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Captive Breeding of Asian Elephants at the Pinnawala Elephant Orphanage, Sri Lanka

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Abstract. The Pinnawala Elephant Orphanage (PEO) was established in 1975 to rehabilitate orphaned wild elephants. Elephants at the PEO have the freedom to roam in the facility during the day. Captive breeding was encouraged at PEO and the first captive-born elephant was reported in 1984. Up to now, there have been a total of 70 successful births by 32 females. The M:F sex ratio was 1:0.84, the birth rate was 1.8 ± 2.92 /year and the stillbirth rate 0.13 ± 0.410 /year.
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Introduction

The Asian elephant (*Elephas maximus*) has been an important cultural symbol since ancient times (Santiapillai *et al*. 2010). At present, Asian elephants are found in 13 countries including Bangladesh, Bhutan, China, Nepal, Vietnam, Cambodia, Laos, Thailand, Indonesia, India, Bhutan, and Sri Lanka (Fernando & Pastorini 2011). However, in many of these countries, their numbers have drastically declined (Fernando & Pastorini 2011). Consequently, the Asian elephant has been classified as 'endangered' by the IUCN, and an Appendix-I species by CITES (CITES 2020). Sri Lanka has around 5,825 wild elephants (Fernando 2015), and around 360 in captivity (Pushpakumara *et al*. 2016). Elephants have been captured from the wild since ancient times (Nijman 2014). Elephant capturing and taming were a central feature in ancient Sri Lanka and kings maintained thousands of elephants including war elephants (Wisumperuma 2004; Kurt & Garai 2007). However, the captive elephant numbers in Sri Lanka have decreased as work animals are increasingly being replaced by machines (Fernando & Pastorini 2011). Nevertheless, their use in tourism is increasing (Prakash *et al*. 2020). Elephants held in captive facilities in Asian countries are mostly used for tourism (Nijman 2014). At present in Sri Lanka, captive elephants are kept by temples, private owners, and by the government at the National Zoological Gardens at Dehiwala, the Pinnawala Elephant Orphanage (PEO), the Ridiyagama Safari Park, and the Elephant Transit Home at Udawalawe. There have been very few captive births in Sri Lanka with the exception of the PEO (Jayantha 2011). Improving the facilities and care for elephants is important for their captive management. However, studies on elephant reproduction are limited due to the length of the reproductive cycle, safety concerns, and ethical considerations (Thitaram 2012).

Pinnawala Elephant Orphanage

The PEO is located in the Kegalle District about 88 km away from Colombo. It was established in 1975 by the Department of Wildlife Conservation to manage orphaned wild elephants and was initiated with five such baby elephants. Subsequently, orphaned elephants from different parts of the country were received and integrated into the herd at PEO. The elephants are managed within a 10.52-ha area close to the river Ma Oya. In 1982, the management of PEO was transferred to the Department of National Zoological Gardens (DNZG 2021). The first captive-bred elephant was born at the PEO in 1984. Orphaned elephants were received exclusively by the PEO until 1995 when the Elephant Transit Home was set up, after which they were taken to both PEO and Elephant Transit

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Home. From inception till 2022, a total of around 80 orphaned elephants have been received by the PEO. The last time wild-born orphaned calves were received by the PEO was in 2013 when five were received from the Department of Wildlife Conservation.

The objective of the PEO has changed from being an orphanage to a centre for elephant conservation, welfare, captive breeding, research, education, and recreation. It averaged about 60,000 visitors and generated 296,845 US$ per month during 2016–2020. In 2022, a total of 73 elephants including 32 males of which 15 are adults and 41 females of which 32 are adults were housed at PEO including 27 that were born in-house. Individuals that are born at the PEO and received as orphaned are integrated into the existing herd (Fig. 1).

Elephants are managed as a herd and individually in PEO. The herd comprises females of all ages and males up to around 10 years old. Males are then separated from the herd and cared for individually. A team of 3–5 mahouts is assigned daily to take care of around 5–6 male elephants. They walk the elephants to the river Ma Oya for bathing from 09:45 to 11:00 and 13:45 to15:00. The herd is released to a free-roaming area around 3 ha in extent from 08:30 to 10:00 (Fig. 2) and herded to the river from 10:00 to 12:00, and 14:00 to 16:00 (Fig. 3), under the supervision of 5–6 mahouts. All elephants are housed in sheds at 16:00.

Old females whose body condition is deteriorating, females who have difficulty in walking or are suspected of being harmed by other elephants in the herd, and sick females are separated from the herd and form a "day-care group", which usually consists of a few individuals and currently, this group has five individuals. When the main herd is in the free-roaming area, the day-care group is taken to the river Ma Oya and vice versa. Once they come back from the river at 14:00, they are housed in separate sheds near the veterinary office.

Figure 1. A calf born at PEO, with the herd.

Figure 2. The elephant herd in the free-roaming area at PEO.

Calves born at PEO are not bottle-fed unless rejected by the mother or the mother does not have enough milk. Around 400–500 kg of fresh fodder is provided daily for the herd, in the free-roaming area. Fresh fodder is provided to each elephant equal to 9% of its body weight in the evening for the night. The fodder consists of kithul (*Caryota urens*) logs and leaves, coconut (*Cocos nucifera*) leaves, jack (*Artocarpus heterophyllus*) leaves and many varieties of other leaves and some grass species such as *Brachiaria ruziziensis*, *Brachiaria brizantha* and *Pennisetum purpureum*. In addition, some elephants are being given watermelon (*Citrullus lanatus*), banana (*Musa* spp.), pineapple (*Ananas comosus*), and animal pellets as per the recommendation of the veterinarian. The PEO spends about 40 US$ on an adult elephant per day for food.

Most elephants in the main herd are not fully tame and cannot be ridden nor made to work. However, mahouts can lead them to the water, free-roaming area, and sheds. Around 10–15 adult elephants are trained for basic work, such as carrying and distributing fodder and riding by the mahout. Training is essential especially for males as it makes them more manageable. When an elephant turns 8–10 years old, ma-

Figure 3. The herd in the river Ma Oya.

houts separate it from the herd and train it in basic commands under the supervision of curators and veterinarians. It takes around 1–3 months to train an elephant.

Methods

Records of elephants maintained at the PEO from 1984 to September 2022, were analysed. The records were maintained by the curator who is the head of the animal section. Events related to elephants such as births, deaths, their origin, and release from PEO were recorded. For births, details of the mother and father and time of birth were recorded, for new arrivals the time and date received from the wild, place of capture, and characteristics at the time of receiving such as height and weight were recorded. Information was also obtained from discussions with officers of the PEO.

Results and discussion

Selecting breeding individuals

Selecting females for breeding was based on observing changes in behaviour and external signs of oestrous by mahouts. The main behavioural signs observed were; the female approaching a male and turning her back to him, the male following the female and touching the vagina with the trunk, and when a male is released to the herd in the free-roaming area, the female approaching the male or vice versa. Specific behaviour such as increased clitoris-directed, underbody tail flicking reported in oestrous (Rasmussen & Krishnamurthy 2000), was not observed at the PEO. The main external sign of oestrous looked for at the PEO was vaginal discharge. Female elephants may not show clear and distinct morphological genital changes or obvious behavioural changes due to oestrus (Thitaram 2012). Consequently, identifying oestrous by behavioural changes and signs is not very effective. Detection of oestrous by hormone monitoring is more reliable (Thitaram 2012). However, it was not done at the PEO due to the lack of laboratory facilities.

Wild-origin individuals were preferred for breeding in order to maintain high genetic diversity. Since the majority of adults at the PEO were of wild-origin, mating between most males and females was not contraindicated. In choosing a pair for mating, the elephants' behaviour was also considered. Some females avoided some males and some individuals both male and female, attack certain individuals and hence were not used for mating even though of wild origin. A male's behaviour such as aggressiveness towards people, other elephants, and preference towards particular females was also considered based on the experience of the staff. Given that the PEO was a public place, aggressive bulls were difficult to use for mating due to safety concerns for visitors and therefore only the controllable bulls were used for breeding. There was also a preference to use males that were more successful in sexual interactions, for breeding. Sometimes, if there were additional matching males to a female in oestrus, the males were switched each day but only one male was

put in at a time. The time and number of days each male received depended on how successful the sexual interaction was with the female. In such cases, paternity could not be attributed accurately. Males and females with signs of disease were not used for mating.

Mating

The oestrus cycle in elephants at PEO was between 3–3.5 months and females were in receptive condition for 1–3 days (Rajapaksa 2007). When a female in oestrus was identified, a selected male was released to the herd in the free-roaming area from 08:30 onwards and at the river from 10:00 onwards. If the male was aggressive, the pair were released to an isolated area or the free-roaming area before releasing the other elephants between 06:00 to 08:30. Sexual contact with the female could last from 3 days to a week or more (Fig. 4). Depending on the response shown by a male and female, the same or a new male was introduced the next day. If there was good sexual interaction between them and the male was not aggressive, the pair was allowed to have interactions for a few days until the end of oestrus. If sexual interaction did not occur, or a male behaved aggressively, that male was not put in the next day.

Births

From 1984 to 2022, 70 births and 5 stillbirths were recorded. The birth rate was 1.8 ± 2.92 per year and the births per reproducing female were 0.06 per year. Of the 32 females that reproduced, 25 wild-origin females gave birth to 59 calves (0.06 births/female/year) while 7 captive-origin females gave birth to 11 calves (0.04 births/female/year). In north-east India, the birth rate was 0.04 calves/adult female/year (Jerang *et al*. 2020). Less than 20% of Asian and 10% of African elephants have given birth in North American zoos (Brown *et al*. 2004; Keele *et al*. 2010). Although some western zoos have used methods including artificial insemination, success was low (Thitaram 2012). Thus, breeding success at the PEO has been comparatively high. However, in Myanmar, the country with the largest number of captive elephants (Sukumar 2006), captive breeding was much more successful and 25% of captive elephants in Myanmar were born in captivity (Mar 2013).

Figure 4. Mating attempt in the free roaming area by a male put together with an oestrus female.

The births at PEO consisted of 38 male and 32 female calves giving a M:F sex ratio of 1:0.84 (Fig. 5). The sex ratio in Myanmar timber elephants was almost 1:1 (Mar 2013) and in Thailand, 1:0.75 (Toin *et al*. 2020).

The number of births at the PEO varied between years and 2011 had the highest with 15 births. After 2015 there were no births despite numerous breeding attempts until 2021, with four calves being born between 2021 and 2022. The longest inter-birth interval recorded at PEO was 12.25 years and the shortest was 2.34 years. In Myanmar, the longest and the shortest interbirth intervals were 21.44 and 1.52 years for captive-born mothers and 19.29 and 1.71 years for wild-caught mothers (Mar 2013).

Although calving was recorded at the PEO in all months, 30 out of 70 births (42.8%) were

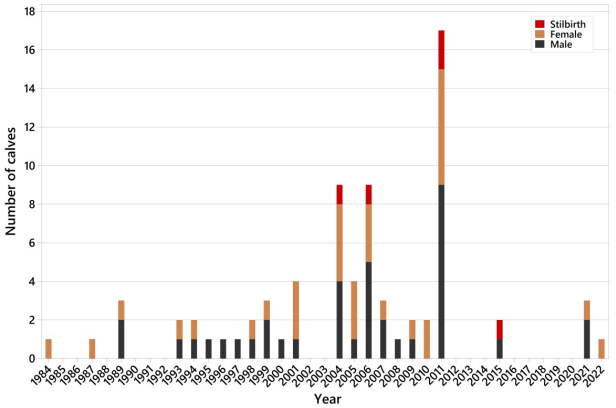

Figure 5. Number of calves born and stillbirths from 1984 to 2022.

from July to September (Fig. 6). In captive elephants in Myanmar, although births were recorded throughout the year, the rate was lower from May to August and highest from December to March (Mar 2013).

The stillbirth rate at the PEO was 6.7 per 100 births. (Fig. 5). In contrast, the stillbirth rate in Myanmar timber elephants was around 4% (Mar *et al*. 2012).

A total of 12 deaths were recorded of ages less than 15 years at the PEO from 1984 to 2022, mostly from natural causes. Four died due to disease. Information on disease conditions was available only for two – a female born on 10.01.2007 that died on 14.04.2021 due to a growth defect and a male born on 9.07.2015 that died on 27.11.2018 due to respiratory issues. One calf was killed by the mother, one died in an accidental drowning in a pit in the river, and one died due to rejection by the mother with not feeding the calf and hitting it. Calf killing by mothers has also been reported in some western zoos (Saragusty *et al*. 2009). All the deaths of calves at the PEO were of wild-born mothers. Of 975 births among captive elephants in Myanmar 25.6% of calves died before reaching the age of five (Mar *et al*. 2012). In Myanmar the major cause of death for calves under five years age was accidents (42.4%) (Mar *et al*. 2012). In contrast, PEO recorded 8.3% of deaths due to accidents.

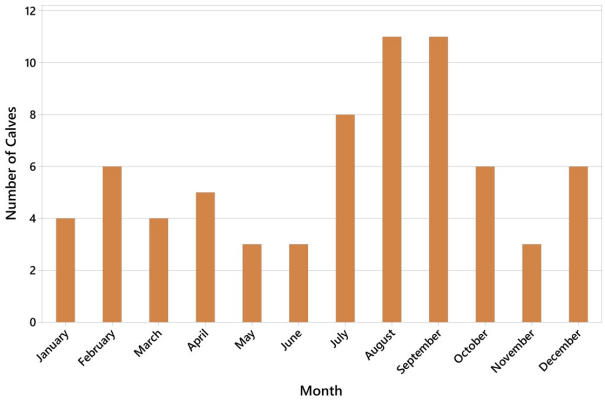

Figure 6. Monthly variation in births from 1984 to 2022 at PEO.

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