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VIEWPOINT

THE CAPTIVE POPULATION OF THE LION-TAILED MACAQUE *MACACA SILENUS* (LINNAEUS, 1758). THE FUTURE OF AN ENDANGERED PRIMATE UNDER HUMAN CARE

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Population development

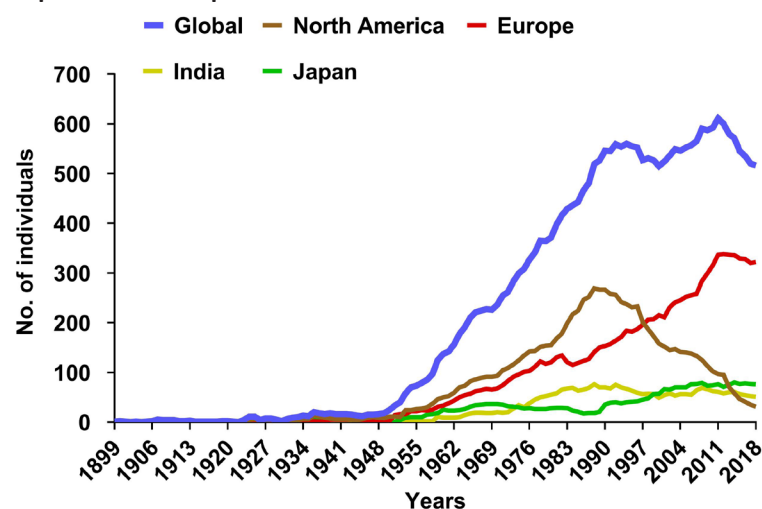


Figure 1. Development of the global historical population.

Population dynamics

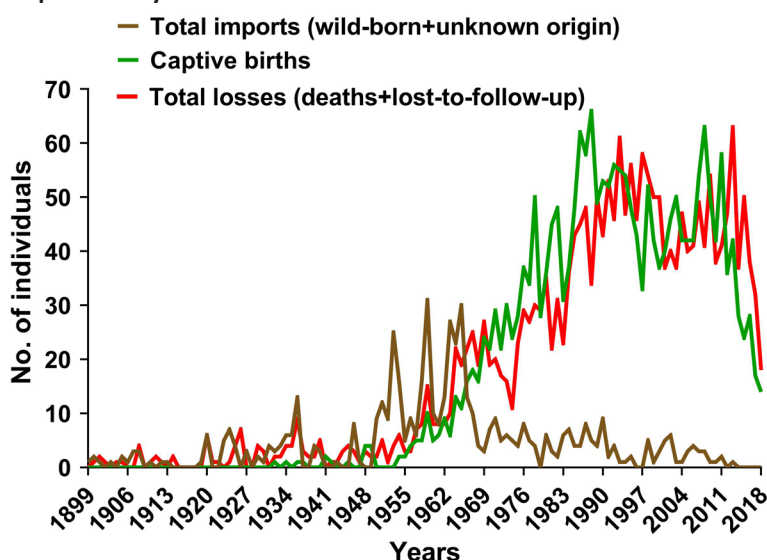


Figure 2. Annual number of imports, births and losses in the global historical population

studbook keeper Laurence Gledhill had its peak size and productivity in the decade after the start of the SSP, with about 269 individuals in 1988. Currently, there are only 31 individuals living (Sarno 2018). The reasons for the decrease were space problems, widely executed birth control measures in the 1990s, ageing, and possibly loss of interest (Lindburg 2001; Ness 2011, 2013). The Indian captive population currently comprises 51 individuals including 16 wild-born macaques. The Japanese Lion-tailed Macaque subpopulation has 76 individuals; other smaller stocks comprise 36 individuals totally.

The current global population comprises 516

individuals in 98 zoos. The wild population of the LTM at present is estimated to be about 4,000 individuals, distributed in 47 isolated subpopulations at seven locations (Singh et al. 2020), with less than 2,500 mature individuals in about 200 groups. The current captive population in 98 groups, therefore, constitutes about 11% of the global population.

The breeding programmes for the LTM always acted with a perspective on the species in the wild. The establishment of the SSP for the LTM was realised assuming that at that time only about 1,000 LTMs were left in the wild (see Hill 1971). To establish a

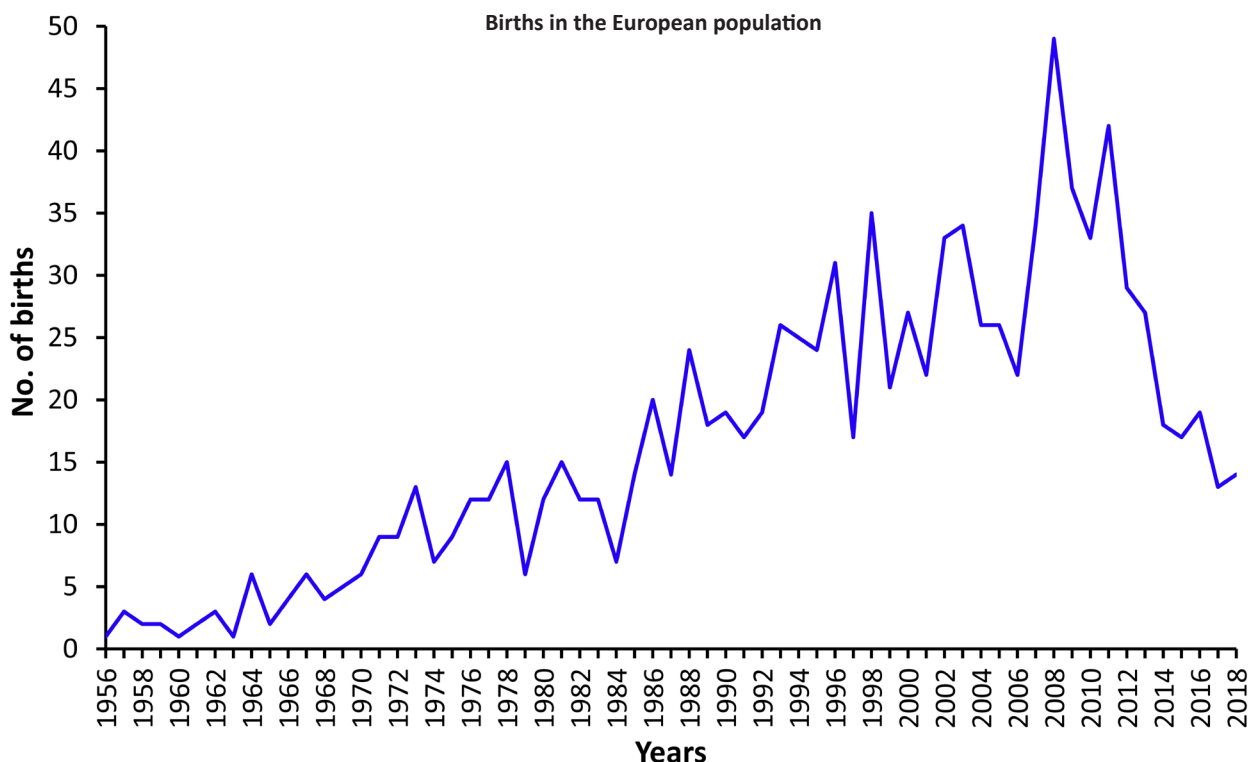


Figure 3. Annual number of births in the European population.

reserve in zoos was intended. Contacts and cooperation between American and Indian institutions were realised (including financial support for field studies). American scientists and especially Dr. Donald Lindburg, San Diego Zoological Society, contributed important studies both with reference to the biology of the species and its captive propagation (e.g., Lindburg et al. 1989; Lindburg & Gledhill 1992; Lindburg & Harvey 1996).

Almost since its establishment, the European LTM population was managed in contact with Indian wildlife biologists. Results from their studies on the wild population in its natural habitat (Western Ghats, southern India) were integrated. Since 1998 (till 2004) the annual reports for the captive population also reported on the status and other relevant aspects of the wild population. This was based on a close (ongoing) cooperation of the first EEP coordinator with Dr. Mewa Singh and Dr. Ajith Kumar. Prof. Mewa Singh, University Mysore, leading Indian primatologist, and wildlife biologist visited Germany to work on LTM matters with Dr. Werner Kaumanns since the 1990s more than 25 times. Mainly due to Mewa Singh and his working group, the conservation of the LTM became and is still an important issue in India. In addition to grants from major Indian sources, some of the studies were financially supported by German Primate Center, Volkswagen

Foundation, various American and European zoos, and private persons. Due to this work, the current status of the species and conservation needs are well known, and the Lion-tailed Macaque is one of the best-studied macaque species, both in the wild and in captivity (for an overview see Singh et al. 2009 and Kaumanns et al. 2013). In situ and ex situ studies resulted in a large number of publications that cover aspects of husbandry and management, conservation and especially many aspects of the species biology. A number of Prof. Singh's students were involved in Lion-tailed Macaque studies and will continue working for the conservation of the species. Efforts to save the LTM in India got much support through the Fifth International LTM Conference in 1999, that was organised by Mewa Singh at the University of Mysore and supported by the EEP coordinator. Two volumes (58, 59) of German Primate Center's Primate Report (Schwibbe et al. 2000, 2001) report on the results of the conference. These reports provide an overview on the status of in situ and ex situ research and captive propagation efforts for the species.

The contact with Indian colleagues, the involvement in field studies on a number of aspects of the species biology, and the resulting knowledge, significantly influenced the management of the EEP population. From the beginning of the EEP's existence, the



importance of behavioural and especially social aspects, breeding patterns and aspects of life histories were emphasised. According to Singh et al. (2006), especially considering the reproductive system and social system of the species, is the key to the conservation of the species. EEP policy strongly went for this. Although close cooperation between EEP and SSP was initiated during the Third International LTM Conference (1990) in San Diego, the programmes developed differently. In the SSP population, birth control on a large scale, based on a strict genetic management was carried out from about 1988 onwards (Lindburg & Gledhill 1992; Lindburg et al. 1997; Lindburg 2001). Figure 1 demonstrates the effects on the development of the global historical population. It also shows the latter's "recovery" (2001–2011) and a new decline from 2012 onwards. This results from a strong decrease in the number of births (Figure 2). This decrease is induced by the development of the European population (Figure 3). Birth control has been carried out there, too, to deal with space problems. Under these pressurising conditions, the EEP long-term management plan edited in 2016 (Sliwa et al. 2016) recommends further birth control measures on a large scale.

Birth control on a large scale over long periods of time to control population size, however, can have enormous risks for the survival of a population. The example of the SSP population and a number of relevant studies (Kaumanns et al. 2013; Penfold et al. 2014; Kaumanns & Singh 2015; Kaumanns et al. 2020) demonstrate possible negative consequences and elaborate ways to stop negative trends.

We are afraid that under the conditions given, the EEP population's and therefore the global captive population's, long-term survival is threatened – given the trend in population development continues and no serious changes in management are initiated soon. The 'Endangered' status of the LTM in the wild (Singh et al. 2020) with increasing fragmentation of its range of distribution and habitat destruction, strongly recommend, to continue with preserving a reserve in zoos, especially in India. Measures to stabilise the European and thus the global captive population, and new steps towards achieving its long-term survival are urgently required in order to prevent a loss of reproductive potential, like it happened in the SSP population. The European population is the only captive population that is still large and potentially productive enough to be developed further as a reserve. It seems, that space problems and other infrastructural limitations currently hinder to achieve this goal. EEP participants should consider whether all means to allow more

breeding again are *really* exhausted or whether stopping birth control or more moderate schedules are possible, at least. It is suggested that more should be done to preserve the population's breeding potential, size, and structure, with the goal to send European LTMs back to other regions and especially to their country of origin.

Zoos in India keep a small LTM population with a number of potential founders. Many zoos however report breeding problems. According to the last edition of the international studbook, totally 51 animals are kept in 10 Indian zoos, six of which keep less than three animals each. There are two zoos with more individuals – Chennai (n= 20) and Trivandrum (n= 10). These group sizes come close to group sizes in the wild. Historically, Chennai Zoo contributed to more than one-third (n= 64) of the captive births in India (n= 185) and between 2003 and 2018, it contributed to 75% (n= 45) of births in Indian zoos (n= 60) in this period. This might be due to an accumulation of husbandry know-how, personnel experience, and constancy in the management system. Delhi Zoo played an important role in the past by contributing to 49 births, many of them in the 1970s–80s. Judging from the experiences in the European breeding programme, successful breeding requires allowing groups to grow undisturbed, to larger sizes of around 20 individuals with differentiated demographic structures that allow the females to live permanently in their natal groups and to maintain strong social bonds (female-bonded system; see Kumar 1987). This would allow intergenerational overlap and to acquire the necessary social and cognitive competence to interact properly in a complex social system and to raise offspring (Kaumanns et al. 2013). According to field observations, only the males are the mobile elements of the Lion-tailed Macaque social system (Kumar 1987; Kumar et al. 2001). Under captive conditions only males should be transferred between groups (for details see Kaumanns et al. 2006). More information derived from the studies in the wild (e.g., Kumar 1987; Krishnamani & Kumar 2000; Umapathy & Kumar 2000; Sharma 2002; Sushma 2004; Singh et al. 2006) is available to be used in designing keeping systems for the species. It refers to the species' arboreal life, selective and individualised foraging on diverse plant and animal species, seasonal variations in diet, large time spent in foraging and exploration, maintenance of large interindividual distances, low reproductive turnover, and a number of special features of the reproductive system. Many aspects have been emphasised for the management of the species in the international breeding programmes. Their consideration would also support successful breeding in the country

of origin especially with its advantage of natural living conditions, availability of native food plants and large open-air enclosures.

The Indian zoo community is interested in building up a larger, more productive population in cooperation with the European Breeding Programme (Govindhaswamy Umapathy, pers. comm. 03.viii.2020). This constellation provides a chance to develop perspectives and solutions for problems on both sides. A cooperation could provide spaces for Lion-tailed Macaques from European zoos. Even more importantly, a larger and productive Indian population supported both in terms of animals and know-how from Europe could serve as an interface between the captive and the wild populations. It could be used for a number of conservation purposes – including providing animals for reintroductions in the long run. The establishment of an “Indo-European Lion-tailed Macaque reserve population” would require careful planning. An integrated (One-Plan) approach needs to be developed that aims at the integration of the know-how on the species and the conservation-oriented research interests as provided by the above-mentioned Indian scientists and their institutions. It furthermore should aim at the development of the infrastructural conditions in selected Indian zoos as required for an appropriate management and husbandry aiming at conservation breeding (for a more elaborated outline on this topic see Singh et al. 2012). Research institutions, selected Indian zoos in the range states of the species (like Chennai, Trivandrum, and Mysore) and the EEP should cooperate closely. A small board of experts from these institutions should be established to guide and supervise the project. Previous attempts to establish a breeding programme for the LTM in India and to transfer breeding groups from the USA and from Europe did not work out well due to bureaucratic issues and difficulties with local competence and motivation (see also Krishnakumar & Manimozhi 2000; Singh et al. 2009). The proposed new approach should be designed such that corresponding problems are minimised. It is of particular importance to ‘institutionalise’ captive propagation of the LTM in its country of origin more strongly. It should include to choose a competent coordinator who permanently overlooks and organises the work above the level of individual zoos and is supported by the Central Zoo Authority of India. A successfully carried out project would also serve as a model for other species and co-operations. It could help to establish Indian zoos as important partners in metapopulation management programmes especially concerning endemic Indian species like the LTM. It is important to note thereby,

that time is running out for the development and establishment of international metapopulation management programmes (see Macdonald & Hofer 2011; Powell et al. 2019). They are needed to overcome the sustainability problems threatening many captive populations. Many of them are shrinking for instance due to breeding problems. In terms of climate, available space, and other resources, a number of zoos in India could establish very good keeping systems for the LTM. As elaborated by Singh et al. (2012), conservation breeding in Indian zoos, however, still requires a serious change in professional attitudes, training opportunities and infrastructural requirements. The future of the global captive population of the LTM, for instance, may depend on progress there.

Many zoos and many dedicated people in several countries worked for the survival of the LTM in the wild and for the establishment of a reserve population under human care over many decades. They achieved a lot. Currently, much of what has been achieved with the captive population is at risk. To allow a development ending with a captive LTM population without much breeding and thus with a low conservation potential would be against professional standards and simply sad.

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