal district of Colombo, through Kegalle, to Kandy: these three districts accounted for 334 elephants or 62.7% of the island's total domesticated elephant population (Jayasinghe & Jainudeen, 1970). Most of the remainder lived in nearby provinces (Lair, 1997). Part of the reason for the concentration of domesticated elephants along this corridor is cultural. As Jayasinghe & Jainudeen (1970) point out, the more wealthy and aristocratic families who reside here keep elephants as a status symbol, work being only a secondary factor.

Number of domesticated elephants

According to Santiapillai & de Silva (1994), there were 736 domesticated elephants in Sri Lanka in 1946. The number declined slightly to 670 by 1955 (Deraniyagala, 1955). When the Smithsonian Institution carried out a survey of domesticated elephants, jointly with the University of Peradeniya in 1967, it indicated that there were only some 532 elephants, of which 530 were owned by private individuals, and only 2 belonged to the Government (Jayasinghe & Jainudeen, 1970). By 1980, the number had further declined to 344 of which 183 were males and 161 females. This appears to be somewhat an underestimate for by 1988, according to Lair (1997), another independent survey by W.H. Ranbanda, showed there could be anything between 400 to 450 elephants. The situation still remains unclear as no reliable survey has been carried out island-wide since the joint Smithsonian Institution-University of Peradeniya study in 1967. As Lair (1997) points out, "Sri Lanka probably holds between 400 and 600 domesticated elephants". If this is so, then the population of elephants at Pinnawala represents between 16% and 11% of the total number under captivity. This is a very small proportion of the number of elephants that were once held in captivity in Sri Lanka. As Bedi (1969) points out, in the display of kingly affluence, splendour, pageantry and pomp, elephants have played a prominent part. During the time of King Rajasingha I (A.D. 1581-1598), there were 2,200 elephants used in the assault on the Fort of Colombo (Peris, 1994).

The Elephant Orphanage

The Elephant Orphanage encompasses an area of 9 ha of largely coconut plantation, and is situated at Pinnawala in the Kegalle District, some 80km northeast of Colombo. It was founded in 1975 by the Department of Wildlife Conservation, but was taken over by the National

Zoological Gardens in 1978 (Lair, 1997). The orphanage was established mainly to provide refuge and care for the elephants that were injured, orphaned, abandoned or separated from their herds in the wild. Today, the population of domestic elephants at Pinnawala includes 63 animals. In 1982, the orphanage began an active breeding programme, which has resulted in over 10 calves being born (Lair, 1997). Since its inception, the orphanage has been popular both among the foreign tourists as well as local people, who visit in large numbers to watch the animals being fed and bathed. A substantial revenue is collected, largely from the fees levied from foreign tourists, but much of this goes to fill the coffers of the government, and only a part of it reaches Pinnawala for the care and management of the animals. One of the serious problems in Pinnawala is the shortage of mahouts. At present there are only 23 mahouts for the 63 elephants. There are also plans to decant excess elephants to another facility in Kandy (Fernando, 2000). So far, there has been no serious assessment of the status of the elephants in Pinnawala. In the absence of any critical assessment of the elephants and their management, it would be difficult to make any recommendations for their improvement. It was with this in mind that this preliminary study was undertaken, as a student project.

Methods

The study was carried out during six months. Information on the number, sex-ratio, composition of the elephants was obtained from both direct observations as well as from the use of a questionnaire (see Appendix I). Much of the information was obtained from the records that were kept at Pinnawala, and from the discussions held with the Manager of the Orphanage and the mahouts.

Results & Discussion

Information regarding the names, sex, date of registration, capture locality, and age of the 63 elephants in Pinnawala are given in Table 1. The age-criteria and composition of the elephants are given in Table 2. The particulars regarding the birth and parentage of the calves are given in Table 3. The sex and parentage of the calves born at Pinnawala is given in Table 4. Medicinal plants traditionally used in the treatment of elephants are given in Table 5. Age and sex of the elephants that died in Pinnawala are given in Table 6.

Table 2. Age criteria for Elephas maximus used in Pinnawala (modified after Eisenberg & Lockhart, 1972)

	Adult	Subadult	Juvenile	Calf
Males	**9+ yrs**	**3+ to 9 yrs**	**1+ to 3 yrs**	**up to 1 yr**
Number	11	10	4	2
Females	**8+ yrs**	**3+ to 8 yrs**	**1+ to 3 yrs**	**up to 1 yr**
Number	.2	4	4	1
Total	**38**	**14**	**8**	**3**

Population Structure & Composition

Table 3 shows the structure and composition of the population of elephants at Pinnawala. They have been classified according to age and sex. The overall male:female sex ratio appears to be 1:1.33. However, when only the adult animals are taken into consideration, the sex ratio becomes, 1:2.5. As far as can be determined, the sex ratio of calves and juveniles are approximately 1:1. The sex ratio of the adults however, is slightly skewed to 1:2.5. In the wild, Hendavitharana et al (1994) found the adult sex ratio to vary from 1:1.8 to 1:2.9. Thus the observed adult sex ratio in Pinnawala lies within the range observed in the wild. Sex ratio is a measure of the reproductive performance of any population, and so a knowledge of it is essential in understanding and interpreting other vital statistics of the population (Downing, 1980). In general, the sex ratios among calves and juveniles are roughly 1:1 but they vary in adults. According to Lair (1997), the male/female sex ratios for domesticated elephants in Myanmar and Thailand are 0.74 and 0.86 respectively, probably indicating the norm in the wild. In the censuses carried out between 1955 and 1993, domesticated males numbered more than females. The higher number of males then, according to Lair (1997), indicated a possible preference for male elephants. However, since 1993, females predominate in captivity.

There are only two tuskers in Pinnawala. In general, tuskers are rare in the wild in Sri Lanka. Only about 6% of the bulls in the wild are tuskers today. In contrast, in South India, over 90% of the bulls are tuskers. Deraniyagala (1955) on the basis of his study of elephants in captivity, found that the tuskers represented just 10.2% of the bulls.

Age ratios are also an important source of information for management of elephants. They are a measure of the mortality and rearing success of the population (Downing, 1980). On average, the population of elephants at Pinnawala is composed of 60.3% adults, 22.2% subadults, 12.7% juveniles, and 4.8% calves (Fig. 5).

Reproduction

Professionally managed zoological parks and aquariums play an important role in conserving endangered species (Smith & Hutchins, 2000). Pinnawala provides an opportunity to breed elephants in captivity. Although captive breeding programmes cannot replace in-situ conservation, they can still play a role in the field of conservation education and research. Sri Lanka has had a poor record in the past of breeding elephants in captivity. The occasional births that were recorded resulted from the chance mating of domestic cows by wild bulls (Lair, 1997). In the distant past, elephants were so numerous in the wild, that capture and domestication was far more economical and convenient than raising them from birth. Another factor was the lack of proximity to other elephants. Jainudeen et al., (1972) observed that the elephants in captivity had very little opportunity to associate with each other. Although the Pinnawala Elephant Orphanage was started with the main purpose for caring of displaced, orphaned and injured animals, from the beginning, the authorities concerned were keen to exploit the facility and promote the breeding of elephants in captivity, given the importance elephants play in the social, religious and cultural lives of the people.

In India, it has been observed by Bedi (1969) that in captivity, the rate of breeding among elephants tends to fall. At Pinnawala, an active programme to breed elephants in captivity was started in 1982, and between 1984 and 2000, there were 18 births (Tables 2&4). Age of sexual maturity in captive elephants varies widely and appears to be influenced by nutrition. In captivity, with better diet, domesticated elephants are known to become sexually mature earlier than their counterparts in the wild. Although females can reach sexual maturity by the age of 8 years (or even earlier), it is exceptional for them to give birth before 12 years. The mean age at first calving seems to be much later, probabbly between 18 and 20 years (Sukumar, 1989). At Pinnawala, 3 cows (Anuradha, Rajina & Sukumali) had their first calf at the age of 13 years, but in general the

mean age at first calving appears to be much later, between 17 and 18 years. In India, Bedi (1969) suggests that there is a difference in the gestation periods, based on the sex of the calves. If the calf is a female, the gestation period is estimated to be about 20 months, but that of a male calf is estimated at 22 months. In India, elephant-cows in captivity have been known to breed at regular intervals of 30 months (Bedi, 1969).

Of the 27 adult females in Pinnawala, 8 have dropped calves, of which three females, seem to be responsible for 50% of the births. These three cows are Kumari (35 yrs), Komali (29 yrs), and Mathalee (20 yrs). The youngest is Suthumalee (16 yrs), while the oldest is Anusha (55 yrs). Although like human beings, elephants too reach menopause, they nevertheless are known to produce calves up to an advanced age. According to Sukumar (1989), a cow that died at the age of 68 years in captivity gave birth to its last calf at the age of 54 years. A new-born calf weighs some 90kg and is approximately 83 cm in height (Bedi, 1969).

Of the 11 bulls, only two, Wijaya (34+ yrs) and Neela (30+ yrs) seem to come into musth regularly, and are responsible for the birth of the 18 calves. 33% of the calves were sired by Wijaya and 67% by Neela. As is normal, in Pinnawala, so far only one calf has been brought forth in calving. But in India, on occasions, twins have been born. Bedi (1969) even documents a case of an elephant in Thailand that gave birth to triplets on 27 October 1913.

Food and Feeding

The elephant like any other animal, needs a balanced diet for healthy living. According to Lair (1997), the elephants in Pinnawala are fed on a monotonous diet of palms supplemented by few other plants. But such monotonous diets may lead to anaemia, and deficiency in iron and phosphorus among elephants. Krishnamurthy (1992) recommends the provision of grain rations in cooked form, as it improves digestion and palatability. Cereals such as rice, wheat, finger millet, maize or any other millet will help meet the elephant's energy needs as they are rich in carbohydrates. Today, the elephants receive a mixed diet composed chiefly of the Kitul palm *(Caryota urens)*, Coconut *(Cocos nucifera)* and Jak *(Artocarpus integrafolia)*. In addition, they are also provided with a mixture of food that is high on nutrients. Such a mixture of food includes plants such as Bread fruit *(Artocarpus nobilis)*, Banyan *(Ficus bengalensis)*, Bo *(Ficus religiosa)*, Ahata and Attikka (local names). Ideally, elephants need to range freely and obtain the food that they prefer, if they are to remain healthy and strong. But this is not possible in Pinnawala, which is an old coconut plantation, situated in a highly human dominated landscape. In the wild, elephants are known to feed on over 60 plant species in a day (Olivier, 1978). In all, an elephant may feed on as many as 225 species of plants (Vancuylenberg, 1977) in Sri Lanka. According to Karunaratne & Ranawana (1999) most of the species of plants eaten by elephants in captivity belong to a few taxonomic groups. For the elephants in Pinnawala, food is brought daily from outside. The supplier is selected through a tender procedure. The food is collected from Gampaha, Pilimatalawa, Kadugannawa, Molagoda, Rambukkana, and Kegalle, and transported daily to the Orphanage. Domesticated elephants are often given some supplements with their normal diet. In India, they are given paddy with a little salt. In Tamil Nadu, cooked rice is also given to the elephants.

On average, the Orphanage needs 10,000 kg of food daily. 1 kg of food costs Rs. 3.75 and hence the total daily expenditure on food in Pinnawala for elephants is Rs. 37,500 (= US$ 500). This translates into an annual budget of Rs. 13,687,500 (=US$ 182,500). Given that adults eat on average about 150 kg of wet food per day (Vancuylenberg, 1977), this provides the necessary 5,700 kg for the 38 adults in the population, and has substantial amount left for the rest of the animals.

The calves are suckled by their mothers. Abandoned calves rescued from the wild are fed on milk made from milk powder (e.g. Lactogen). Calves are given milk daily up to

3.5 years of age. Calves are fed on milk five times a day, at 0600h, 0915h, 1315h, 1700h, and 2000h. At each bout of feeding, a calf is given 7 bottles of milk which amounts to 5,250 cc. So in a day, each calf receives 26.25 litres of milk. As it is possible to make 7 bottles of milk from a packet of Lactogen, each calf needs 5 packets daily. Given the cost of one Lactogen packet is Rs. 112, the expenditure in feeding one calf per day is 5 x 112 = Rs. 560. Therefore the cost of milk for the 7 calves in Pinnawala for a days is Rs. 3,920 (US$ 52). This amounts to an annual expenditure of Rs. 1,430,800 (or US$ 19,077). There is in fact no real substitute for mother's milk – even in the case of elephants. As Bedi (1969) points out, when calves are fed on cow's milk or buffalo's milk, their digestion tends to suffer and they grow weak. He suggests that adding egg albumen, calcium and vitamins in the diet may improve the digestion and assimilation of substitute milk. In the wild, suckling continues for at least 2 years. The calf is usually weaned when it is 2 years old, especially if the calving interval is 4 years, but it may occasionally suckle even after the birth of the next calf (Hanks, 1978). Male calves take slightly longer to be weaned than female calves. In the wild, there is evidence that foster mothers will adopt and suckle orphaned calves. But in Africa, Hanks (1978) could not find any evidence of suckling calves moving around from cow to cow within a family unit. In captivity, should the cow elephant in lactation be put on to some heavy work or placed in training, then she may go dry, as a result of which her attachment to the calf may also begin to lessen. Therefore Bedi (1969) suggests that calves in captivity must be weaned as soon as they are able to feed on fodder and grains.

Evans (1961) recommends that elephants should be allowed to feed at all times except when at work. In Pinnawala, fresh fodder is brought in the mornings and the elephants are allowed to utilize it throughout the day. In India and Myanmar, the food of captive elephants was supplemented with two ounces of salt and one ounce of oil (Evans, 1961). During the hot season, tamarind pulp is also added, which acts as a cooling laxative (Evans, 1961). In India, aromatic spice balls are also given occasionally.

Bathing

Bathing is one of the natural functions of the elephants, and most important to their health (Evans, 1961). Elephants are bathed twice a day: once in the morning from 1000-1200 hrs and later in the afternoon from 1400-1600 hrs. However, given the large number of elephants and the few mahouts recruited to look after them, it is not possible to provide individual care to every elephant. As a result, the bathing of elephants is highly unsatisfactory, and has become a mere ritual designed to amuse the tourists. Bathing and cleaning elephants in captivity is an art: mahouts attached to traditional elephant owning families in Sri Lanka are known to devote many hours to scrubbing and cleaning their charges. In an area known as Elephant Bath, in Kandy, close to the Katugastota bridge, elephants used to be brought daily and bathed and cleaned for hours in the afternoon, once their duties were over. Special brushes made out of coconut husks, or stones are used by mahouts to clean the nails, and scrub the body thoroughly to remove parasites and dirt. Natural orifices and feet must be kept clean. In Myanmar and India, once the elephants are bathed, it is customary for the mahouts to apply oil all over the upper portion of the head, the idea being that it has a cooling effect and soothes the irritation of the head (Evans, 1961). At Pinnawala, unfortunately, no such intimate care is given to the elephants, and bathing them is at best a cursory exercise, designed more to amuse the tourists than to clean the animals. Just pouring water over the animals is not enough, for as Krishnamurthy (1992) points out, the animals must be made to lie down in the water in a lateral position, and scrubbed vigorously to remove the dirt from the folds of the skin. Good scrubbing as he recommends, improves the health of the skin by increasing the cutaneous circulation of the blood, and keeping it free of ectoparasites and fungus. Areas around nails, tusks, behind ears and base of the tail are likely to harbour ectoparasites and egg packets of oestrid flies (Krishnamurthy, 1992).

Drinking

In their natural state, elephants drink shortly after sunrise and before sunset (Evans, 1961). Elephants love water and in the wild, they are known to spend hours lying in water holes, especially during the hottest part of the day to cool off. It is only during bathing that elephants at Pinnawala obtain their drinking water too. Elephants like running water, and this is the case in Pinnawala, where the elephants are bathed in the Maha Oya – a relatively unpolluted river. According to Evans (1961) in general, elephants in captivity drink between 13 gallons (59 litres) to 18 gallons (82 litres) at a time. The total intake of water per day is about 225 litres (Bedi, 1969). It is important that the elephants are provided with clean water, preferably in an area that is separate from where they are bathed. Many ailments of elephants are traceable to the use of bad water (Evans, 1961). If elephants are not provided with water, under heat stress, they are known to even regurgitate water and spray it via the trunk onto the body (Tennent, 1867). In the wild, elephants are known to spray their body after a bath with dry soil or mud (McKay, 1973). This is usually followed by the animals rubbing their body against a tree or rock

Veterinary care

In ancient India elephants in captivity were cared well, with particular attention being given to their health. According to Bedi (1969), findings from years of study of elephant diseases came to be codified into Gajayurveda or Hastyayurveda – the science that treats elephant's diseases. In the epic Ramayana, there are references to elephants being gripped by fever. Elephants in captivity are prone to many diseases. As Bedi (1969) points out, "they are susceptible to enteric fever, pox and foot-and-mouth disease". They are also vulnerable to rabies when bitten by mad-dogs. Despite the large number of elephants that have been maintained in captivity in the past in Sri Lanka, the number of competent veterinarians who can provide the necessary veterinary care is woefully inadequate. During the Kings' time, there were traditional Sinhala elephant doctors known as Vederalas, who used their knowledge of indigenous medicine in the care and management of elephants (Lair, 1997). Even today, senior mahouts at private elephant holdings, are knowledgeable in the use of medicinal plants in the treatment of elephants. Such knowledge is usually passed on from the mahout to his son by word of mouth. In the absence of any written records, and with the passing away of experienced mahouts, their unique knowledge is being lost to posterity. At Pinnawala, there is a resident veterinarian to attend to the elephants.

One of the first signs of illness among elephants in captivity is dullness, indicated by the cessation of the usual restless movements of the trunk, ears, limbs and body so characteristic of health (Evans, 1961). Some of the most common veterinary problems concern the care of foot and nails. These are often prone to infection in bulls that are left to stand for months in their own urine and faeces. Wounds on legs, especially where the rope used to tie the animal has cut into the skin, are another common problem seen in elephants in captivity. These wounds often become infected and septic. Flies lay eggs in the open wounds and the condition of the animal may worsen from day to day (Bedi, 1969). Mahouts have the habit of using old, dirty rags to wipe such wounds. But this may aggravate the problem. Evans (1961) recommends that all pieces of cloth and dressings after use be burnt. Some animals that were caught in the wild have abscesses. An abscess refers to a circumscribed collection of matter (pus) usually occurring in the deeper layers of the skin or tissues beneath it (Evans, 1961). Despite the enormous size of the elephant, it has no escape from flies, in the hot season. Elephants become extremely agitated and annoyed when flies are around. They flap their ears, swish their tails and trunk in vain efforts to chase these creatures. In Pinnawala, sand-flies and mosquitoes are common. Malarial fever and filariasis are caused by mosquitoes. Given the occurrence of various types of gastro-intestinal parasites, a de-worming schedule must be planned for the elephants at regular intervals (Krishnamurthy, 1992). There is no previous record of an elephant contracting rabies in Sri Lanka. The death of the elephant named Anura was suspected to be due to rabies. It is recommended that vaccinations be given against outbreaks of serious

diseases such as anthrax and pasturellosis. Elephants can also catch a chill and get pneumonia or pleuropneumonia (Bedi, 1969).

Most common diseases of elephants at Pinnawala refer to such dietary disorders as diarrhoea, colic, loose motion, and also to parasitic infestations and mechanical damage. According to Godagama *et al.*, (1999), the prevalence of eye defects amongst domesticated elephants in Sri Lanka is fairly high. In Pinnawala, eye infections are common and are second only to dietary disorders. One of the common management concerns at Pinnawala is the accumulation of elephant dung where the animals are tethered for long periods. The accumulated dung and litter around this area should be removed to a suitable place for composting (Krishnamurthy, 1992). Thus, the decayed material can be used as manure in the adjoining Government farm.

Elephant mortality

Between 1975 and 1999, at least six elephants have died in captivity (Table 5). It is significant to note that of the 6 animals that died, 5 were bulls. Some animals in the process of trying to break free, after their capture in the wild, cut themselves so badly that they succumb to their injuries from secondary infections, such as blood poisoning (Jayasekera & Atapattu, 1995). The major cause of death among captive elephants is post-capture stress. According to the analyses of Lair (1997), nearly all the 25 animals (mostly bulls) that were captured and sold by the Government, died soon after. In Pinnawala, an elephant named Hondakota succumbed to its serious wounds.

Elephants and Mahouts

In the distant past, riding an elephant was an honour and it was mostly the prerogative of kings and nobles; common people could only enjoy this privilege on their wedding days or on special occasions (Bedi, 1969). Therefore the mahouts who handle the elephants were treated with great respect. They took pride in their work as mahouts, and developed an intimate relationship with their charges. In India, according to Patanjali, scholars who had fully mastered the discipline of grammer with all its branches were presented with elephants (Bedi, 1969).

The 63 elephants in Pinnawala are cared for by only 26 mahouts – a ratio of 1 mahout per 2.4 animals. Ideally, there should be a mahout for each animal so that an intimate bond between the two could be developed and maintained. Elephants are extremely intelligent and are therefore very adaptable to human control as long as it is not cruel. For the elephants that are in private hands, there usually is a mahout to care for each animal. This is the ideal. The skills, knowledge and experience of the mahout are usually passed on to the son, who then takes over on the retirement or death of the father. Today, with the advance of modern technology and improved education, children of mahouts are no longer interested in following in their fathers' footsteps. As a result, there is a real danger that Sri Lanka can lose its traditional know-how. As Lair (1997) points out, "in no more than twenty years, perhaps even just ten, it will be very difficult to find competent riders, men who truly deserve the title, 'mahout'.

A mahout at Pinnawala receives a monthly salary of about Rs. 3,500 (US$ 47). The 26 mahouts receive a total of Rs. 1,092,000 (US$ 14,560) per annum. In the absence of strong incentives to mahouts in Sri Lanka, the country will soon lose the services of experienced mahouts, and their skills in communicating with the elephants in captivity. As Bedi (1969) points out, during the period of training, an elephant needs to remember in all 27 command words, with which "it can be made to turn, to sit, to stand up, to lift the trunk, to kick, to walk, and to do many other things". Some of the common words used in Pinnawala by the mahouts to communicate with their charges are:-

Dha	– to go forward
Hethah	– to go back
Deri	– to bring
Pichath	– to let go or release something that the elephant holds
Udari	– to opn the mouth or hold up the trunk
Bila	– to lift the leg
Puru	– to push
Dhaha ida	– to turn to a side
Kiri	– to come to be fed on milk
Kiri hoow	– to wait for milk
Hoow	- to stop or wait
Hidha	- to sleep or lie down
Kana ida	- to flap the ear
Deri harama	- to throw or bring
Bila puru	- to chop kitul palm
Dana	- to worship
Deri udderi	- to take up something fallen
Teththa bila	- to lift the hind leg
Bilaharima dha	- to push by fore leg
Haruma	- to attack
Ketideri	- to put the trunk into the mouth
Deri udderi harama	– to spray water on the back
Dha diga	- to stretch the limbs
Chee	- don't!

Revenue

Admission charges vary: locals pay less, while foreigners pay much more. This is an unfair way of exploiting our visitors, and the difference is sadly based on skin colour and Not on nationality, for an Indian, if he kept his mouth shut, could get away with paying less as a local, while a "white" man has to pay the higher fees. As far as the locals are concerned, adults have to pay Rs. 20 as entrance fee, while children between the ages 3-16 are charged Rs. 15. School children as a group are charged at the rate of Rs. 7 per person. Foreigners: adults pay Rs. 150, children Rs. 75, and the charge for using a video camera is is Rs. 200, while professional photographers are charged Rs. 600 per head

The largest number of visitors come to Pinnawala in August and September, while the lowest number of visitors have been recorded from May to July. On average the daily takings amount to Rs. 56,600 (US$ 754). Thus annual earnings from the gates amounts to Rs. 20,659,000 (= US$ 275,453)

Income	=	US$ 275,453
Expenditure		
Food for elephants	=	US$ 182,500
Milk for calves	=	US$ 19,077
Mahouts' salaries	=	US$ 14,560
Total	=	US$ 216,137
Balance (profit)	=	US$ 59,316

How the orphanage could support conservation of elephants

Public education

Pinnawala provides an excellent opportunity to inform the public about the plight of the elephants in Sri Lanka. Given that some quarter of a million people visit the orphanage annually, a substantial segment of the public is able to observe and learn about the problems of elephant conservation. Research has shown that the presence of live animals does stimulate interest and curiosity (Saunders & Young, 1985) and that bringing people in contact with animals appears to have a positive impact on effective learning (Sherwood et al., 1989). Since Pinnawala is frequented by mostly the affluent, and middle-class, urban people and foreign tourists, they can be informed of the impact of ivory poaching on elephant survival in Asia in general, and the foreign visitors can be encouraged to refrain from buying any products made from endangered species.

Scientific research

Pinnawala can sustain high quality scientific research by both resident scientists as well as foreign biologists. Even field studies can benefit from ex-situ research on elephants by nutritionists, physiologists, veterinarians, pathologists, and reproductive biologists. Much of our knowledge on the reproductive physiology of elephants comes from

observations carried out in the zoos and captive elephant facilities. Jainudeen et al (1971) pioneered the study of the reproductive physioloy and the oestrus cycle of elephants in Sri Lanka. Osborn & Rasmussen (1995) used information on chemical communication is currently being examined for its effectiveness as a repellent against crop-raiding wild elephants in Zimbabwe. It was from a study of captive Asian elephants that Payne et al., (1986) discovered the infrasonic communication among elephants. Another line of research is the extraction of genetic information of elephants through DNA collected from faecal samples. The technique could then be extended to prepare a geographic map of gene frequencies of wild elephant populations (Smith & Hutchins, 2000). There is therefore much scope to carry out research on captive elephants in Pinnawala and thus augment the in-situ conservation of elephants in the wild.

Eco-tourism

The use of trained elephants to carry tourists into national parks and nature reserves offers a great opportunity to utilize the pool of domesticated elephants currently available in Pinnawala. Tourism is one of the biggest foreign-exchange earners in Sri Lanka and the use of trained elephants in eco-tourism would greatly enhance their value to man. Although domesticated elephants are slow to move compared to vehicles, visitors in Africa are willing to pay for the unique experience (Iverson, 1995). By incorporating domesticated elephants in eco-tourism, wildlife management, forestry operations, and agriculture, a strong case can be made for the conservation of such a useful mammal in Sri Lanka.

Uses of trained elephants

According to Bedi (1969), "a properly trained elephant is one of the most serviceable animals". In Sri Lanka, trained elephants are a part of the island's history, culture, mythology, religion, and even politics. They are an essential feature of the annual Esala Perahera held in Kandy. In the past, elephants have been used extensively in war and peace. During British colonial rule, trained elephants were also used in game hunting. As Santiapillai & Widodo (1992) point out, a fully trained elephant is an investment for a lifetime. The elephant, used for selective logging operations in sensitive areas, could be the basis for a comparatively benign mode of resource extraction. A fully grown elephant according to Bedi (1969), can carry a load of up to 540 kg. Unlike heavy machinery used in logging operations, trained elephants cost less, work for much longer, and do not rust, corrode or pollute the environment. They do not need expensive spare parts, and their dung acts both as fertilizer and as an agent of seed dispersal in the forest (Santiapillai & Widodo, 1992). Furthermore, they work under any conditions, on dry land as well as in swamps. Trained elephants can also be used to patrol reserves.

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