## Forum

# Asian elephants in zoos face global extinction: should zoos accept the inevitable?

Paul A. Rees

**Abstract** Captive breeding programmes for the Asian elephant *Elephas maximus* have failed to establish self-sustaining zoo populations. Birth rates are low and calf mortality rates are high. The zoo population is widely dispersed, with few animals being moved on breeding loan. New techniques may increase birth rates but current predictions suggest demographic extinction within 50 years. It would be difficult to justify importing elephants from sustainable zoo reserves in Asia to participate in *ex situ* breeding programmes where reproductive success is low. Zoos should either urgently regroup animals to form breeding units, or accept that Asian elephants will die out in zoos and that funds should be diverted to *in situ* conservation projects.

**Keywords** Asian elephant, captive breeding, *Elephas maximus*, zoo reserves, zoos.

In response to the decline in wild Asian elephant *Elephas maximus* populations, *ex situ* captive breeding programmes for the species face the challenge of creating self-sustaining zoo populations. This objective is frustrated by an imbalance in the sex ratio, low fecundity, high calf mortality, inadequate accommodation and the emergence of new diseases within zoo populations. The Asian elephant Species Survival Plan (SSP) was established by the American Zoo and Aquarium Association in 1985. Schulte (2000) reported that there were 46 males (eight castrated) and 239 females in the North American population in 73 facilities in 1999. Both sexes were present in 23 facilities (31.5%). Wiese (2000) used a population model to predict that the North American population will drop to approximately 10 elephants in 50 years and become demographically extinct. The European Endangered species Programme (EEP) for Asian elephants was established in 1991. By 31 December 1998, the EEP included 79 zoos holding 50 bulls and 199 cows (Anon, 2000). At the beginning of 1993, the ratio of bulls to cows was 1:5 but by 2000 it had increased to 1:4.4.

Information on the holdings of Asian elephants in captivity is available from the International Species Information System (ISIS), which serves around 550 zoological institutional members from 54 countries. In 2002, ISIS members held a total of 100 bulls and 378 cows worldwide. Seventy-seven per cent of all bulls and 88% of all cows were held in Europe and North America (Table 1). Fifty per cent of all ISIS zoos had either one or two elephants and three quarters of groups consisted of four or fewer individuals.

Birth rates are low in zoos, and calf mortality is high (Kurt, 1994; Taylor & Poole, 1998). There were 141 births in European zoos and circuses between 1902 and August 1996 (Haufellner *et al.*, 1993; Anon., 1996); 37% of which died within their first year, 48% were stillborn and 27% were killed by their mothers. Infanticide has not been reported from captive elephants in Asia (Schmid, 1998). In 1998 the Asian elephant EEP reported just 11 births (Anon, 2000). Of these only three bulls and one cow survived. During 1999 just two births were recorded. Fecundity in the North American population is also low and first year mortality is over 30% (Wiese, 2000).

Well-managed captive populations of Asian elephants, such as those found in forest logging camps, may have a breeding performance comparable to wild populations and better than zoo animals (Krishnamurthy, 1995; Taylor & Poole, 1998). The mean life expectancy of calves born in Europe, however, is only 6.1 years (Schmid, 1998) compared with nearly 30 years in Burmese working elephants (Schmidt & Khyne U Mar, 1996). To try and address the problem of low reproductive rates in zoos, ultrasonography of the urogenital tract has been used to assess female and male reproductive function (Hildebrandt *et al.*, 2000a, b), and in 1999 the first successful artificial insemination pregnancy was reported by Dickerson Park Zoo, USA (Hodgkins, 2000). Such techniques may improve fecundity in the future, but breeding failure is a zoo phenomenon and not inherent in the species.

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*Received 3 July 2001. Revision requested 15 February 2002. Accepted 16 August 2002.*



© 2003 FFI, *Oryx*, **37**(1), 20–22 DOI: 10.1017/S003060530300005X Printed in the United Kingdom

**Table 1** Regional distribution of Asian elephants recorded on the ISIS database for 131 zoos as at February 2002 (Anon, 2002).

| Region | Male | Female | Unknown | Births* | Total | % of total |
|---|---|---|---|---|---|---|
| Europe | 48 | 189 | 1 | 5 | 238 | 49.7 |
| N America | 29 | 143 | 0 | 1 | 172 | 35.9 |
| S America | 2 | 5 | 0 | 0 | 7 | 1.5 |
| SE Asia | 18 | 34 | 0 | 1 | 52 | 10.9 |
| Australasia | 3 | 7 | 0 | 0 | 10 | 2.1 |
| Total | 100 | 378 | 1 | 7 | 479 | 100.0 |

*Births reported during the previous 6 months and counted in totals for males and females.

Kurt (1994) found that only 20% of elephant transfers between zoos resulted in pregnancies, possibly due to stress caused by the removal of the cow from its social group (Schmid, 1998). Movements of elephants between zoos are rare. In 1992 EEP zoos held 212 elephants but no movements were reported. In 1999 there were 83 zoos participating in the Asian elephant EEP, holding 49 bulls and 217 cows at 31 December 1999 (Dorresteijn, 2001). During the year only 3 bulls and 8 cows were transferred between EEP zoos, but eight of these movements related to a single zoo. In addition a single bull and 11 cows were transferred into the EEP from non-EEP zoos. Dorresteijn (2001) estimates that more than 50% of the females that are in the best breeding age category (<25 years old) have never been in a potential breeding position, although almost all are believed to be capable of breeding. The risks associated with the movement of elephants between collections have increased since the appearance of new fatal herpes viruses (Rickman *et al.*, 2000) and tuberculosis (Mikota *et al.*, 2000) in the zoo population.

A survey of 'elephant space' in European zoos conducted in 1999 (Griede, 2000) found that of 80 respondent institutions, 66 planned to have Asian elephants in 2009. There will be a net loss of two institutions intending to hold the species by 2004. The study predicted an increase of 9 bulls and 76 cows in EEP zoos between 1999 and 2009, and suggested that five bachelor herds might eventually be created.

The North American Asian elephant population is not self-sustaining (Wiese, 2000) and an estimated four elephants per year need to be imported simply to maintain the population at its current level, based on a model that makes extremely optimistic assumptions. Wiese (2000) suggested the Asian elephant is a perfect candidate for the establishment of an extractive zoo reserve (Conway, 1998). This concept proposes the intensive management of habitat reserves so that wild populations can sustain an extractive harvest for use by zoos. Some forest timber camps in India are reported to be self-sustaining or growing (Sukumar *et al.*, 1997), and Wiese has suggested that these camps may be a logical source for trial extractions. However, Dorrestijn & Terkel (2000) considered this proposal to be unacceptable as a means of supporting the European breeding programme.

If wild or *in situ* captive populations become sustainable to the point where they are able to supply zoos with excess animals, this must put into question the conservation need for an *ex situ* zoo population, with no immediate prospect of returning captive-bred elephants to the wild. The translocation of excess animals within range states would arguably make a greater contribution to elephant conservation.

In conclusion, there is little evidence of commitment on the part of zoo directors to translocate elephants between zoos either temporarily or to form viable breeding units. Zoos that are investing in new elephant accommodation are gambling large sums of money on being able to breed or otherwise acquire elephants in the future, while in India the solar-powered electrified elephant fencing used to reduce human-elephant conflict only costs *c.* Rs 15,000 ($300) per km (Appayya, 1995).

It may be time to reconsider the role of zoos in elephant conservation. Many zoos have already stopped keeping elephants. If there is no realistic prospect of establishing self-sustaining *ex situ* captive-breeding populations in western zoos it may be more productive to use the existing animals as ambassadors to raise money exclusively for *in situ* conservation in the range states until they die out naturally.

Perhaps future strategies for Asian elephant conservation should be influenced by careful consideration of the answer to a single question. If Asian elephants did not already exist in zoos would we spend scarce resources developing an *ex situ* captive breeding programme with no guarantee of success?

## References

Anon. (1996) *Ein Beitrag zum Workshop 'Elefant und Mensch', Münster, 7–9 September 1996.* European Elephant Group, Karl Wenschow, Munich, Germany.

Anon. (2000) Asian elephant (*Elephas maximus*) EEP Annual Report 1998. In *EEP Yearbook 1998/99 including Proceedings of the 16th EAZA Conference, Basel 7–12 September 1999* (eds F. Rietkerk, B. Hiddinga, K. Brouwer & S. Smits), pp. 234–236. EAZA Executive Office, Amsterdam, Netherlands.

Anon. (2002) *ISIS Abstracts:* Elephas maximus. International Species Inventory System, http://www.worldzoo.org/abstract/Abs76325.htm [accessed 22 February 2002].

Appayya. M.K., (1995) Elephants in Karnataka (India): a status report. In *A Week with Elephants. Proceedings of the International Seminar on the Conservation of Asian Elephant* (eds J.C. Daniel & H. Datye), pp.88–94. Bombay Natural History Society, Oxford University Press, Oxford, UK.

Conway, W. (1998) Zoo reserves; a proposal. In *AZA Annual Conference Proceedings*, pp. 54–58. American Zoo and Aquarium Association, Silver Spring, USA.

Dorresteijn, T. (2001) Asian elephant (*Elephas maximus*) EEP Annual Report 1999. In *EEP Yearbook 1999/2000 including Proceedings of the 17th EAZA Conference, Aalborg, 19–24 September 2000* (eds B. Hiddinga & K. Brouwer), pp. 441–444. EAZA Executive Office, Amsterdam, Netherlands.

Dorresteijn, T. & Terkel, A. (2000) Forward planning and EEP management for elephants in EAZA institutions. In *EEP Yearbook 1998/99 including Proceedings of the 16th EAZA Conference, Basel, 7–12 September 1999* (eds F. Rietkerk, B. Hiddinga, K. Brouwer & S. Smits), pp. 480–481. EAZA Executive Office, Amsterdam, Netherlands.

Griede, T. (2000) Results of the 1999 Elephant Space Survey. In *EEP Yearbook 1998/99 including Proceedings of the 16th EAZA Conference, Basel, 7–12 September 1999* (eds F. Rietkerk, B. Hiddinga, K. Brouwer & S. Smits), p. 479. EAZA Executive Office, Amsterdam, Netherlands.

Haufellner, A., Kurt, F., Schilfarth, J. & Schweiger, G. (1993) *Elefanten in Zoo und Zirkus. Dokumentation Teil 1: Europa.* Karl Wenschow, Munich, Germany.

Hildebrandt, T.B., Göritz, F., Pratt, N.C., Brown, J.L., Montali, R.J., Schmitt, D.L., Fritsch, G. & Hermes. R. (2000a) Ultrasonography of the urogenital tract in elephants (*Loxodonta africana* and *Elephas maximus*): an important tool for assessing female reproductive function. *Zoo Biology*, **19,** 321–332.

Hildebrandt, T.B., Hermes, R., Pratt, N.C., Fritsch, G., Blottner, S., Schmitt, D.L., Ratanakorn, P., Brown, J.L., Rietschel, W. & Göritz, F. (2000b) Ultrasonography of the urogenital tract in elephants (*Loxodonta africana* and *Elephas maximus*): an important tool for assessing male reproductive function. *Zoo Biology*, **19,** 333–345.

Hodgkins, L.D. (2000) *AZA Annual Report on Conservation and Science 1997–98, Volume II, Member Institution Conservation and Research Projects.* American Zoo and Aquarium Association, Silver Spring, USA.

Krishnamurthy, V. (1995) Reproductive pattern in captive elephants in the Tamil Nadu Forest Department: India. In *A Week with Elephants. Proceedings of the International Seminar on the Conservation of Asian Elephant* (eds J.C. Daniel & H. Datye), pp. 450–455. Bombay Natural History Society, Oxford University Press, Oxford, UK.

Kurt, F. (1994) Die Erhaltung des Asiatischen Elefanten in Menschenobhut – ein Vergleich zwischen verschiedenen Haltungssystemen in Südasien und Europa. *Zeitschrift des Kölner Zoo*, **37,** 91–113.

Mikota, S.K., Larsen, R.S. & Montali, R.J. (2000) Tuberculosis in elephants in North America. *Zoo Biology*, **19,** 393–403.

Rickman, L.K., Montali, R.J. & Hayward, G.S. (2000) Review of a newly recognised disease of elephants caused by endotheliotropic herpesviruses. *Zoo Biology*, **19,** 383–392.

Schmid, J. (1998) Status and reproductive capacity of the Asian elephant in zoos and circuses in Europe. *International Zoo News*, **45/6,** (287), 341–351.

Schmidt, M.J. & Khyne U Mar. (1996) Reproductive performance of captive Asian elephants in Myanmar. *Gajah*, **16,** 23–42.

Schulte, B.A. (2000) Social structure and helping behaviour. *Zoo Biology*, **19,** 447–459.

Sukumar, R., Krishnamurphy, V., Wemmer, C. & Rodden, M. (1997) Demography of captive Asian elephants (*Elephas maximus*) in southern India. *Zoo Biology*, **B,** 263–72.

Taylor, V.J. & Poole, T.B. (1998) Captive breeding and infant mortality in Asian elephants: a comparison between twenty western zoos and three eastern elephant centers. *Zoo Biology*, **17,** 311–322.

Wiese, R.J. (2000) Asian elephants are not self-sustaining in North America. *Zoo Biology*, **19,** 299–309.

## Biographical sketch

Dr. Paul Rees' research interests include wildlife law and the behaviour, ecology and conservation of large mammals, especially elephants.

## Forum

# Asian elephants in zoos – a response to Rees

R. Sukumar

The real role of zoos in the conservation of threatened animals is increasingly coming under public scrutiny, and this is perhaps natural in the case of intelligent, charismatic animals such as elephants. From Roman times up to the mid nineteenth century the elephant was a curiosity in Europe, and then with the establishment of zoos and the popularity of modern circuses there was a steady influx of animals from colonies in Africa and Asia. Elephants, however, never bred well in captivity, either historically in Asia or in recent decades in western zoos. Kings and other rulers have over the centuries obtained their elephant stocks mainly through capture from the wild, in many instances depleting these populations to the point of local extinction (Sukumar, 1989). Even the stocks of timber camp elephants in British India and Burma during the twentieth century were built up mainly through capture as opposed to breeding (Williams, 1950; Stracey, 1963; Gale, 1974; Krishnamurthy & Wemmer, 1995). The longevity of elephants ensured that sizeable numbers were available at any point in time; there was breeding among the timber camp elephants but in most places this rarely compensated for the mortality rate.

The problems with breeding captive elephants in Asia were similar in some respects to those faced in western zoos; thus even when bulls and cows were kept together the bulls had to be restrained when they were in musth and more likely to breed. Wild bulls have sired most of the calves born to cows in timber camps because of the proximity of such camps to wild elephant populations. The overall record of breeding (as seen from per capita birth rates) in Asian timber camps has of course been far superior to that of western zoos (Taylor & Poole, 1998), although it is not comparable to breeding rates in the wild. However, the only Asian camps that have maintained an intrinsically stable or growing population, as seen from analysis of records, are some in southern India (Sukumar *et al.*, 1997). This has been achieved not only through a relatively high breeding rate but through a low sub-adult and adult mortality rate. I suspect that the dedication and competence of a few individuals made this possible. Some Burmese camps may also have a similar record of achievement but this is yet to be demonstrated (Khyne U. Mar, unpub. data).

The role of zoos in the future conservation of Asian elephants is undoubtedly debatable. On the positive side, research in zoos has provided us with a detailed understanding of the elephant's reproductive physiology and biochemistry (Hess *et al.*, 1983; Rasmussen, 1998; Brown, 2000), knowledge that is useful both for the management of elephants in Asian timber camps as well as for *in situ* conservation programmes. Some of this research could of course have been done in timber camps, but the scientific establishment in the west used a resource closer to home (work is now being undertaken in some Asian camps). The ambassadorial role of the elephant is obvious; few species have the same power to capture the attention of the public at large. The birth of an elephant calf in a zoo gives a significant boost to revenue through gate collections, and thus zoo elephants may be thought of as raising their own funds! On the negative side, the maintenance of elephants in zoos is very expensive. In spite of modern veterinary care, the overall health and longevity of elephants in zoos is poorer than in Asian timber camps. The lack of physical activity and the overweight condition of animals are probably the cause of elephants' health problems in zoos (Kurt, 1995; pers. obs.).

There is no disputing the urgent need to consolidate captive elephants into fewer, social herds. I agree with Dr. Rees that it is absurd for almost every zoo to keep elephants. It is however unfair to brand the entire community of zoo directors as lacking commitment to manage elephants in viable units. I personally know many zoo directors, and their staff, who are acutely conscious of the need to properly manage elephants in their care, of the limitations of zoos in the broader context of elephant conservation, and who are willing to work with Asian counterparts on both *in situ* and *ex situ* conservation projects. Some zoos have also supported conservation projects in Asia, although this effort has been largely in an individual capacity rather than directly from the zoo community. Much more could be achieved if zoos pooled their elephants, knowledge and financial resources to support conservation efforts in Asia.

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*Manuscript accepted 23 October 2002.*

The maintenance of elephants in western zoos must be firmly linked to conservation efforts in the elephant's range states.

The irony with captive Asian elephants is that, on the one hand, the maintenance of sufficient numbers has inevitably resulted in depletion of wild populations while, on the other, many more wild elephants are certain to be taken into captivity as field managers struggle with problems of elephant-human conflicts, fragmented habitats, non-viable herds, and even locally abundant populations. The Asian elephant has insufficient space or faces an uncertain future in several of its range states (the sorry plight of several hundred captive elephants in Sumatra is one such example), but zoos can take only a few animals each year. In other words, zoos cannot solve the problem of 'unwanted elephants' in Asia. The development of ultrasound (Hildebrandt *et al.*, 2000) and the recent success of artificial insemination may help zoos to partly overcome their problems with declining populations but this will be a costly proposition.

At several forums I have suggested that the management of captive Asian elephants has to be addressed at the global scale. Lair (1997) has provided an excellent overview of the captive Asian elephant population (updated in October 2000 at a meeting in Bangkok), but this is essentially a status report. We now need a detailed global analysis of the demography and economics of captive elephants, an analysis that looks not only at the linkages among captive populations in various situations (timber camps, zoos, temples and private ownership) but also between captive and wild populations (how many elephants are likely to be taken into captivity because of the straying of calves, the capture of problem animals or removal of non-viable herds?). Such an analysis can help us in planning for the future role of captive Asian elephants.

## References


Brown, J.L. (2000) Reproductive endocrine monitoring of elephants: an essential tool for assisting captive management. *Zoo Biology*, **19,** 347–367.

Gale, U.T. (1974) *Burmese Timber Elephant*. Trade Corporation, Rangoon, Burma.

Hess, D.L., Schmidt, A.M. & Schmidt, M.J. (1983) Reproductive cycle of the Asian elephant (*Elephas maximus*) in captivity. *Biology of Reproduction*, **28,** 767–773.

Hildebrandt, T.B., Göritz, F., Pratt, N.C., Brown, J.L., Montali, R.J., Schmitt, D.L., Fritsch, G. & Hermes, R. (2000) Ultrasonography of the urogenital tract in elephants (*Loxodonta africana* and *Elephas maximus*): an important tool for assessing female reproductive function. *Zoo Biology*, **19,** 321–332.

Krishnamurthy, V. & Wemmer, C. (1995) Veterinary care of Asian timber elephants in India: historical accounts and current observations. *Zoo Biology*, **14,** 123–133.

Kurt, F. (1995) The preservation of Asian elephants in human care – a comparison between the different keeping systems in South Asia and Europe. *Animal Research and Development*, **41,** 38–60.

Lair, R.C. (1997) *Gone Astray: the Care and Management of the Asian Elephant in Domesticity*. Food and Agricultural Organization, Rome, Italy and Bangkok, Thailand.

Rasmussen, L.E.L. (1998) Chemical communication: an integral part of functional Asian elephant (*Elephas maximus*) society. *Ecoscience*, **5,** 410–426.

Stracey, P.D. (1963) *Elephant Gold*. Weidenfeld and Nicholson, London, UK.

Sukumar, R. (1989) *The Asian Elephant: Ecology and Management*. Cambridge University Press, Cambridge, UK.

Sukumar, R., Krishnamurthy, V., Wemmer, C. & Rodden, M. (1997) Demography of captive Asian elephants (*Elephas maximus*) in southern India. *Zoo Biology*, **16,** 263–272.

Taylor, V.J. & Poole, T.B. (1998) Captive breeding and infant mortality in Asian elephants: a comparison between twenty western zoos and three eastern elephant centers. *Zoo Biology*, **17,** 311–332.

Williams, J.H. (1950) *Elephant Bill*. Rupert Hart-Davis, London, UK.

## Forum

# The welfare and conservation of Asian elephants – a reply to Sukumar

Paul A. Rees

Since my summary of the global fate of Asian elephants in zoos (this issue) was written Clubb & Mason (2002) have published a review of the welfare of zoo elephants in Europe, commissioned by the Royal Society for the Prevention of Cruelty to Animals in the UK. In an attempt to collect data on behaviour, reproduction, group composition, welfare and other aspects of husbandry, they sent questionnaires to the directors of the 18 zoos in the UK that hold elephants. Professor Sukumar doubts my contention that zoo directors lack the commitment necessary to manage the zoo elephant population as viable breeding units. Why then did none of the zoos contacted by Clubb & Mason reply?

After an extensive review of the literature and an analysis of available population data, Clubb & Mason concluded that the breeding and importation of elephants should be halted until the factors responsible for poor welfare have been investigated. They also recommended that only zoos that then solve these problems should be allowed to keep elephants in the future.

Clubb & Mason's research clearly had a welfare agenda, and they did not directly address the conservation role of zoo elephants. Students of animal welfare generally take the view that it is the welfare of the individual animal that is paramount, whereas conservationists are primarily concerned with the survival of species. Threatened species, however, are not caged mink or factory-farmed poultry. Many rare species survive in the wild only because the 'rights' of their predecessors were infringed when they were taken into captive breeding programmes. If we take a purely animal welfare approach to dealing with zoo elephants we would have to treat them all as individuals and ignore the need to prevent the extinction of the species. We could look after the welfare of the individual animals to a very high standard and let the captive breeding programmes fail.

If zoos are to continue to keep elephants they need to find a compromise that both meets welfare requirements and the conservation objectives of establishing sustainable captive populations. These objectives may have synergistic solutions because addressing welfare issues may contribute to captive breeding success. The resultant presence of young animals will create more natural social structures and be much more valuable in stimulating natural behaviour than artificial enrichment devices (Rees, 2000).

Professor Sukumar proposes an ambitious global study of the potential future conservation role of captive Asian elephants. Such an analysis would be interesting, but whether or not western zoos have a part to play is debatable. These zoos are independent institutions that cooperate in breeding programmes only by consent. Some have decided to invest in new elephant facilities, but this alone does not guarantee that they will be able to obtain more elephants in the future (from the wild or from other zoos), or that these elephants will breed. Cooperative efforts are further constrained by international law (the Convention on Trade in Endangered Species of Fauna and Flora, 1973), and according to Clubb & Mason (2002) only 67 Asian elephants were exported from Asia to European zoos between 1975 and 1999.

Those zoos which will be best placed to respond to the criticism of the animal welfare lobby and the conservation movement are likely to be those that have high husbandry standards, large breeding groups and active outreach programmes in Asia. A small number of such zoos already exist. Professor Sukumar summarizes the situation perfectly: "The maintenance of elephants in western zoos must be firmly linked to conservation efforts in the elephant's range states".

## References

Clubb, R. & Mason, G. (2002) *A Review of the Welfare of Zoo Elephants in Europe. A report commissioned by the RSPCA.* Animal Behaviour Research Group, Department of Zoology, University of Oxford, Oxford, UK.

Rees, P. A. (2000) Are elephant enrichment studies missing the point? *International Zoo News*, **47**, 369–371.

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*Manuscript accepted 25 October 2002.*