

NATIONAL STUDBOOK

Stump Tailed Macaque (*Macaca arctoides*)

Published as a Technical Report of the Central Zoo Authority sponsored project titled
“Development and maintenance of studbooks for selected endangered species in Indian zoos”

Data: Till December 2013

Published: March 2014

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STUMP TAILED MACAQUE (*Macaca arctoides*)

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Citation: Nigam P., Nilofer B., Srivastav A. & Tyagi P.C.(2014) National Studbook of Stump-tailed Macaque (*Macaca arctoides*), Wildlife Institute of India, Dehradun and Central Zoo Authority, New Delhi.

FOREWORD

For species threatened with extinction in their natural habitats ex-situ conservation offers an opportunity for ensuring their long-term survival. This can be ensured by scientific management to ensure their long term genetic viability and demographic stability. Pedigree information contained in studbooks forms the basis for this management.

The Central Zoo Authority (CZA) in collaboration with zoos in India has initiated a conservation breeding program for threatened species in Indian zoos. As a part of this endeavor a Memorandum of Understanding has been signed with the Wildlife Institute of India for compilation and update of studbooks of identified species in Indian zoos.

As part of the project outcomes the WII has compiled the studbook for Stump tailed macaque (*Macaca arctoides*) in Indian zoos. The recommendations contained in the studbook will form the basis for the long term management of the species in captivity. It is hoped that the zoos will adopt the recommendations and keep the WII informed of changes in their populations to enable the timely update of the studbook.

(B.S. Bonal, I.F.S.)
Member Secretary
Central Zoo Authority

ACKNOWLEDGEMENTS

This Studbook is a part of the assignment to the Wildlife Institute of India, Dehradun assigned by the Central Zoo Authority, New Delhi, for the development and maintenance of studbooks of selected endangered species in Indian zoos.

The authors thank the Central Zoo Authority for financial support and the opportunity to compile the National Studbook for Stump tailed macaque, especially Shri. B.S. Bonal, Member Secretary, CZA and all the staff members of the Central Zoo Authority for facilitating this work.

The authors wish to thank the Central Zoo Authority for financial support and the opportunity to compile the National Studbook for Phayre's leaf monkey, especially Shri. B.S. Bonal, Member Secretary, Dr. Brij Kishor Gupta, Evaluation and Monitoring Officer and Dr. Devendra Thakur, Scientific Officer of the CZA and all the staff members of the Central Zoo Authority.

We are thankful to Dr. V.B. Mathur, Director WII and Dr. P.K. Mathur, Dean Faculty of Wildlife Sciences, WII for their valuable advice and support. We also thank Mr. Virendra Sharma and Mr. Mukesh Arora for providing secretarial assistance and in formatting this document.

We acknowledge the support from zoo directors, biologists, curators and veterinarians from the following contributing zoos for providing pedigree information that led to the successful establishment of the studbook.

Alipore Zoological Garden, Kolkata
Aizawl Zoological Park, Aizawl
Assam State Zoo cum Botanical Garden, Guwahati
Aurangabad Municipal Zoo, Aurangabad
Bokaro Steel Plant Zoo, Bokaro
Indira Gandhi Zoological Park, Visakapatnam
Kamla Nehru Zoological Garden, Ahmedabad
Kanpur Zoological Park, Kanpur
Lady Hydari Park Animal Land, Shillong
Lucknow Zoological Garden, Lucknow
Mahendra Chaudhury Zoological Park, Chhatbir
Manipur Zoological Garden, Imphal
National Zoological Park, New Delhi
Nehru Zoological Park, Hyderabad
Sanjay Gandhi Biological Park, Patna
Sayajibaug Zoo, Vadodara
Sri Venkateswara Zoological Park, Tirupati

Authors

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Stump Tailed Macaque (*Macaca arctoides*) I. Geoffroy, 1831

Species Biology

The stump-tailed macaque, also called the bear macaque, is a primate species found in South Asia including north-east India. They have long, thick, dark brown fur except for a naked face and short tail. Primarily frugivorous, they however also feed on many types of vegetation, such as seeds, leaves and roots, and small animals such as freshwater crabs, frogs, bird eggs and insects.

Taxonomy

Phylum	Chordata
Subphylum	Vertebrata
Infraphylum	Gnathostomata
Superclass	Tetrapoda
Class	Mammalia
Subclass	Theria
Infraclass	Eutheria
Order	Primates
Family	Cercopithecidae
Subfamily	Cercopithecinae
Type	<i>Macaca arctoides</i>
Species Authority	(I. Geoffroy Saint-Hilaire, 1831)



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Stump-tailed macaques (*Macaca arctoides*) are one of the most distinctive species among macaques, and their phylogenetic position has been controversial (Delson 1980; Fooden 1976; Hayasaka *et al.* 1996; Tosi *et al.* 2003). Based on morphological characteristics, Fooden (1980) classified macaques into four species groups: *silenus-sylvanus* group, including Barbary (*M. sylvanus*), lion-tailed (*M. silenus*), and pig-tailed macaques (*M. nemestrina*) and species of Sulawesi macaques (*M. nigra* and *M. tonkeana*); *sinica* group, including toque (*M. sinica*), bonnet (*M. radiata*), Assamese (*M. assamensis*), and Tibetan macaques (*M. thibetana*); *arctoides* group, including stump-tailed macaque (*M. arctoides*); and *fascicularis* group, including Japanese (*M. fasciata*), rhesus (*M. mulatta*), Taiwanese (*M. cyclopis*), and crab-eating macaques (*M. fascicularis*). Delson (1980) modified the classification by removing *M. sylvanus* from *silenus* group to form a sister taxon to all of the Asian groups and suggested that *M. arctoides* should be included in the *sinica* group since modifications of the glans penis in *M. arctoides* represent an extreme of the sagittate form already present in the *sinica* group.

There has been an unusual discrepancy regarding the position of *M. arctoides* between the mtDNA and the nuclear DNA topologies. Studies based on mtDNA data indicate that *M. arctoides* is more closely associated with the *fascicularis* group than the *sinica* group and should be classified into the

fascicularis group (Hayasaka et al., 1996; Tanaka and Takenaka, 1996; Morales and Melnick, 1998; Tosi et al., 2003; Li and Zhang, 2005). On the contrary, macaque phylogenetic analyses based on nuclear DNA markers, including Y-chromosomal and autosomal genes, are in agreement with morphological studies in assigning *M. arctoides* to the *sinica* group (Tosi et al. 2000, 2003; Deinard and Smith, 2001).

Tosi et al. (2000, 2003) suggested a possible hybrid origin of *M. arctoides*. They concluded that extensive hybridization between proto- *M. assamensis/thibetana* and proto- *M. fascicularis* in a Pleistocene forest refugium may have given rise to a unique entity that is *M. arctoides*. A study based on Alu insertions by Li et al. (2009) also supports a close relationship between *M. arctoides* and the *sinica* group.

Morphology

Stump-tailed macaques (*Macaca arctoides*) have a variety of pelage colours in different shades of red, brown, and black (Fooden 1990). Based on pelage colour and geographical distribution, Lekagul and McNeely (1988) classified them into 2 subspecies: northern populations from southern China to northern Thailand, with bright brown pelage — *Macaca arctoides arctoides*— and southern populations, that inhabit the lower latitudes of Southeast Asia, with black pelage- *M. a. melanota*. However, different colour variants in *Macaca arctoides* have been seen to coexist within same populations of southern (Fooden 1990) and western Thailand (Malaivijitnond and Hamada 2005) and hence have not been classified as sub species (Fooden 1990; Koyabu et al. 2008).

Newborns have pale pink faces, but become dark red or black as they age (Malaivijitnond and Hamada 2005). Adult macaques are hairless on their hands, feet, faces and stumpy hamster-like tails. Older stump-tailed macaques, like older humans, suffer from baldness on their heads.

Males are larger and heavier than females. Males grow up to 10.2 kg while females weigh 7.5 kg. Males grow to 25.59 inches long (58.5 cm) while females are 19.09 inches (48.5 cm). Tail lengths vary considerably, irrespective of gender. Tails have been recorded with lengths from 1.26 to 2.72 inches (32 to 69 mm) Males also sport prominent canine teeth, which they bare at intruders and rival males.

Distribution

Stump-tailed macaques (*Macaca arctoides*) have been reported to be distributed primarily in the hilly areas of Southeast Asia, ranging from southeast of the Brahmaputra river, in north eastern India (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, and Tripura provinces), to northern Myanmar, and south western China (Guangdong, Guangxi, Guizhou, and Yunnan provinces) and throughout Thailand, Lao PDR, Vietnam, Cambodia, north western Malaysia (Htun et al. 2008). Stump-tailed macaque populations are thought to be absent from most parts of Thailand (Htun et al. 2008) and appear to be locally extinct in Bangladesh (Molur et al. 2003). It was last recorded in 1982 and 1989 and field studies since then have not revealed their presence (Molur et al 2003).

Srivastava and Mohnot (2001) and Chetry *et al.* (2003) report possible records of the species from Namdapha National Park, though they were morphologically distinct from other representatives of the species, and could represent an undescribed subspecies (Htun *et al.* 2008).

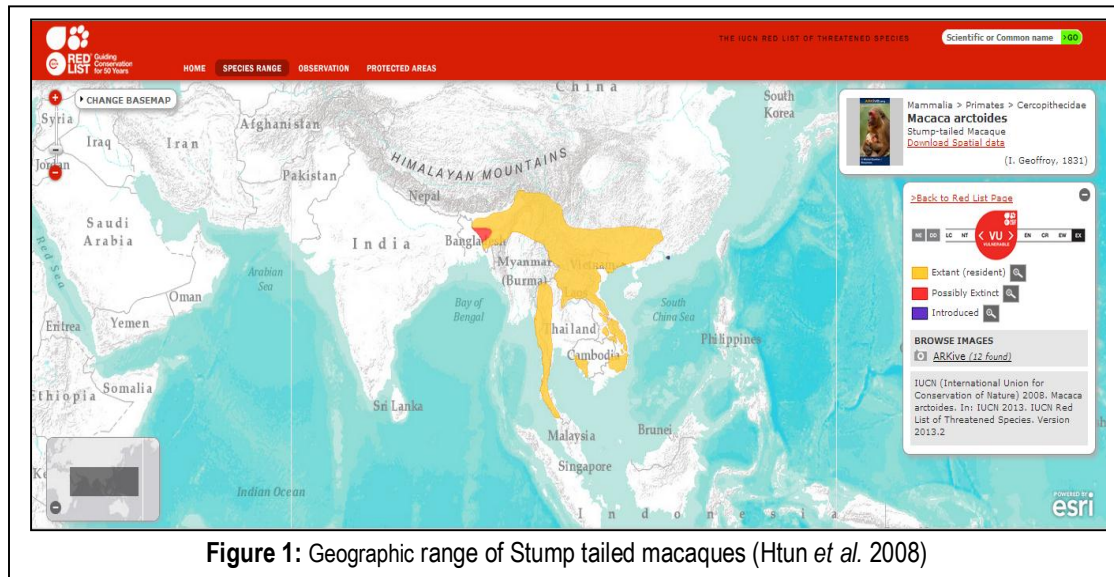


Figure 1: Geographic range of Stump tailed macaques (Htun *et al.* 2008)

Habitat

The natural habitat of Stump-tailed macaques consists of subtropical and tropical broadleaf evergreen forest (Fa 1989). They are found in lowland forests, monsoon forests, dry forests and mountain forests of India, which are upto 2000 m in altitude. Stump-tailed macaques are sympatric with long-tailed macaques in the Wat Tham Khao Daeng National Park in Thailand and use the same provisioned food resource (Malaivijitnond and Hamada 2005). They are known to be sympatric with four other species of macaques (*M. fascicularis*, *M. mulatta*, *M. assamensis* and *M. nemestrina leonina*) found in Thailand (Fooden 1982, Fooden 1990). He considered that the sympatry between stump-tailed and long-tailed macaques was facilitated by ecological habitat separation. Stump-tailed macaques are restricted to the broadleaf evergreen forest, while the long-tailed macaques inhabit the non-broadleaf evergreen forest (Fooden 1982). No interspecific association between the two species has been observed at Wat Tham Khao Daeng, although they fed at the same site within a very short time interval of one another (Malaivijitnond and Hamada 2005). It was reported that in the provisioned situation long-tailed macaques appeared to avoid the stump-tailed macaques.

Behavioural ecology

Activity patterns

Stump tailed macaques are considered arboreal as well as terrestrial, and are diurnal in habit. They feed primarily on seeds and fruits. They spend the early morning, until midday, travelling and feeding. In the afternoon they stop to take rest in the shade, spending time on social activities such as grooming while juveniles and adolescents play (Fooden *et al.* 1985). Home range is unknown but thought to be

several square kilometres (Srivastava 1999). Though they spend the majority of the day travelling on the ground, usually along the banks of rivers and streams, stump-tailed macaques also forage for fruits and leaves and flee to trees when in danger (Fooden 1990).

Foraging and feeding behaviour

Stump tailed macaques feed on fruits, seeds, insects, small vertebrates and young leaves (Smith *et al.* 2008). As in other macaques they possess cheek pouches to carry food while foraging. The Mexican stumptails hunt spiders, worms, snails, insects, frogs, lizards, birds and field mice and also search out turtle and bird eggs (Fooden 1990). They are also known to raid crops preferring corn and other cultivated fruits. Foraging takes place starting in the morning through midday. Foraging begins again in the late afternoon as they travel to their sleeping site, usually large trees or cliffs. The daily range of stump-tailed macaques is between two and three kilometres, but is restricted during the rainy season when food is in abundance.

Social and breeding behaviour

Stump-tailed macaques (*Macaca arctoides*) live in multimale, multifemale social groups with troop sizes varying from 10 to 60 individuals (Fooden 1990). They live in female bonded social groups with the core of the group consisting of related females that develop preferential relationships and support each other during conflicts (Thierry 2007). Neighbouring groups have typically overlapping home ranges, females form kin-bonded subgroups (or matriline) within their natal groups and most males usually disperse at sexual maturity (Thierry 2007).

Stump tailed macaques show extreme variability in social behaviour, especially in sexual behaviour (Chevalier-Skolnikoff 1974). Grooming behaviour is correlated with dominance rank, and adults holding adjacent ranks tend to interact with each other more (Estrada 1976). Male grooming of the female is lowest before menstruation, and female grooming of the male declines sharply after ovulation.

In stump tailed macaques, both sexes solicit mating (Chevalier-Skolnikoff 1975). A male solicits a female by approaching and staring at her and displaying teeth chattering facial expression (Brereton 1989). A female solicits by approaching a male and presenting her hindquarters, while maintaining eye contact throughout.

Stump tailed macaque is an exception to the *Macaca* genus, as females of this species lack prominent sexual swellings (Fooden 1990). The loss of sexual swellings in female Stump tailed macaques could be a strategy to confuse paternity, or an attempt to reduce the energetic cost of maintaining the trait, as suggested by Fooden (1990) and or alternatively to decrease chances of infanticide (Hrdy1979). Despite the lack of sexual swellings, males are able to detect the female receptive phase, made obvious by an increase in copulations and male–male agonistic encounters (Shively *et al.* 1982; Murray *et al.* 1985). Although females lack specialized glands near the perineal region to signal their reproductive status chemically (Fooden 1990), male stump-tailed macaques are able to detect female

reproductive phases through chemicals within vaginal secretions, as well as through behavioural solicitations (Cerdeña-Molina *et al.* 2006). A large amount of time is spent by males in inspection—visual, oral, olfactory, and/or tactile—of the females' perineal region (Bertrand 1969; Fooden 1990).

Menstrual cycle in stump tailed macaques last for 28 days and most males copulate throughout almost the entire menstrual cycle, with the α males monopolizing to a greater extent their access to females during the periovulatory period (Murray *et al.* 1985)

Males are single mount ejaculators and they lip-smack and bark while mounting. Copulation is divided into 3 phases, the pre ejaculatory, ejaculatory and post ejaculatory phases (Chevalier-Skolnikoff 1975). During copulation, adult as well as sub-adults (in particular) of both sexes, tend to harass the copulating pair (Gouzoules 1974). Besides copulation, stump tailed macaques display greater variety of socio sexual behaviour than other macaque species, such as sniffing, fingering, and mounting of the perineal region, probably since they have to rely mostly on non-visual cues to assess female reproductive status (Linnankoski *et al.* 1981).

Males are extremely tolerant to infants, while the latter show no fear toward males (Estrada 1984). Adult males in captivity have been seen to lip smack at infants (Blurton-Jones and Trollope 1968) and they often use infants to regulate their relationship with other troop members, especially during fights, also termed as “agonistic buffering” (Gouzoules 1975). Infant care by males is inversely related to the age of infants (Estrada 1976). In stump tailed macaques infants generally hold dominance ranks immediately lower than their mothers and these dominance patterns often guide the course of infant care by males (Mitchell 1979). However, infanticide in captive conditions have been reported by Solanki and Zothansiana (2013), whereby the infanticidal β -male mated with the victim's mother and increased its chances to sire the subsequent infant.

Stump tailed macaques display a variety of visual and tactile signals. Most gestural signals in Stump tailed macaques are associated with dominance and submission rather than social bonding (Maestripietri 1996). Hind quarter presentation is a common form of gestural communication, displayed mostly by sub-ordinates to appease dominant members. Other forms of submissive signals include bared-teeth, lip-smack, teeth-chatter, and presenting their arm to be gently bitten off to communicate submission to a dominant individual (Estrada *et al.* 1977). Aggressive behaviour is often displayed by mock biting, while female bonding is displayed by a ventro-ventral embrace. Other forms of behaviour indicating dominance, submission or protection are non-thrusting mount, hip touch, hip clasp, and genital manipulation. Stump tailed macaques respond to the presence of predators through alarm calls (Estrada and Estrada 1976).

Fooden *et al.* (1985) reported that Stump tailed macaques in Yunnan, China mated throughout the year with a peak in October-November, and births in May-June. In India, mating in captive Stump tailed macaques have been reported to peak during October to December and is negligible during April to

May. However, lack of a seasonal mating cyclicity has been reported by studies on birth patterns in stump-tailed macaques living under laboratory or free ranging conditions (Smith 1984). The average age at first reproduction is 4.9 years and they have an average gestation length of 176.6 days (Nieuwenhuijsen *et al.* 1985).

Table 1: Life history traits of Stump tailed macaques

Mating System	Polygynandrous (promiscuous)
Age at sexual maturity	4.9 years in captivity (Nieuwenhuijsen <i>et al.</i> 1985)
Breeding season	Non-seasonal (Smith 1984)
Number of offspring	1 (Smith <i>et al.</i> 2008)
Average gestation period	176.6 days (Nieuwenhuijsen <i>et al.</i> 1985)
Inter birth interval in captivity	23 ± 2 months (Solanki and Zothansiana 2013)
Weaning age	7 months (Nieuwenhuijsen <i>et al.</i> 1985)
Lifespan	maximum longevity in captivity 29.2 years (Weigl 2005); have shorter life spans in the wild (Choudhury 2002)

Population status in the wild

Populations in South Asia and in Myanmar are few and fragmented (Molur *et al.* 2003). The species is suspected to be extinct in Bangladesh, having last been recorded there in 1989. It is very scarce all over its range in north-eastern India (Choudhury 2001). However, it is common in the mountains of Nagaland, Manipur, and eastern Mizoram (Choudhury 2001). In China the species is still common in Yunnan, though the populations are thought to be lower in the eastern portions of its range (Zhang *et al.* 2002). Populations of this species are critically threatened in India, declining in Myanmar, stable in Thailand, and declining rapidly in China and Viet Nam. There are some declines in Lao PDR and Cambodia. Future declines are predicted to be faster in Lao PDR, Viet Nam, India, Myanmar and China due to habitat loss and/or hunting.

Threats and conservation status

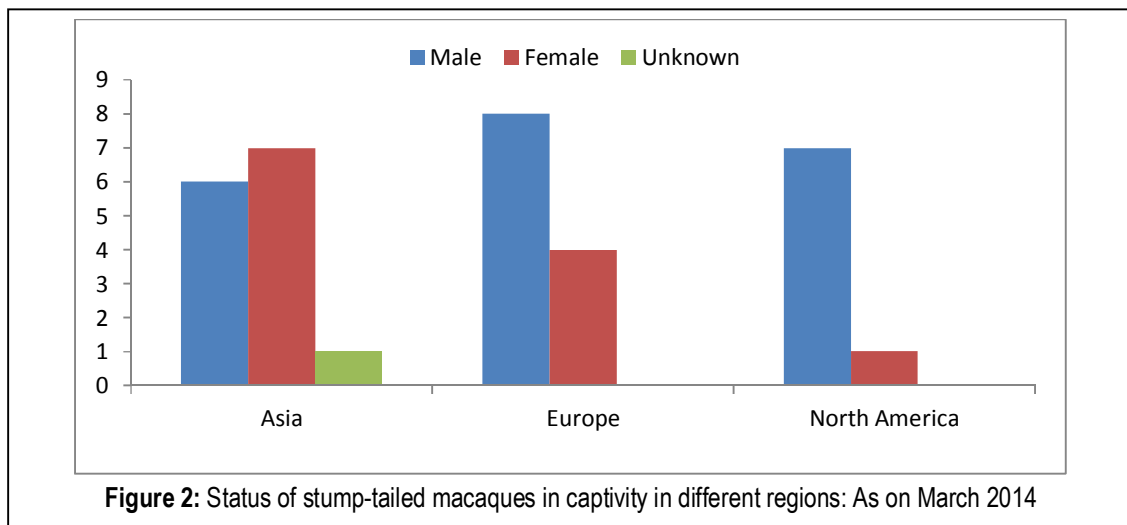
Major threats to *M. arctoides* throughout its range were reported to be habitat disturbances (such as selective logging, timber and firewood collection for charcoal and infrastructure development), hunting for food, sport and traditional medicine, and accidental mortality due to trapping (Molur *et al.* 2003; in: Htun *et al.*, 2008).

Macaca arctoides has been listed in CITES Appendix II since 1977. Globally, reported trade in *M. arctoides* 2000-2007 was also low, consisted primarily of live animals for circuses, travelling exhibitions and zoos, and specimens for scientific and biomedical research. The only reported trade in live, wild-sourced animals was the import of four *M. arctoides* by Mexico from Cuba in 2003.

It is listed as Vulnerable in the IUCN Red List of threatened species (2008), due to reduction in the past and projected decline by at least 30% over the coming 30 years (three generations) due to primarily hunting and continued rates of habitat loss (mainly as a result of logging and timber extraction) (Htun *et al.* 2008). Roonwal and Mohnot (1977) considered that *M. arctoides* was uncommon all over its range (Southwick and Siddiqi, 1970). Htun *et al.* (2008) reported that populations in South Asia and in Myanmar are few and fragmented (Molur *et al.*, 2003) and that the overall population trend of the species was decreasing'. According to surveys of the Indo-US Primate project, NE centre, the species has been categorised as Critically Endangered (Walker and Molur 2004).

Status in captivity

Globally, Stump tailed macaques are maintained in captivity in 19 institutions across three regions- Asia, Europe and North America. A total captive population of 38 individuals (16: 14: 1 and 7 in groups) have been recorded in Zoological Information Management System (ZIMS) (Figure 2). This record includes information from 3 zoos (Lucknow, Patna, Tirupati) in India. Based on the data obtained from Indian institutions, the National studbook records 45 living individuals (23: 21: 1) housed at 10 institutions. The ZIMS record has not been updated by many holding institutions from India due to which there is a disparity in the number of individuals recorded in ZIMS and that in the National studbook.



The National studbook presents information on the total population of Stump tailed macaques housed in Indian zoos during the period of 1974-2014. A summary of the institutions to have housed the species in captivity are provided in Appendix 1. The median number of individuals housed at each zoo is 1.5 (4.4±6.8).

Table 2: Status of Stump tailed macaques in Indian zoos (March 2014)

Location	Total	Living	Time span in each zoo (Duration/no. of years)	Births	Deaths
Ahmedabad	3.2.0	0.0.0	1978-97 (20)	0.0.0	2.1.0
Aizawl	12.11.0	12.11.0	2003-14 (12)	8.7.0	0.0.0
Assam	4.6.0	3.4.0	1992-14 (23)	2.4.0	1.2.0
Aurangabad	1.0.0	0.0.0	1995-09 (15)	0.0.0	1.0.0
Bokaro	1.1.0	1.0.0	1992-14 (23)	0.0.0	0.1.0
Calcutta	1.0.0	0.0.0	1995-97 (3)	0.0.0	1.0.0
Chatbir	7.3.0	1.0.0	1984-14 (31)	2.0.0	3.2.0
Delhi	1.1.0	1.1.0	2004-14 (11)	0.0.0	0.0.0
Hyderabad	5.5.0	0.0.0	1985-93 (9)	0.1.0	0.1.0
Kanpur	4.4.0	0.0.0	1974-00 (27)	1.2.0	4.3.0
Lucknow	2.2.0	1.2.0	1998-14 (17)	0.0.0	1.0.0
Manipur	1.1.0	0.0.0	1995-08 (14)	0.0.0	1.1.0
Patna	2.2.0	2.2.0	1998-14 (17)	0.1.0	0.0.0
Shillong	1.3.1	0.1.1	1994-14 (21)	0.0.0	1.1.0
Tirupati	2.3.0	1.0.0	1993-14 (22)	0.0.0	1.3.0
Vadodara	1.1.0	0.0.0	1987 (1)	0.0.0	0.0.0
Visakapatnam	2.1.0	1.0.0	1986-14 (29)	0.0.0	0.0.0

Methods

Pedigree data was collected by means of mailed questionnaires, zoo visits and from the websites of CZA and ZIMS (Zoological Information Management System). Questionnaires were sent to various institutions housing Stump tailed macaques in India, requesting information about each captive specimen. Data was entered in the Single Population Analysis and Records Keeping System (SPARKS v 1.66) (ISIS, 2004) and subsequently exported to population management program PMx v 1.2 (Ballou *et al.* 2010). Data was exported from SPARKS as *Exchange.csv* and *PMxCensus.csv* files which were then used as input files in PMx for further analysis. Further visualization and analysis of pedigree data was performed using the program Lineage v 1.06 (Pollak *et al.* 2001).

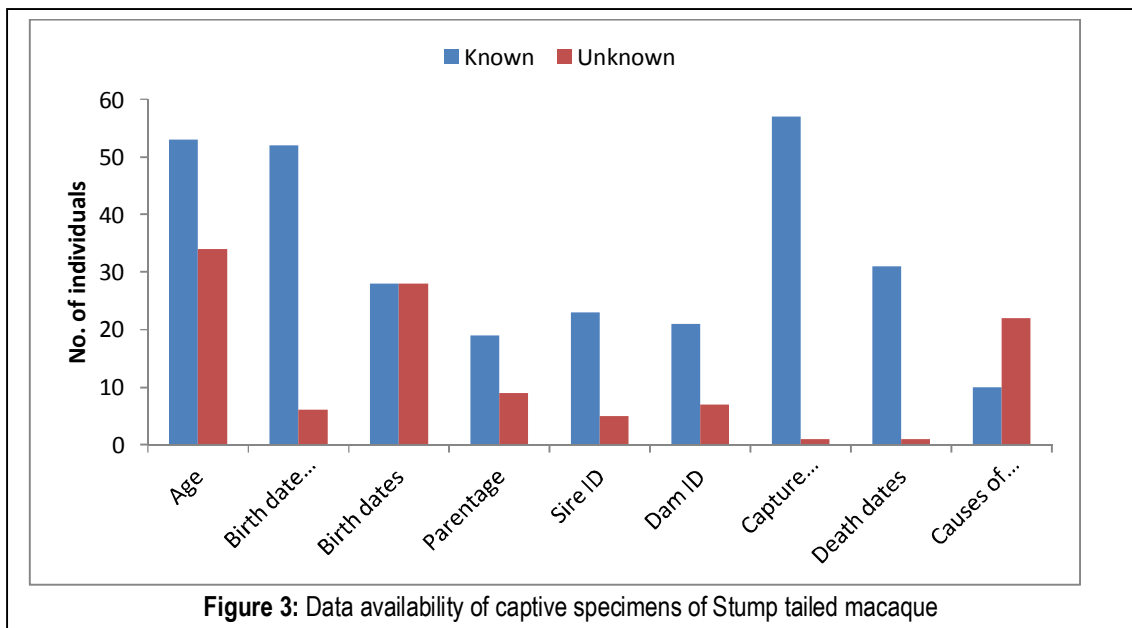
Analysis

Data quality

The questionnaire response varied from the 25 zoos housing the species since its entry to captivity in Indian zoos. However; data was available from 17 (Table 2) of these zoos. Birth date estimates for wild-born specimens were available for only 6 individuals and complete parentages were recorded for 19 out of 28 captive births. A total of 10 individuals (6:4) were lost to follow up. Due to the small population size and the small sample size of known age individuals in the captive population life table and detailed demographic and genetic analysis could not be carried out.

Data deficiency for construction of life tables

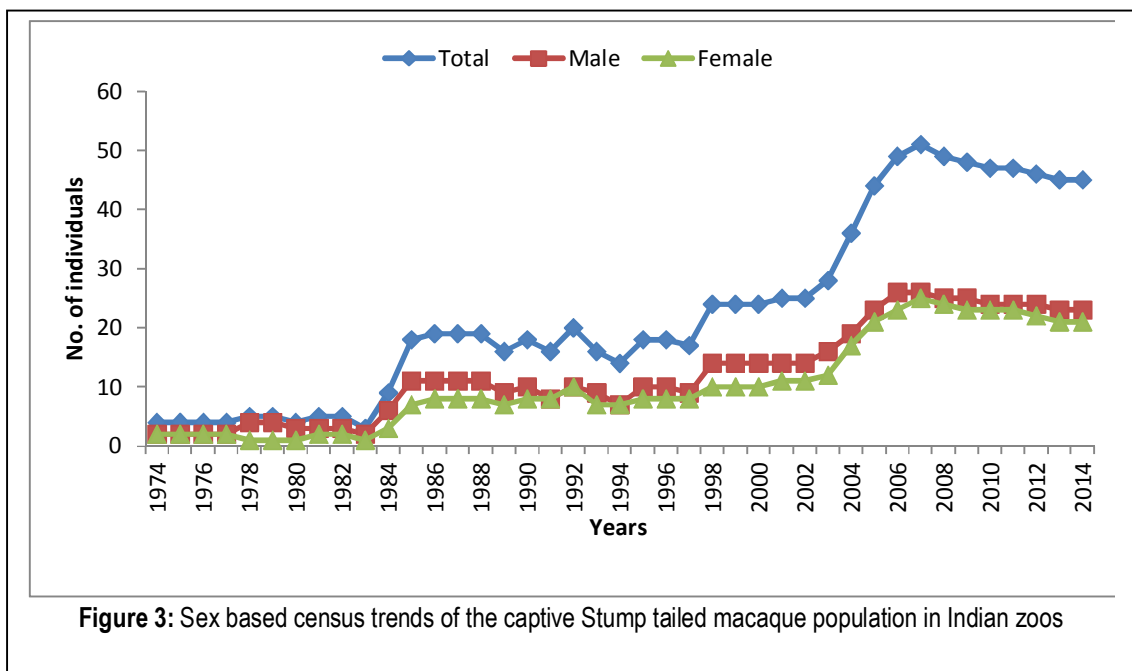
Data for 34 out of 87 individuals was amenable to life table analysis the basis of detailed demographic analysis of captive populations. Of these 6 were wild-born and 28 were captive-born individuals. The age distribution of the individuals for which data was used for life table ranged between 0 to 7 individuals for each age class. The validity of life table analysis by population management programs like PMx depend on adequate sample sizes, accuracy of birth and death dates, parentage information and a minimum representation of 30 individuals (living+ dead individuals) in the different age classes (Traylor-Holzer 2011) so that the population's history in captivity is accurately identified.



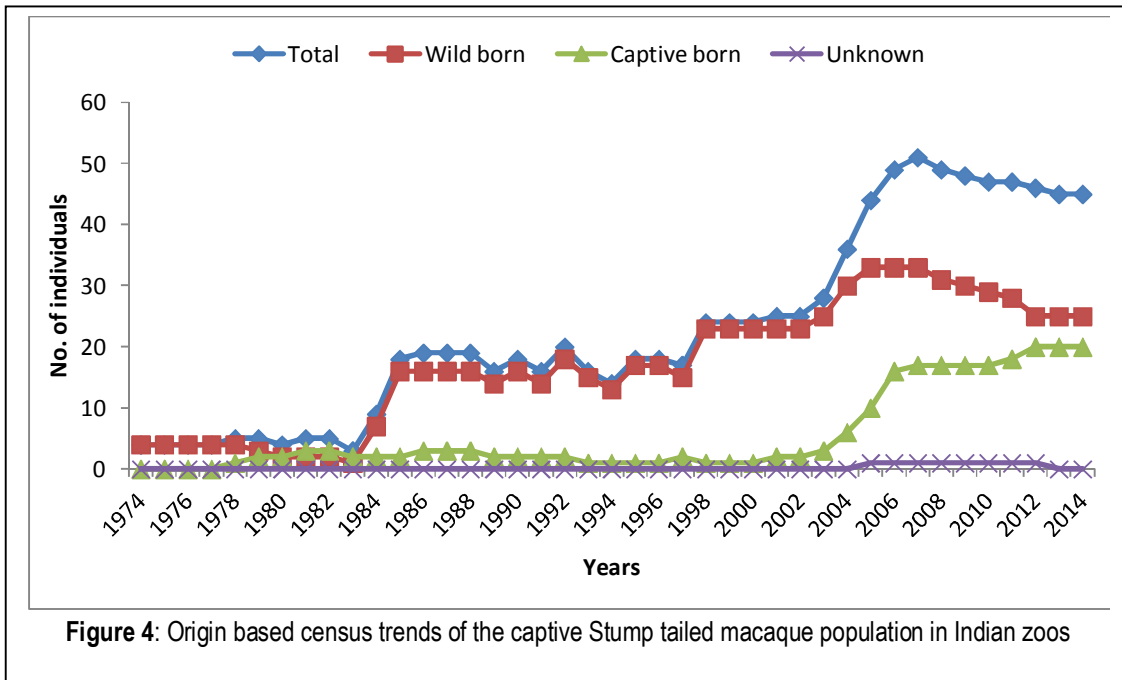
The results for select demographic and genetic parameters are provided in the following sections.

Historical population

The captive population was initiated with 4 individuals housed at Kanpur Zoo in 1974 and the first birth was documented there in 1978. The Studbook records a historical population of 87 individuals (45: 41: 1). Of these 58 were wild-born (32: 25: 1), 28 (13: 15: 0) were captive-born, and 1 (female) was an unknown origin individual. The historic listing of the individuals is provided in Appendix I.

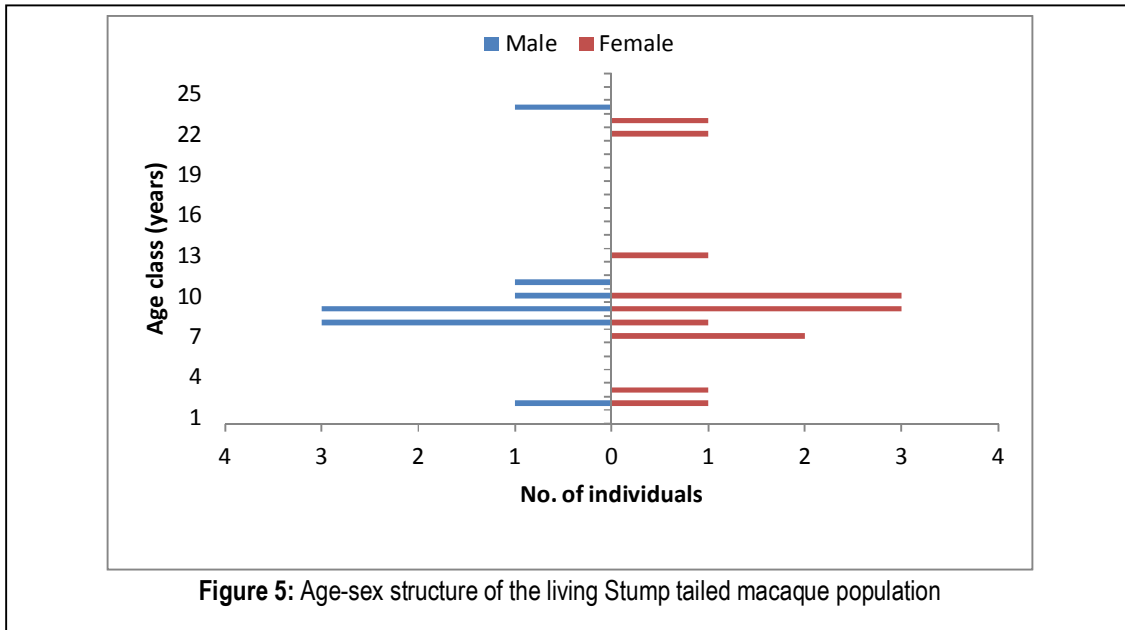


The sex and origin based census trends over the years respectively are represented in the figures 3 and 4. The figures show the population trends since its inception 1974. The population remained small during the initial 10 years in captivity with a median of 4 individuals (4.3 ± 0.67). The growth observed in the population from 1984 to 2004 was mainly due to acquisitions from the wild. During this period, more than 50% (48 individuals) of the total population were acquired from the wild. Post 2004, acquisitions from wild reduced considerably, only 5 individuals were added during 2005 and 2014. The captive population gradually reached a maximum of 51 individuals in 2007, but has declined thereafter.



Living population

The living population consists of 45 individuals (23: 21: 1) of which 55.55% (25) are wild-born and 44.44% (20) are captive-born individuals. Birth dates were available for all the 20 births and birth date estimates were available for 4 wild-born individuals. The age – sex distribution of these individuals is shown in Figure 4.



The age distribution reveals that 12.5% (3) of the individuals are in the pre reproductive age class (age 0-3 years), 75% (18) of the individuals are in the reproductive age class, with 25% in their early reproductive ages (age 4–7 years) and 50% in the late reproductive ages (age 8–12 years) and 12.5% (3) in the post reproductive age class (age 20-25 years). Only 12 individuals (7 males, 5 females), or 27% of the current population, have bred in the past. Of these, 1 is captive-born and 11 are wild-born; which means, 14 wild-born individuals of the current population are yet to contribute to reproduction.

Captures, births and mortality

A total of 58 wild-born individuals (32: 25: 1) were added to the population with a mean of 1.45 ± 2.36 individuals per year. Of these 8 individuals were lost to follow up. Records on the age at capture were not available for 90% (52) of the wild-born individuals but capture dates indicated that wild-born individuals spent a median of 10 years (11.7 ± 7.35) years in captivity. The sexual proportion of wild-born individuals was 1.28:1.

A total of 28 births (13: 15: 0) were recorded during 1974 and 2014, of which 2 were lost to follow up. The median age of the captive-born individuals was 8 years (8.03 ± 3.62) and the sexual proportion was 0.87:1. Identification of both parents was known for 19 of these, while either of the parents was known for 6 and both parents were unknown for 3 individuals. The births with complete known parentage were contributed by 10 sires and 8 dams. Of the 25 wild origin females, only 7 reproduced with a mean contribution of 2.6 infants and the mean contribution per female was 0.72 infants only (Table 3). Among the 32 wild-born males, only 8 reproduced and the mean contribution per reproducing male was 2.6 infants (Table 4).

Breeding has been recorded in 6 institutions, with Aizawl zoo recording the highest number of births (N=15). Figure 6 shows the breeding population as a proportion of the total population over the years. It

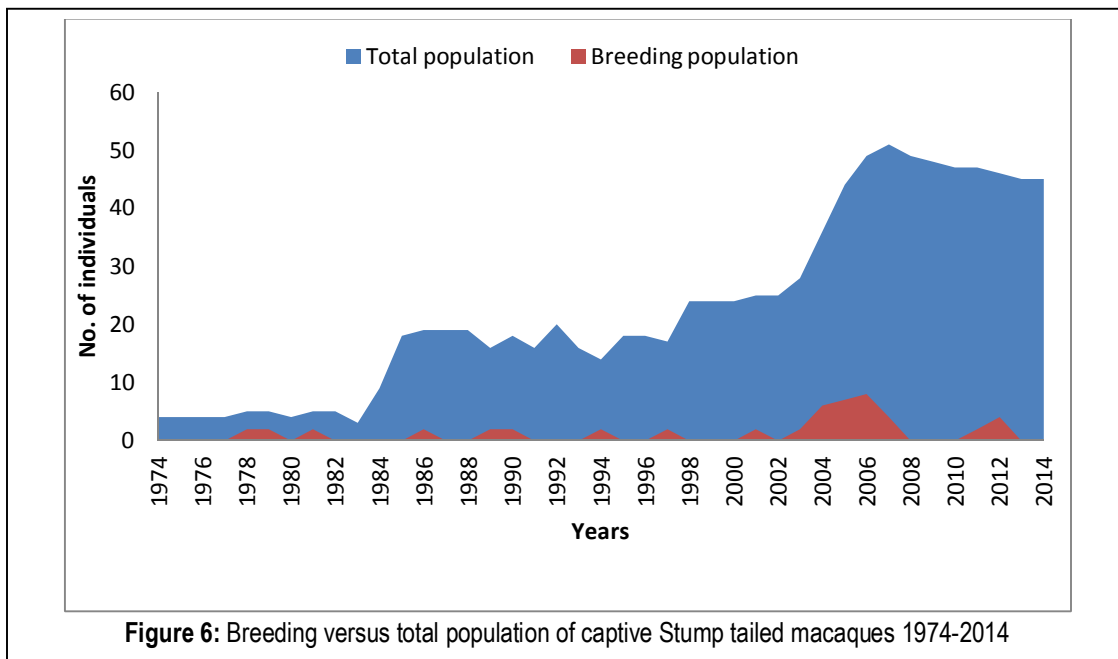
indicates that a small number of individuals contributed to breeding each year with complete absence of breeding in many years. During its entire 40 year history in captivity, breeding was recorded for a period of 15 years only. Maximum number of individuals contributing to breeding was during 2004-2006, when the breeding population corresponded to 15-16% of the total population. The mean number of individuals contributing to breeding per year was 1.24 ± 2 .

Table 3: Reproductive output per generation/ known female

Generation	No. of females	No. of reproducing females	No. of infants	Mean no. of infants per reproducing female
F0	25	7	18	2.6
F1	11	1	1	1
Total	36	8	19	2.38

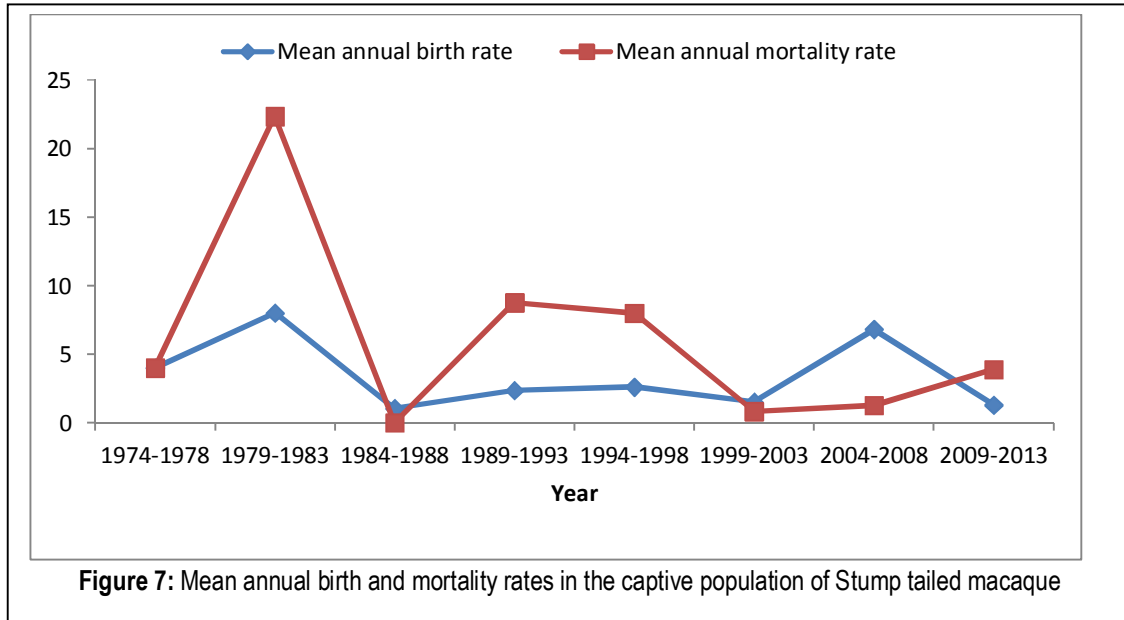
Table 4: Reproductive output per generation/ known male

Generation	No. of males	No. of reproducing males	No. of infants	Mean no. of infants per reproducing male
F0	32	8	21	2.61
F1	12	2	2	1
Total	44	10	23	2.3



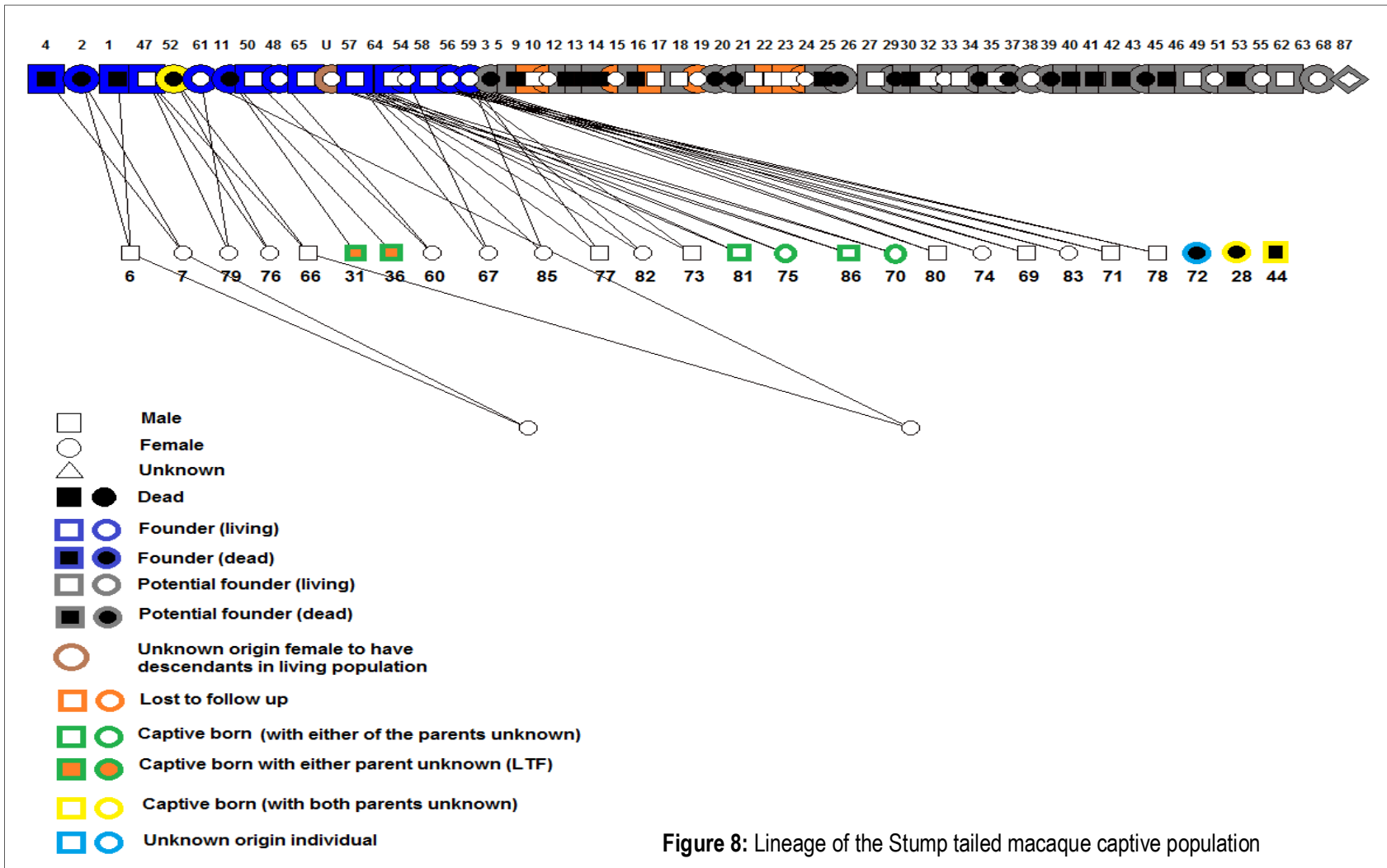
The birth and mortality rates in the stump tailed macaque population in Indian zoos are depicted in Figure 7. The birth rates show trends similar to the total population as depicted in figures 3 and 4 increasing when the total population shows an increasing trend and vice versa. Overall the population had a low number of births till 2004, however since then the births in captivity have increased and the

proportion of captive-born individuals in the overall population has increased. A total of 32 (16 males, 16 females) mortalities have been recorded. The mean number of deaths per year was 0.8 ± 1 . The mean annual mortality was highest during 1979-1983 (22%) and has decreased considerably since then, to 8% during 1989-1998 and to 1.3% during 2009-2013. Decreased mortality rates and an increase in captive births had resulted in a net increase in population post 2004 from 36 to reach a high of 51 specimens in 2007. The population has thereafter declined to the current total of 45 individuals.

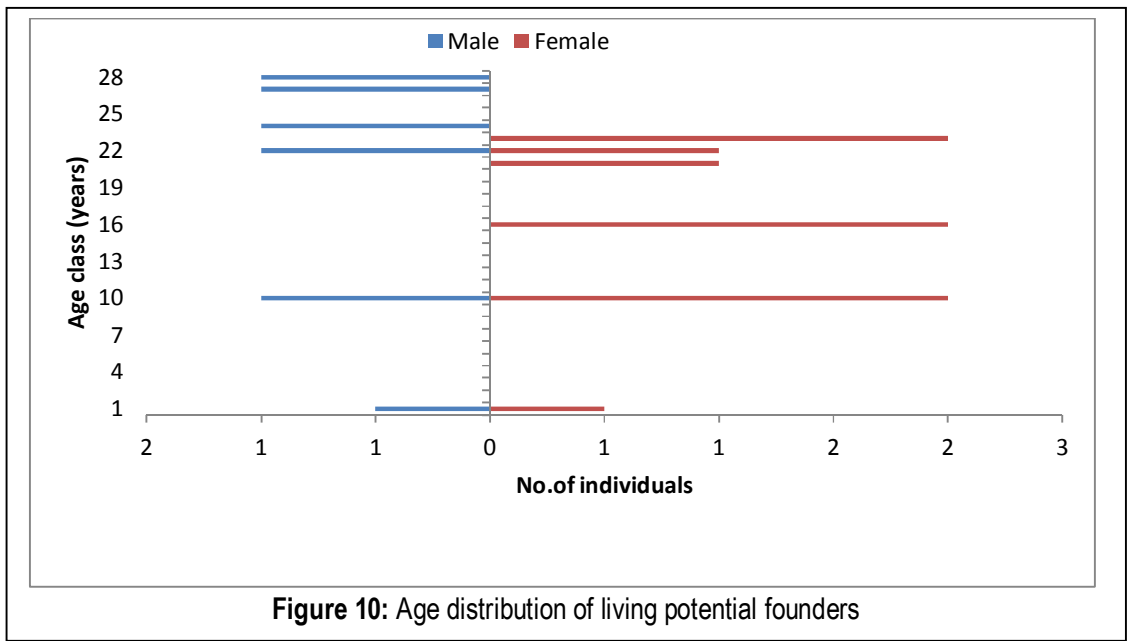


Genetic analysis

The lineage of the captive-born individuals is summarized in figure 8. The living population contains 16 descendants from the historical population with known parentage and 4 descendants with either of the parents unidentified. Around 93% of the pedigree of the living captive-born individuals could be identified and traced back to known founders. At present, there are 11 founders and 14 potential founders who have not contributed to the population. Although birth date estimates for most of the living wild-born individuals was not available, assuming that Stump tailed macaques reproduce for the first time at the age of 4.9 years (Niuwenhuijsen 1984), the minimum age of these individuals as on March 2014 was calculated, as per capture dates available and the dates of their first reproduction in captivity. The minimum age of the founders and potential founders as on March 2014 is shown in Figures 8 and 9. The age structure of founders suggests that all the founders are more than 10 years of age. Of these 10 are housed in Aizawl zoo, 2 in Patna zoo and 1 in Assam. Of the 14 potential founders, 8 are more than 20 years of age, 5 are in the 10-16 years age class and 1 potential founder was brought into captivity in 2013 (NSN 87) should be at least 1 year of age.

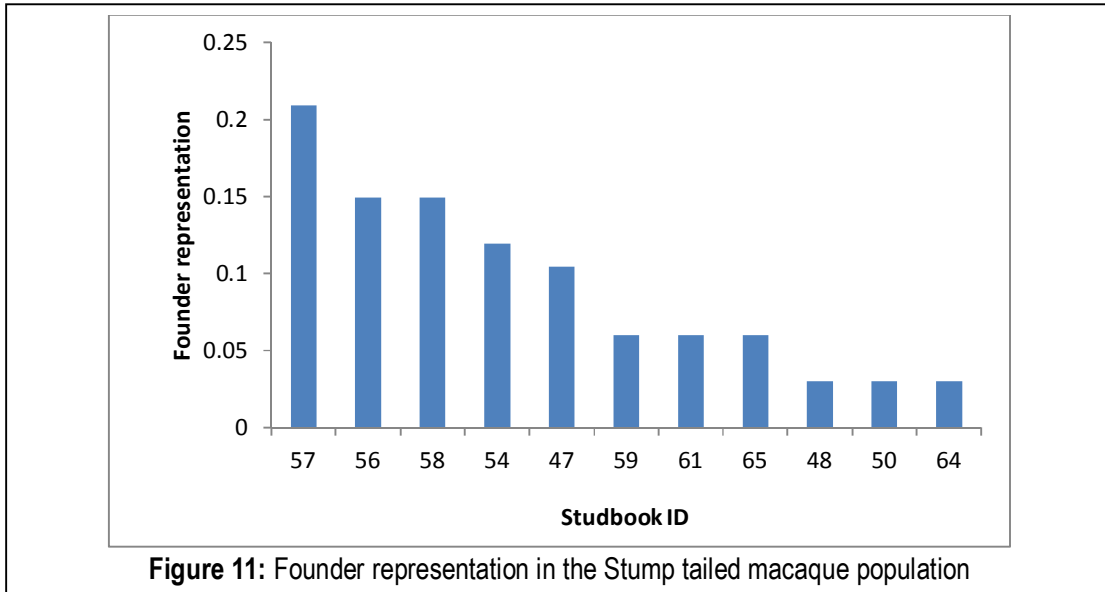


The age distributions of living and potential founders are depicted in Figures 9 and 10 respectively. The individuals with unknown sex at the time of data analysis were considered 0.5 of each sex. The age distribution of living founders suggests that currently all the individuals are in the reproductively active age classes. While the age distribution of the potential founders suggests that most of individuals have already reached reproductive senescence or are approaching it. This possible genetic contribution thus has effectively been lost from the captive population.



Founder representation

The proportion of genetic representation of the founders in the current population is presented in Figure 11. It suggests that while some founders (studbook nos. 57, 56, 58, 54 and 47) are overrepresented several others are underrepresented. Studbook number 57; a male from Aizawl zoo has seven descendants in the living population and 35% of the population's genes have descended from this prolific male.



Population mean kinship

The mean kinship of a population is equal to the proportional loss of gene diversity of the descendant (captive-born) population relative to the founders and is also the mean inbreeding coefficient of progeny produced by random mating. Individuals with a lower mean kinship values have relatively fewer genes in common with the rest of the population, and are therefore more genetically valuable in a breeding program. A mean kinship of 0.063 is equivalent to an individual being related to the population on average at the level of first cousin. The population mean kinship was 0.0786 suggesting of breeding between second order kins *i.e.* first and second cousins.

Gene diversity

Gene diversity is the principal measure of genetic diversity in populations. Current retained gene diversity as a percentage of the genetic diversity present in the wild-caught founder population, excluding the wild-caught individuals that did not reproduce is 92.14%.

Inbreeding

The mean inbreeding coefficient of a population is the proportional decrease in observed heterozygosity relative to the expected heterozygosity of the founder population. The mean inbreeding coefficient of the population was 0, indicating that mating between closely related individuals *i.e.* siblings-parents and between siblings has been avoided.

Summary

- The population is maintained in a viable social group at only one zoo.
- The living population comprises of a large proportion of individuals in the pre-reproductive and reproductively active age classes.
- The population is characterized by low population growth rate and a lower reproductive potential of captive bred animals as compared to the wild origin animals and the number of reproductively active animals is a small proportion of the total number of animals.
- A large part of the genetic diversity captured from the wild has been lost due to poor reproductive performance in captivity and the skewed founder contribution in favour of a few individuals.
- Limitations of data quality in terms of dates of events (captures, births and deaths) and lineages limited detailed demographic and genetic analysis and subsequent recommendations redundant.

Conclusion

The results of the analysis carried out suggest the need for improving the husbandry practices followed in the management of the species as suboptimal conditions have been associated with reduced reproductive potential. The current husbandry practices followed by the holding zoos need to be assessed and shortcomings identified and addressed.

The species shows female philopatry typical to macaques and lives in troops comprising multiple males and females. The holding zoos must maintain the species in appropriate social groups. However; captures of entire troops for conservation breeding can have deleterious consequences for the free ranging population. It is therefore suggested that with appropriate socialization process the troop organization can be recreated in captive environments by pooling together the single/pairs of animals housed across the various holding institutions.

The captive population comprises of a large proportion of animals in the reproductively active age class. With appropriate management interventions and modifications in the husbandry practices the species is capable of the rapid growth required to provide a demographically stable captive population. Once the population has achieved demographic stability the genetic diversity can be managed by regulation of mating choices and inclusion of additional founder animals as required. Maintaining complete records of all specimens by the holding zoos is essential for effective genetic management of the population.

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Appendix I

Historical listing of Stump tailed macaque (*Macaca arctoides*) in Indian zoos

Sl. no.	National Studbook No.	House name Local ID. Transponder ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
1.	1	Unnamed	M	????	Wild	Wild	India Kanpur	26-Aug-74 26-Aug-74 ~ Jul 1980	Capture Transfer Death
2.	2	Unnamed	F	????	Wild	Wild	India Kanpur	26-Aug-74 26-Aug-74 08-Aug-79	Capture Transfer Death
3.	3	Unnamed	F	????	Wild	Wild	India Kanpur India	28-Aug-74 28-Aug-74 ~ Aug 1978	Capture Transfer Death
4.	4	Unnamed	M	????	Wild	Wild	India Kanpur	28-Aug-74 28-Aug-74 19-Aug-83	Capture Transfer Death
5.	5	Unnamed	M	????	Wild	Wild	India Ahmedabad	~ 1978 19 May 1978 26-May-91	Capture Transfer Death
6.	6	Unnamed	M	~ Aug 1978	1	2	Kanpur	~ Aug 1978 03-May-89	Birth Death
7.	7	Unnamed	F	16-Jul-1979	4	2	Kanpur	16-Jul-79 04-Dec-83	Birth Death
8.	8	Unnamed	F	15-Apr-1981	6	7	Kanpur	15-Apr-81 03-Nov-98	Birth Death

Sl. no.	National Studbook No.	House name Local ID. Transponder ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
9.	9	Unnamed	M	????	Wild	Wild	India Chatbir Unknown	~ Mar 1984 ~ Apr 1984 18-Nov-89	Capture Transfer Transfer Ltf
10.	10	Unnamed	F	????	Wild	Wild	India Chatbir Unknown	~ 1984 ~ Apr 1984 18-Nov-89	Capture Transfer Transfer Ltf
11.	11	Unnamed	F	????	Wild	Wild	India Chatbir	~ 1984 ~ Apr 1984 ~ 1993	Capture Transfer Death
12.	12	Unnamed	M	????	Wild	Wild	India Chatbir	~ 1984 ~ Apr 1984 04-Jul-91	Capture Transfer Death
13.	13	Unnamed	M	????	Wild	Wild	India Chatbir	~ 1984 ~ Apr 1984 03-Jun-93	Capture Transfer Death
14.	14	Unnamed	M	????	Wild	Wild	India Chatbir	~ 1984 ~ Apr 1984 27-Jun-94	Capture Transfer Death
15.	15	Unnamed	F	????	Wild	Wild	India Hyderabad Visakapatnam	~ 1985 ~ 1985 14-Dec-86	Capture Transfer Ltf

Sl. no.	National Studbook No.	House name Local ID. Transponder ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
16.	16	Unnamed	M	????	Wild	Wild	India Hyderabad Tirupati	~ 1985 ~ Apr 1985 27-Apr-93 30-Aug-10	Capture Transfer Transfer Death
17.	17	Unnamed	M	????	Wild	Wild	India Hyderabad Unknown	~ 1985 ~ Apr 1985 04-Mar-84	Capture Transfer Transfer Ltf
18.	18	Unnamed	M	????	Wild	Wild	India Hyderabad	~ 1985 ~ 1985 20-Oct-97	Capture Transfer Death
19.	19	Unnamed	F	????	Wild	Wild	India Hyderabad Unknown	~ 1985 ~ Apr 1985 4-Mar-84	Capture Transfer Ltf
20.	20	Unnamed	F	????	Wild	Wild	India Hyderabad Tirupati	~ 1985 ~ 1985 27-Apr-93 14-Jan-11	Capture Transfer Transfer Death
21.	21	Unnamed	F	????	Wild	Wild	India Hyderabad Tirupati	~ 1985 ~ Apr 1985 27-Apr-93 08-Feb-12	Capture Transfer Transfer Death
22.	22	Unnamed	M	????	Wild	Wild	India Hyderabad Visakapatnam	~ 1985 ~ 1985 20-Oct-97	Capture Transfer Transfer

Sl. no.	National Studbook No.	House name Local ID. Transponder ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
23.	23	Unnamed	M	????	Wild	Wild	India Hyderabad Visakapatnam	~ 1985 ~ 1985 14-Dec-86	Capture Transfer Ltf
24.	24	Unnamed	M	????	Wild	Wild	India Ahmedabad Vadodara	~ 1986 ~ 1986 14-Feb-87	Capture Transfer Transfer Ltf
25.	25	Unnamed	F	????	Wild	Wild	India Ahmedabad Vadodara	~ 1986 ~ 1986 14-Feb-87	Capture Transfer Transfer Ltf
26.	26	Unnamed	M	????	Wild	Wild	India Ahmedabad	~ 1987 28 Oct 1987 08-Apr-96	Capture Transfer Death
27.	27	Unnamed	F	????	Wild	Wild	India Ahmedabad	~ 1987 28 Oct 1987 28-Nov-97	Capture Transfer Death
28.	28	Unnamed	F	09-Jun-1986	Unk	Unk	Hyderabad	9 Jun 1986 04-May-93	Birth Death
29.	29	Unnamed	M	????	Wild	Wild	India Chatbir	~ 1990 30-Jun-90	Capture Transfer
30.	30	Unnmaed	F	????	Wild	Wild	India Chatbir	30-Jun-90 30 Jun 1990 ~ 1993	Capture Transfer Death

Sl. no.	National Studbook No.	House name Local ID. Transponder ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
31.	31	Unnamed	M	02-Jul-89	Unk	11	Chatbir	02-Jul-89	Birth Ltf
32.	32	Unnamed	M	~ 1989	Wild	Wild	India Lucknow	03-Mar-98 03-Mar-98 07-Mar-13	Capture Transfer Death
33.	33	Lachit	M	????	Wild	Wild	India Assam	20-May-92 20-May-92	Capture Transfer
34.	34	Unnamed	F	~ 1991	Wild	Wild	India Lucknow	03-Mar-98 03-Mar-98	Capture Transfer
35.	35	Mir	M	~ 1990	Wild	Wild	India Bokaro	20-Jun-92 20-Jun-92	Capture Transfer
36.	36	Unnamed	M	11-May-90	Unk	11	Chatbir	11-May-90	Birth Ltf
37.	37	Mira	F	~ 1990	Wild	Wild	India Bokaro	20-Jun-92 20-Jun-92 27-Nov-09	Capture Transfer Death
38.	38	Unnamed	M	~ 1990	Wild	Wild	India Lucknow	03-Mar-98 03-Mar-98	Capture Transfer
39.	39	Unnamed	F	????	Wild	Wild	India Assam	21-Feb-92 21-Feb-92 31-Oct-98	Capture Transfer Death
40.	40	Unnamed	F	~ 1992	Wild	Wild	India Lucknow	03-Mar-98 03-Mar-98	Capture Transfer

Sl. no.	National Studbook No.	House name Local ID. Transponder ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
41.	41	Unnamed 33	F	????	Wild	Wild	India Shillong	06-Jun-94 06-Jun-94 20-Jan-12	Capture Transfer Death
42.	42	Unnamed	M	????	Wild	Wild	India Aurangabad	11-Jul-95 11 Jul 1995 17-Jan-09	Capture Transfer Death
43.	43	Unnamed	M	????	Wild	Wild	India Manipur	~ 1995 ~ 1995 17-Feb-08	Capture Transfer Death
44.	44	Unnamed	M	31-Oct-1994	Unk	Unk	Assam	31-Oct-94 31-Oct-94	Birth Death
45.	45	Unnamed	M	????	Wild	Wild	India Calcutta	~ Feb 1995 ~ Feb 1995 29-Jan-97	Capture Transfer Death
46.	46	Unnamed	F	????	Wild	Wild	India Manipur	~ 1995 ~ 1995 20-Feb-08	Capture Transfer Death
47.	47	Tarzan 0006B76D36	M	????	Wild	Wild	Assam	07-Dec-96 07-Dec-96	Capture Transfer
48.	48	Basant STM2	F	????	Wild	Wild	India Patna	11-Aug-98 11-Aug-98	Capture Transfer
49.	49	Unnamed	M	????	Wild	Wild	India Kanpur	15-Sep-98 15-Sep-98 03-Nov-00	Capture Transfer Death

Sl. no.	National Studbook No.	House name Local ID. Transponder ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
50.	50	Mantoo	M	????	Wild	Wild	India Patna	11-Aug-98 11-Aug-98	Capture Transfer
51.	51	Raju STM3	M	????	Wild	Wild	India Patna	11-Aug-98 11-Aug-98	Capture Transfer
52.	52	Junu	F	25-May-1997	Unk	Unk	Assam	25-May-97 07-Jul-05	Birth Death
53.	53	Unnamed 43	F	????	Wild	Wild	India Shillong	12-May-98 12-May-98	Capture Transfer
54.	54	Unnamed 102057520	F	????	Wild	Wild	India Aizawl	30-Aug-05 01-Sep-05	Capture Transfer
55.	55	Unnamed 44	M	????	Wild	Wild	India Shillong	09-Mar-00 09-Mar-00 23-Sep-12	Capture Transfer Death
56.	56	Unnamed 102057655	F	????	Wild	Wild	India Aizawl	20-Jun-05 22-Jun-05	Capture Transfer
57.	57	Unnamed 10057736	M	????	Wild	Wild	India Aizawl	02-Apr-04 03-Apr-04	Capture Transfer
58.	58	Unnamed 981098100800311	M	????	Wild	Wild	India Aizawl	15-Apr-09 17-Apr-09	Capture Transfer
59.	59	Unnamed 102057656	F	????	Wild	Wild	India Aizawl	08-Aug-04 09-Aug-04	Capture Transfer
60.	60	Soni STM4	F	02-May-01	50	48	Patna	02-May-01	Birth
61.	61	Kabita 0006B7296F	F	????	Wild	Wild	India Shillong Assam	22-Apr-03 22-Apr-03 28-Feb-05	Capture Transfer Transfer

Sl. no.	National Studbook No.	House name Local ID. Transponder ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
62.	62	Unnamed 102037520	F	????	Wild	Wild	India Aizawl	20-May-04 21-May-04	Capture Transfer
63.	63	Unnamed	M	????	Wild	Wild	India Delhi	~ 2004 ~ 2004	Capture Transfer
64.	64	Unnamed 102057737	M	????	Wild	Wild	India Aizawl	05-Sep-05 07-Sep-05	Capture Transfer
65.	65	Unnamed 102056639	M	????	Wild	Wild	India Aizawl	03-Jun-03 05-Jun-03	Capture Transfer
66.	66	Munu 0006B72F63	M	14-Dec-03	47	52	Assam	14-Dec-03	Birth
67.	67	Unnamed 102056567	F	20-Feb-04	57	54	Aizawl	20-Feb-04	Birth
68.	68	Unnamed	F	????	Wild	Wild	India Delhi	~ 2004 ~ 2004	Capture Transfer
69.	69	Unnamed 102058211	M	15-Dec-04	58	56	Aizawl	15-Dec-04	Birth
70.	70	Unnamed 102057913	F	15-Dec-04	65	Unk1	Aizawl	15-Dec-04	Birth
71.	71	Unnamed 102057915	M	07-Mar-05	58	54	Aizawl	07-Mar-05	Birth
72.	72	Unnamed	F	????	Unk	Unk	Unknown Tirupati	???? 30-Nov-06 04-Jan-13	Birth Transfer Death
73.	73	Unnamed 102057914	M	08-Apr-05	57	56	Aizawl	08-Apr-05	Birth
74.	74	Unnamed 102058293	F	23-May-05	58	56	Aizawl	23-May-05	Birth

Sl. no.	National Studbook No.	House name Local ID. Transponder ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
75.	75	Unnamed 1020583	F	22-Jun-05	57	Unk1	Aizawl	22-Jun-05	Birth
76.	76	Dhoon 0006B733ED	F	03-Jul-05	47	52	Assam	03-Jul-05	Birth
77.	77	Unnamed 102057916	M	15-Dec-05	57	59	Aizawl	15-Dec-05	Birth
78.	78	Unnamed 102057917	M	20-Feb-06	64	54	Aizawl	20-Feb-06	Birth
79.	79	Kumkum 0006B733ED	F	07-Apr-06	47	61	Assam	07-Apr-06	Birth
80.	80	Unnamed 102057918	M	24-May-06	58	56	Aizawl	24-May-06	Birth
81.	81	Unnamed 102057919	M	02-Jun-06	57	Unk1	Aizawl	02-Jun-06	Birth
82.	82	Unnamed 102057923	F	21-Apr-07	57	56	Aizawl	21-Apr-07	Birth
83.	83	Unnamed 102057922	F	04-Jun-07	58	54	Aizawl	04-Jun-07	Birth
84.	84	Unnamed	F	16-Oct-11	66	61	Assam	16-Oct-11	Birth
85.	85	Unnamed 102057921	F	05-Mar-12	57	59	Aizawl	05-Mar-12	Birth
86.	86	Unnamed 102057920	M	01-Jun-12	65	Unk1	Aizawl	01-Jun-12	Birth
87.	87	Unnamed	?	????	Wild	Wild	India Shillong	29-Oct-13 29-Oct-13	Capture Transfer

Appendix II

Living population of Stump tailed macaque (*Macaca arctoides*) in Indian zoos

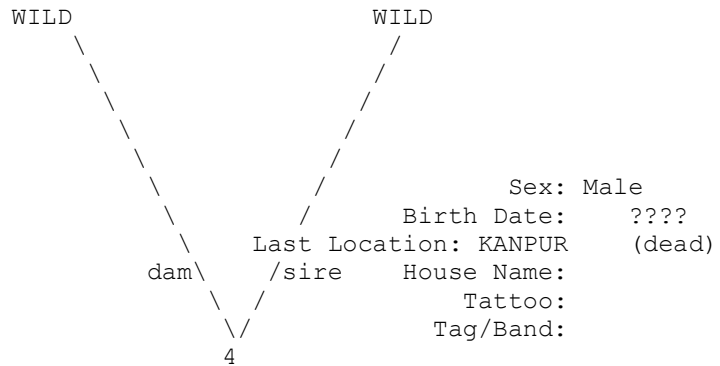
Sl. No.	National Studbook No.	House Name Local ID Transponder ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
1.	18	Unnamed	M	????	Wild	Wild	India Hyderabad Tirupati	~ 1985 ~ 1985 20-Oct-97	Capture Transfer Transfer
2.	22	Unnamed	M	????	Wild	Wild	India Hyderabad Visakapatnam	~ 1985 ~ 1985 20-Oct-97	Capture Transfer Transfer
3.	29	Unnamed	M	????	Wild	Wild	India Chatbir	~ 1990 30-Jun-90	Capture Transfer
4.	33	Lachit	M	????	Wild	Wild	India Assam	20-May-92 20-May-92	Capture Transfer
5.	34	Unnamed	F	~ 1991	Wild	Wild	India Lucknow	03-Mar-98 03-Mar-98	Capture Transfer
6.	35	Mir	M	~ 1990	Wild	Wild	India Bokaro	20-Jun-92 20-Jun-92	Capture Transfer
7.	38	Unnamed	M	~ 1990	Wild	Wild	India Lucknow	03-Mar-98 03-Mar-98	Capture Transfer
8.	40	Unnamed	F	~ 1992	Wild	Wild	India Lucknow	03-Mar-98 03-Mar-98	Capture Transfer
9.	47	Tarzan 0006B76D36	M	????	Wild	Wild	Assam	07-Dec-96 07-Dec-96	Capture Transfer

Sl. No.	National Studbook No.	House Name Local ID Transponder ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
10.	48	Basant STM2	F	????	Wild	Wild	India Patna	11-Aug-98 11-Aug-98	Capture Transfer
11.	50	Mantoo	M	????	Wild	Wild	India Patna	11-Aug-98 11-Aug-98	Capture Transfer
12.	51	Raju STM3	M	????	Wild	Wild	India Patna	11-Aug-98 11-Aug-98	Capture Transfer
13.	53	Unnamed 43	F	????	Wild	Wild	India Shillong	12-May-98 12-May-98	Capture Transfer
14.	54	Unnamed 102057520	F	????	Wild	Wild	India Aizawl	30-Aug-05 01-Sep-05	Capture Transfer
15.	56	Unnamed 102057655	F	????	Wild	Wild	India Aizawl	20-Jun-05 22-Jun-05	Capture Transfer
16.	57	Unnamed 10057736	M	????	Wild	Wild	India Aizawl	02-Apr-04 03-Apr-04	Capture Transfer
17.	58	Unnamed 981098100800311	M	????	Wild	Wild	India Aizawl	15-Apr-09 17-Apr-09	Capture Transfer
18.	59	Unnamed 102057656	F	????	Wild	Wild	India Aizawl	08-Aug-04 09-Aug-04	Capture Transfer
19.	60	Soni STM4	F	02-May-01	50	48	Patna	02-May-01	Birth
20.	61	Kabita 0006B7296F	F	????	Wild	Wild	India Shillong Assam	22-Apr-03 22-Apr-03 28-Feb-05	Capture Transfer Transfer
21.	62	Unnamed 102037520	F	????	Wild	Wild	India Aizawl	20-May-04 21-May-04	Capture Transfer

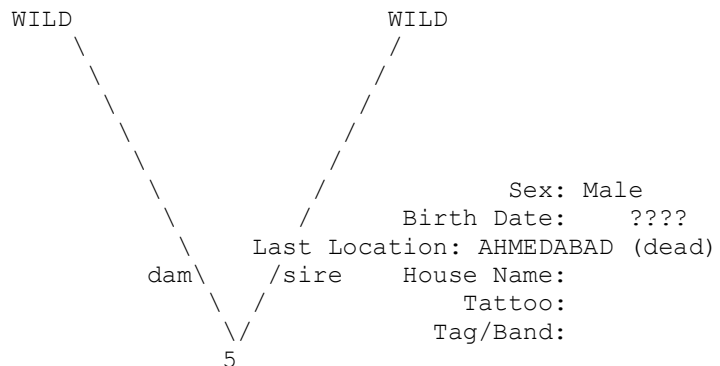
Sl. No.	National Studbook No.	House Name Local ID Transponder ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
22.	63	Unnamed	M	????	Wild	Wild	India Delhi	~ 2004 ~ 2004	Capture Transfer
23.	64	Unnamed 102057737	M	????	Wild	Wild	India Aizawl	05-Sep-05 07-Sep-05	Capture Transfer
24.	65	Unnamed 102056639	M	????	Wild	Wild	India Aizawl	03-Jun-03 05-Jun-03	Capture Transfer
25.	66	Munu 0006B72F63	M	14-Dec-03	47	52	Assam	14-Dec-03	Birth
26.	67	Unnamed 102056567	F	20-Feb-04	57	54	Aizawl	20-Feb-04	Birth
27.	68	Unnamed	F	????	Wild	Wild	India Delhi	~ 2004 ~ 2004	Capture Transfer
28.	69	Unnamed 102058211	M	15-Dec-04	58	56	Aizawl	15-Dec-04	Birth
29.	70	Unnamed 102057913	F	15-Dec-04	65	Unk1	Aizawl	15-Dec-04	Birth
30.	71	Unnamed 102057915	M	07-Mar-05	58	54	Aizawl	07-Mar-05	Birth
31.	73	Unnamed 102057914	M	08-Apr-05	57	56	Aizawl	08-Apr-05	Birth
32.	74	Unnamed 102058293	F	23-May-05	58	56	Aizawl	23-May-05	Birth
33.	75	Unnamed 1020583	F	22-Jun-05	57	Unk1	Aizawl	22-Jun-05	Birth
34.	76	Dhoon 0006B733ED	F	03-Jul-05	47	52	Assam	03-Jul-05	Birth
35.	77	Unnamed 102057916	M	15-Dec-05	57	59	Aizawl	15-Dec-05	Birth

Sl. No.	National Studbook No.	House Name Local ID Transponder ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
36.	78	Unnamed 102057917	M	20-Feb-06	64	54	Aizawl	20-Feb-06	Birth
37.	79	Kumkum 0006B733ED	F	07-Apr-06	47	61	Assam	07-Apr-06	Birth
38.	80	Unnamed 102057918	M	24-May-06	58	56	Aizawl	24-May-06	Birth
39.	81	Unnamed 102057919	M	02-Jun-06	57	Unk1	Aizawl	02-Jun-06	Birth
40.	82	Unnamed 102057923	F	21-Apr-07	57	56	Aizawl	21-Apr-07	Birth
41.	83	Unnamed 102057922	F	04-Jun-07	58	54	Aizawl	04-Jun-07	Birth
42.	84	Unnamed	F	16-Oct-11	66	61	Assam	16-Oct-11	Birth
43.	85	Unnamed 102057921	F	05-Mar-12	57	59	Aizawl	05-Mar-12	Birth
44.	86	Unnamed 102057920	M	01-Jun-12	65	Unk1	Aizawl	01-Jun-12	Birth
45.	87	Unnamed	?	????	Wild	Wild	India Shillong	29-Oct-13 29-Oct-13	Capture Transfer

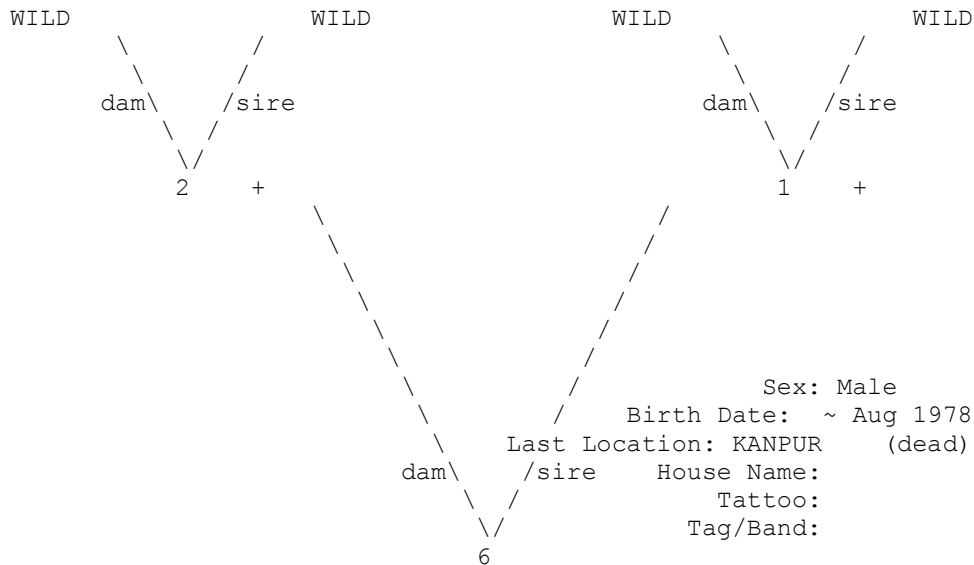
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Taxon Name: MACACA ARCTOIDES Studbook Number: 4
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=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 5
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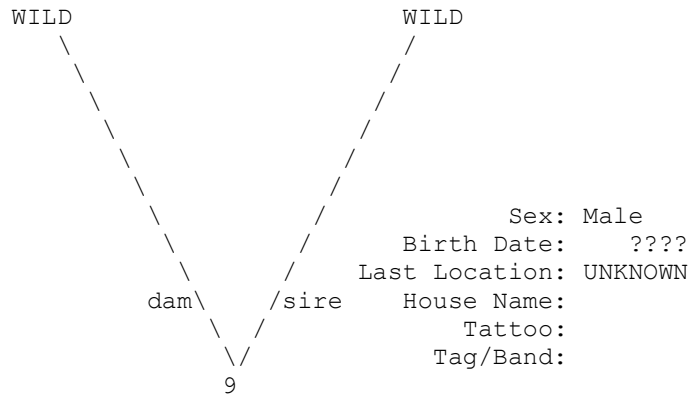


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Taxon Name: MACACA ARCTOIDES Studbook Number: 6
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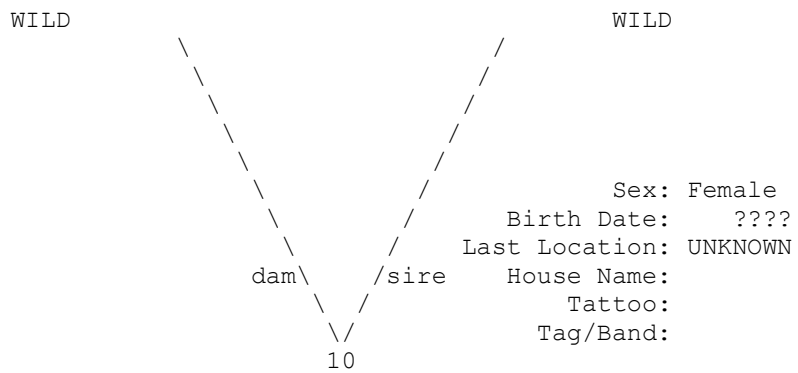


+ Wild-caught...

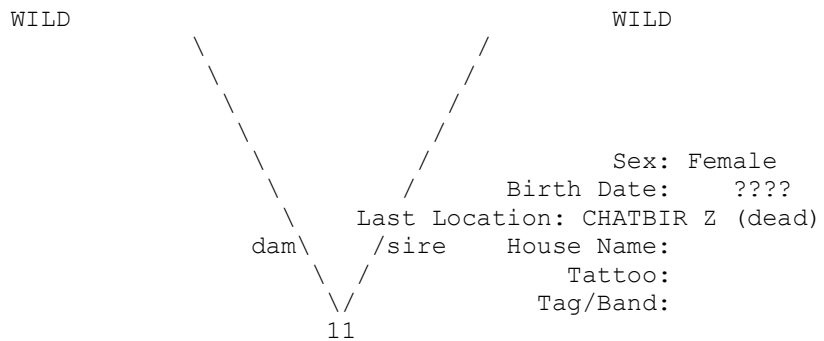
=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 9
=====



=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 10
=====



=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 11
=====



=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 12
=====

WILD

WILD

Sex: Male
Birth Date: ????
Last Location: CHATBIR Z (dead)
dam \ /sire House Name:
Tattoo:
Tag/Band:
12

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 13
=====

WILD

WILD

Sex: Male
Birth Date: ????
Last Location: CHATBIR Z (dead)
dam \ /sire House Name:
Tattoo:
Tag/Band:
13

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 14
=====

WILD

WILD

Sex: Male
Birth Date: ????
Last Location: CHATBIR Z (dead)
dam \ /sire House Name:
Tattoo:
Tag/Band:
14

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 15
=====

WILD

WILD

dam \ /sire

15

Sex: Female
Birth Date: ????
Last Location: VISAKAPAT
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 16
=====

WILD

WILD

dam \ /sire

16

Sex: Male
Birth Date: ????
Last Location: TIRUPATI (dead)
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 17
=====

WILD

WILD

dam \ /sire

17

Sex: Male
Birth Date: ????
Last Location: UNKNOWN
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 18
=====

WILD

WILD

Sex: Male
Birth Date: ????
Last Location: TIRUPATI
House Name:
Tattoo:
Tag/Band:
dam \ /sire
18

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 19
=====

WILD

WILD

Sex: Female
Birth Date: ????
Last Location: UNKNOWN
House Name:
Tattoo:
Tag/Band:
dam \ /sire
19

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 20
=====

WILD

WILD

Sex: Female
Birth Date: ????
Last Location: TIRUPATI (dead)
House Name:
Tattoo:
Tag/Band:
dam \ /sire
20

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 21
=====

WILD

WILD

dam \ / sire
21

Sex: Female
Birth Date: ????
Last Location: TIRUPATI (dead)
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 22
=====

WILD

WILD

dam \ / sire
22

Sex: Male
Birth Date: ????
Last Location: VISAKAPAT
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 23
=====

WILD

WILD

dam \ / sire
23

Sex: Male
Birth Date: ????
Last Location: VISAKAPAT
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 24
=====

WILD

WILD

dam \ /sire

24

Sex: Male
Birth Date: ????
Last Location: VADODARA
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 25
=====

WILD

WILD

dam \ /sire

25

Sex: Female
Birth Date: ????
Last Location: VADODARA
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 26
=====

WILD

WILD

dam \ /sire

26

Sex: Male
Birth Date: ????
Last Location: AHMEDABAD (dead)
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 27
=====

WILD

WILD

dam \ /
 / \
 27

Sex: Female
Birth Date: ????
Last Location: AHMEDABAD (dead)
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 28
=====

UNK

UNK

dam \ /
 / \
 28

Sex: Female
Birth Date: 9 Jun 1986
Last Location: HYDERABAD (dead)
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 29
=====

WILD

WILD

dam \ /
 / \
 29

Sex: Male
Birth Date: ????
Last Location: CHATBIR Z
House Name:
Tattoo:
Tag/Band:

=====
 Taxon Name: MACACA ARCTOIDES Studbook Number: 30
 =====

WILD WILD

Sex: Female
 Birth Date: ????
 Last Location: CHATBIR Z (dead)
 House Name:
 Tattoo:
 Tag/Band:
 30

=====
 Taxon Name: MACACA ARCTOIDES Studbook Number: 31
 =====

WILD WILD

dam\
 /sire
 11 +

UNK

Sex: Male
 Birth Date: 2 Jul 1989
 Last Location: CHATBIR Z
 House Name:
 Tattoo:
 Tag/Band:
 31

+ Wild-caught...

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 32
=====

WILD

WILD

Sex: Male
Birth Date: ~ 1989
Last Location: LUCKNOW (dead)
dam \ /sire House Name:
Tattoo:
Tag/Band:
32

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 33
=====

WILD

WILD

Sex: Male
Birth Date: ????
Last Location: ASSAM
dam \ /sire House Name: LACHIT
Tattoo:
Tag/Band:
33

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 34
=====

WILD

WILD

Sex: Female
Birth Date: ~ 1991
Last Location: LUCKNOW
dam \ /sire House Name:
Tattoo:
Tag/Band:
34

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 35
=====

WILD WILD

dam \ / sire
35
Sex: Male
Birth Date: ~ 1990
Last Location: BOKARO
House Name: MIR
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 36
=====

WILD WILD

dam \ / sire

11 +

UNK

dam \ / sire
36
Sex: Male
Birth Date: 11 May 1990
Last Location: CHATBIR Z
House Name:
Tattoo:
Tag/Band:

+ Wild-caught...

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 37
=====

WILD

WILD

Sex: Female
Birth Date: ~ 1990
Last Location: BOKARO (dead)
House Name: mira
Tattoo:
Tag/Band:
dam \ /sire
37

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 38
=====

WILD

WILD

Sex: Male
Birth Date: ~ 1990
Last Location: LUCKNOW
House Name:
Tattoo:
Tag/Band:
dam \ /sire
38

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 39
=====

WILD

WILD

Sex: Female
Birth Date: ????
Last Location: ASSAM (dead)
House Name:
Tattoo:
Tag/Band:
dam \ /sire
39

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 40
=====

WILD

WILD

Sex: Female
Birth Date: ~ 1992
Last Location: LUCKNOW
dam \ /sire House Name:
Tattoo:
Tag/Band:
40

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 41
=====

WILD

WILD

Sex: Female
Birth Date: ????
Last Location: SHILLONG (dead)
dam \ /sire House Name:
Tattoo:
Tag/Band:
41

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 42
=====

WILD

WILD

Sex: Male
Birth Date: ????
Last Location: AURANGABA (dead)
dam \ /sire House Name:
Tattoo:
Tag/Band:
42

=====
Taxon Name: MACACA ARCTOIDES
=====

Studbook Number: 43
=====

WILD

WILD

dam \ / sire
43
Sex: Male
Birth Date: ????
Last Location: MANIPUR Z (dead)
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES
=====

Studbook Number: 44
=====

UNK

UNK

dam \ / sire
44
Sex: Male
Birth Date: 31 Oct 1994
Last Location: ASSAM (dead)
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES
=====

Studbook Number: 45
=====

WILD

WILD

dam \ / sire
45
Sex: Male
Birth Date: ????
Last Location: CALCUTTA (dead)
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 46
=====

WILD

WILD

dam \ / sire
46
Sex: Female
Birth Date: ????
Last Location: MANIPUR Z (dead)
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 47
=====

WILD

WILD

dam \ / sire
47
Sex: Male
Birth Date: ????
Last Location: ASSAM
House Name: TARZAN
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 48
=====

WILD

WILD

dam \ / sire
48
Sex: Female
Birth Date: ????
Last Location: PATNA
House Name: Basant
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 49
=====

WILD

WILD

dam \ / sire
49
Sex: Male
Birth Date: ????
Last Location: KANPUR (dead)
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 50
=====

WILD

WILD

dam \ / sire
50
Sex: Male
Birth Date: ????
Last Location: PATNA
House Name: Mantoo
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 51
=====

WILD

WILD

dam \ / sire
51
Sex: Male
Birth Date: ????
Last Location: PATNA
House Name: RAJU
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES

Studbook Number: 52
=====

UNK

UNK

Sex: Female
Birth Date: 25 May 1997
Last Location: ASSAM (dead)
House Name: Junu
Tattoo:
Tag/Band:
dam \ /sire
52

=====
Taxon Name: MACACA ARCTOIDES

Studbook Number: 53
=====

WILD

WILD

Sex: Female
Birth Date: ????
Last Location: SHILLONG
House Name:
Tattoo:
Tag/Band:
dam \ /sire
53

=====
Taxon Name: MACACA ARCTOIDES

Studbook Number: 54
=====

WILD

WILD

Sex: Female
Birth Date: ????
Last Location: AIZAWL
House Name:
Tattoo:
Tag/Band:
dam \ /sire
54

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 55
=====

WILD

WILD

dam \ / sire
55
Sex: Male
Birth Date: ????
Last Location: SHILLONG (dead)
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 56
=====

WILD

WILD

dam \ / sire
56
Sex: Female
Birth Date: ????
Last Location: AIZAWL
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 57
=====

WILD

WILD

dam \ / sire
57
Sex: Male
Birth Date: ????
Last Location: AIZAWL
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 58
=====

WILD

WILD

Sex: Male
Birth Date: ????
Last Location: AIZAWL
House Name:
Tattoo:
Tag/Band:
dam \ /sire
58

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 59
=====

WILD

WILD

Sex: Female
Birth Date: ????
Last Location: AIZAWL
House Name:
Tattoo:
Tag/Band:
dam \ /sire
59

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 60
=====

WILD

WILD

WILD

WILD

dam \ /sire

dam \ /sire

48 +
Basant

50 +
Mantoo

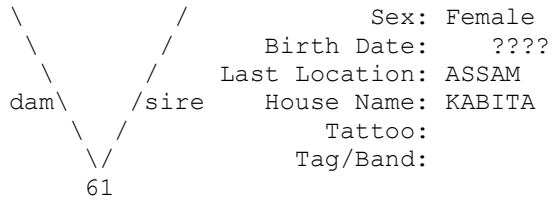
Sex: Female
Birth Date: 2 May 2001
Last Location: PATNA
House Name: SONI
Tattoo:
Tag/Band:
dam \ /sire
60

+ Wild-caught...

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 61
=====

WILD

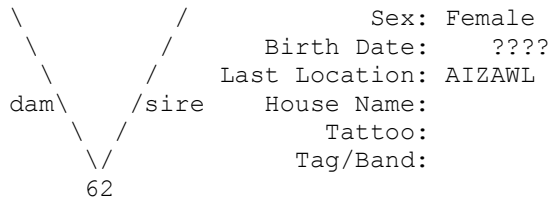
WILD



=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 62
=====

WILD

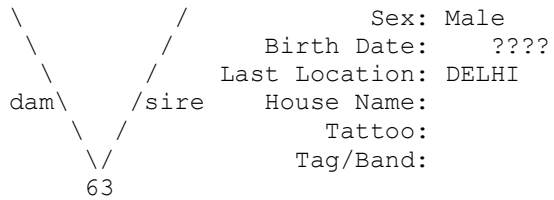
WILD



=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 63
=====

WILD

WILD



=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 64
=====

WILD

WILD

dam \ /sire

64

Sex: Male
Birth Date: ????
Last Location: AIZAWL
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 65
=====

WILD

WILD

dam \ /sire

65

Sex: Male
Birth Date: ????
Last Location: AIZAWL
House Name:
Tattoo:
Tag/Band:

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 66
=====

UNK

UNK

WILD

WILD

dam \ /sire

52
Junu

dam \ /sire

47 +
TARZAN

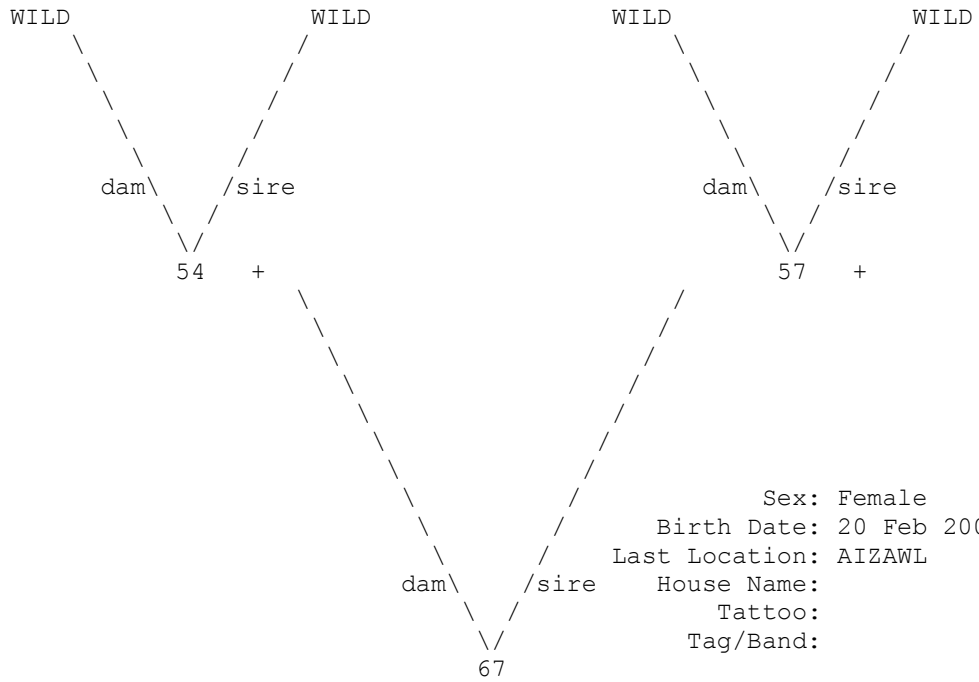
dam \ /sire

66

Sex: Male
Birth Date: 14 Dec 2003
Last Location: ASSAM
House Name: MUNU
Tattoo:
Tag/Band:

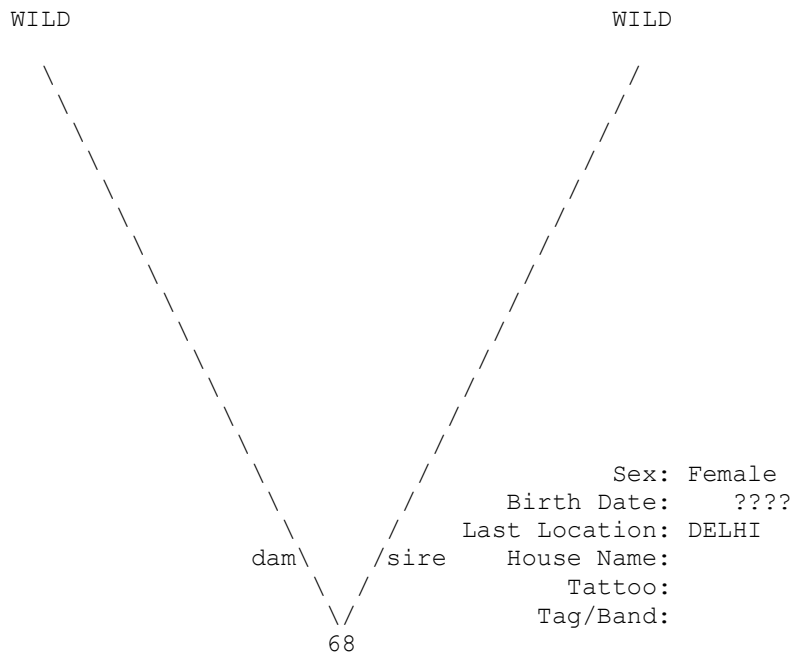
+ Wild-caught...

=====
 Taxon Name: MACACA ARCTOIDES Studbook Number: 67
 =====

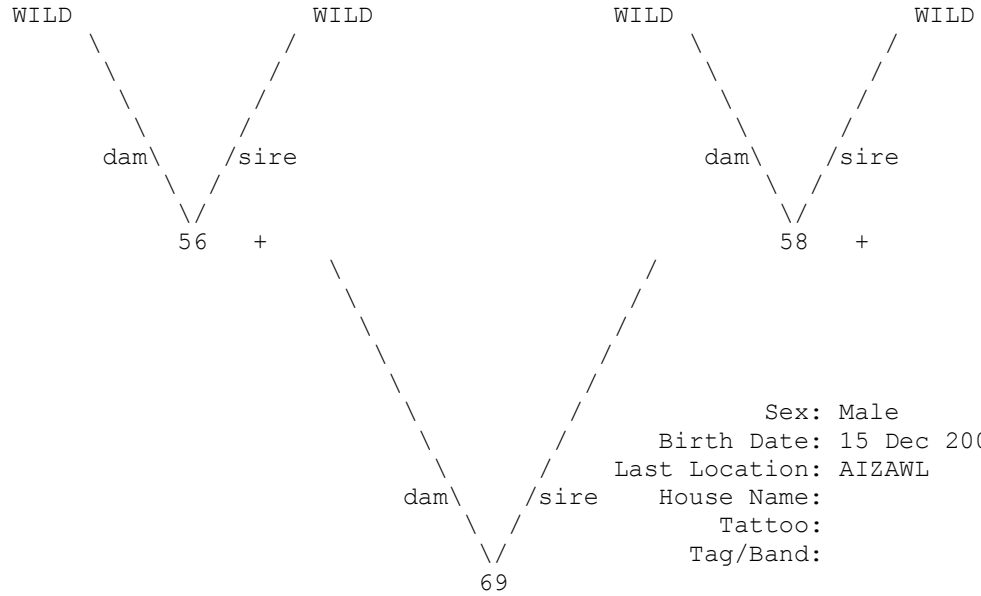


+ Wild-caught...

=====
 Taxon Name: MACACA ARCTOIDES Studbook Number: 68
 =====

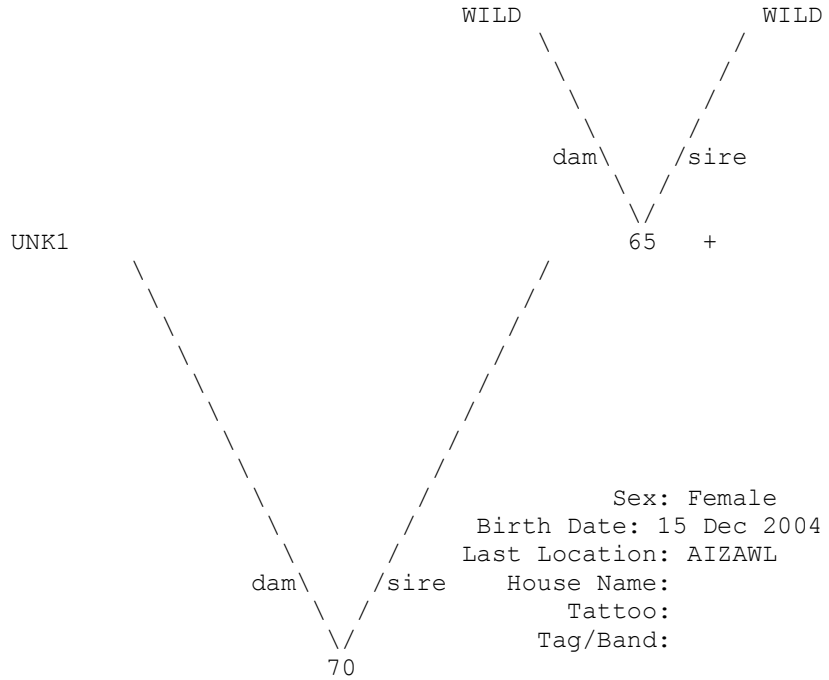


=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 69
=====



+ Wild-caught...

=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 70
=====



+ Wild-caught...

=====
Taxon Name: MACACA ARCTOIDES

Studbook Number: 71
=====

WILD

WILD

WILD

WILD

dam \ /sire

dam \ /sire

54 +

58 +

dam \ /sire

71

Sex: Male

Birth Date: 7 Mar 2005

Last Location: AIZAWL

House Name:

Tattoo:

Tag/Band:

+ Wild-caught...

=====
Taxon Name: MACACA ARCTOIDES

Studbook Number: 72
=====

UNK

UNK

dam \ /sire

72

Sex: Female

Birth Date: ????

Last Location: TIRUPATI

House Name:

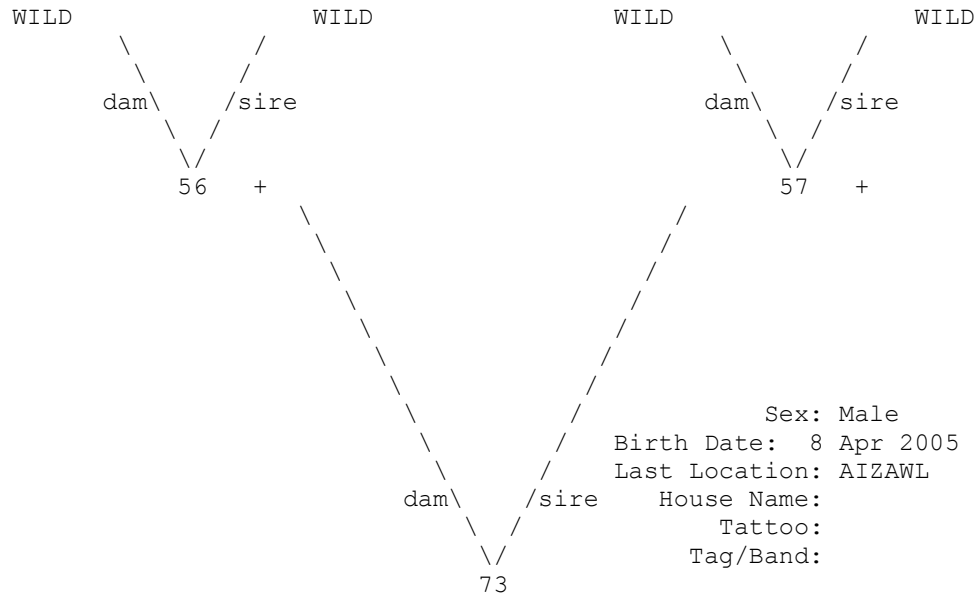
Tattoo:

Tag/Band:

(dead)

=====
Taxon Name: MACACA ARCTOIDES
=====

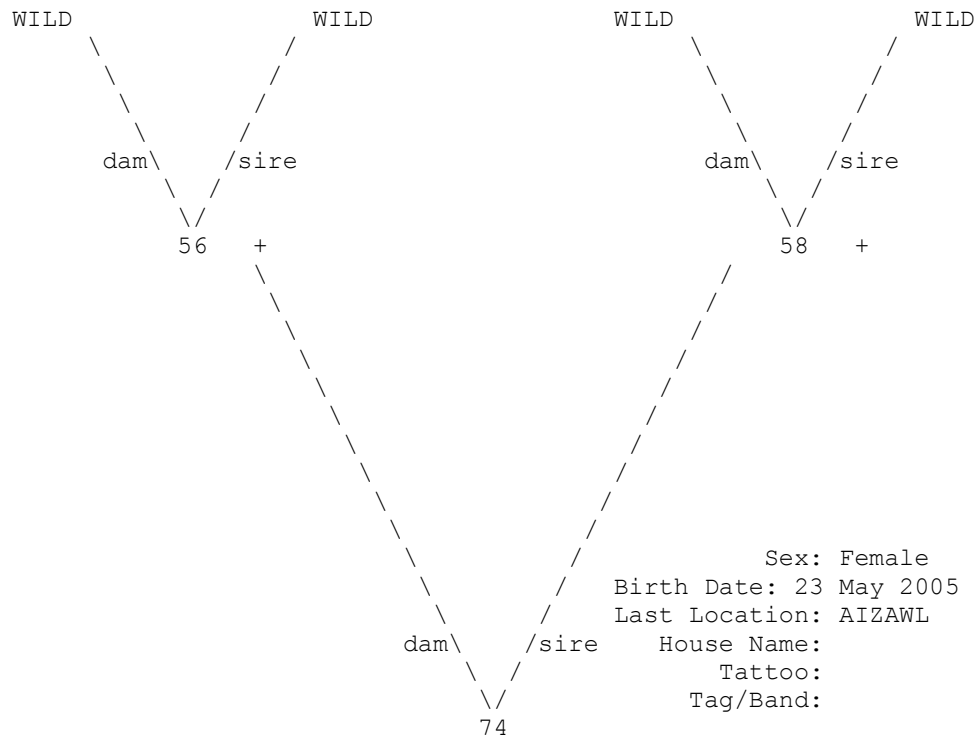
Studbook Number: 73
=====



+ Wild-caught...

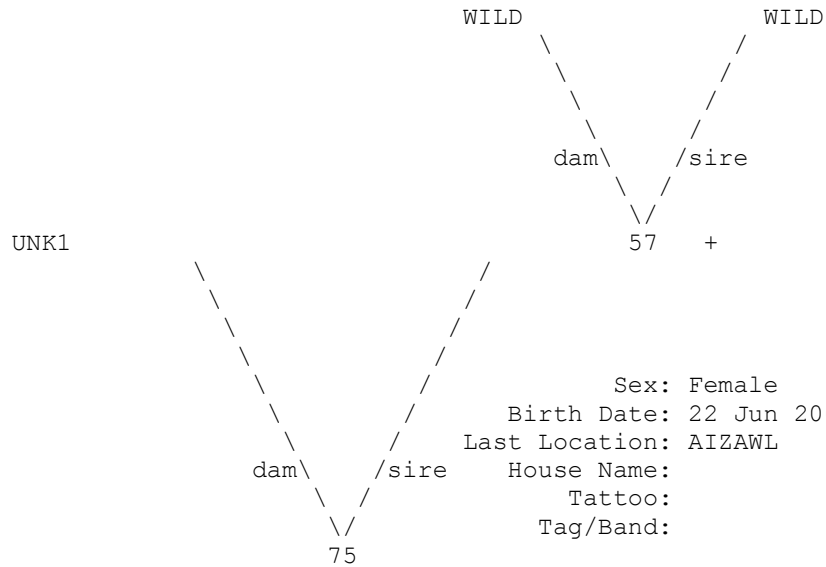
=====
Taxon Name: MACACA ARCTOIDES
=====

Studbook Number: 74
=====



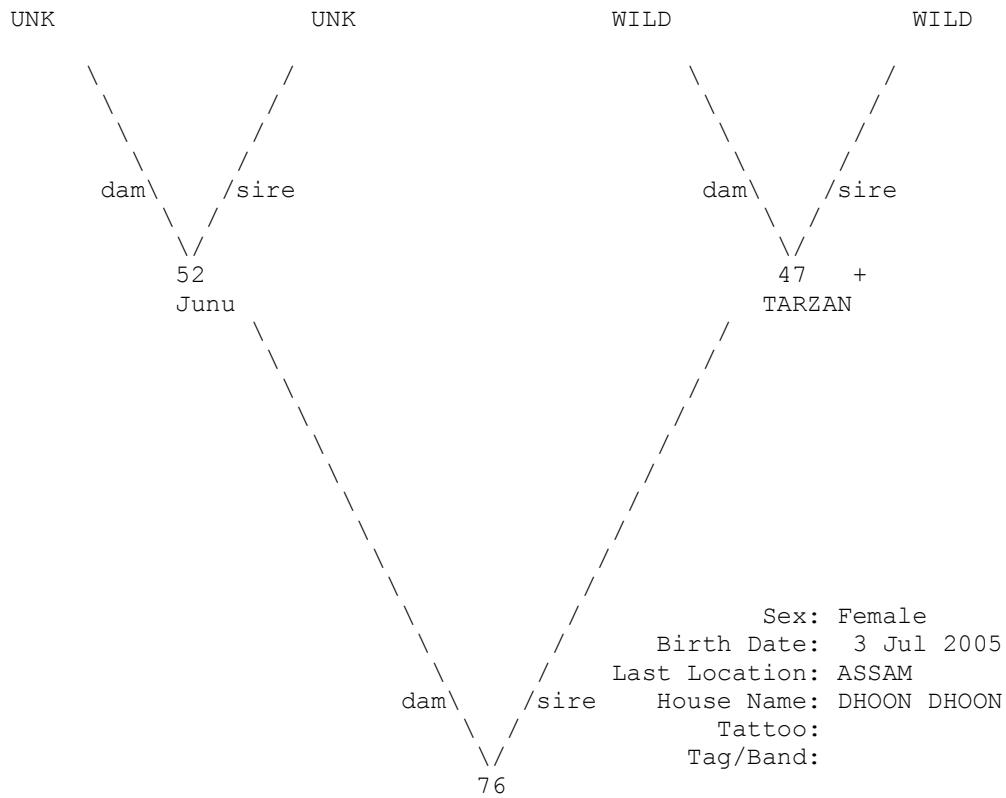
+ Wild-caught...

=====
 Taxon Name: MACACA ARCTOIDES Studbook Number: 75
 =====



+ Wild-caught...

=====
 Taxon Name: MACACA ARCTOIDES Studbook Number: 76
 =====



+ Wild-caught...

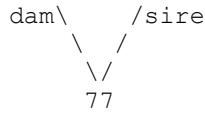
=====
Taxon Name: MACACA ARCTOIDES
=====

Studbook Number: 77
=====

WILD WILD WILD WILD



Sex: Male
Birth Date: 15 Dec 2005
Last Location: AIZAWL
House Name:
Tattoo:
Tag/Band:



+ Wild-caught...

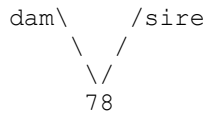
=====
Taxon Name: MACACA ARCTOIDES
=====

Studbook Number: 78
=====

WILD WILD WILD WILD

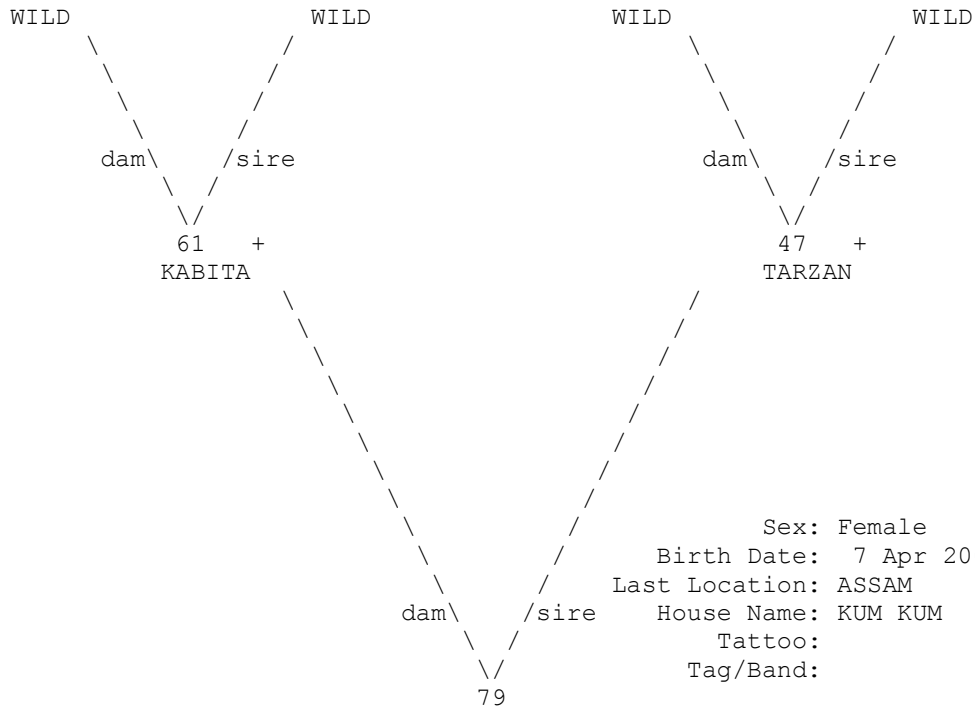


Sex: Male
Birth Date: 20 Feb 2006
Last Location: AIZAWL
House Name:
Tattoo:
Tag/Band:



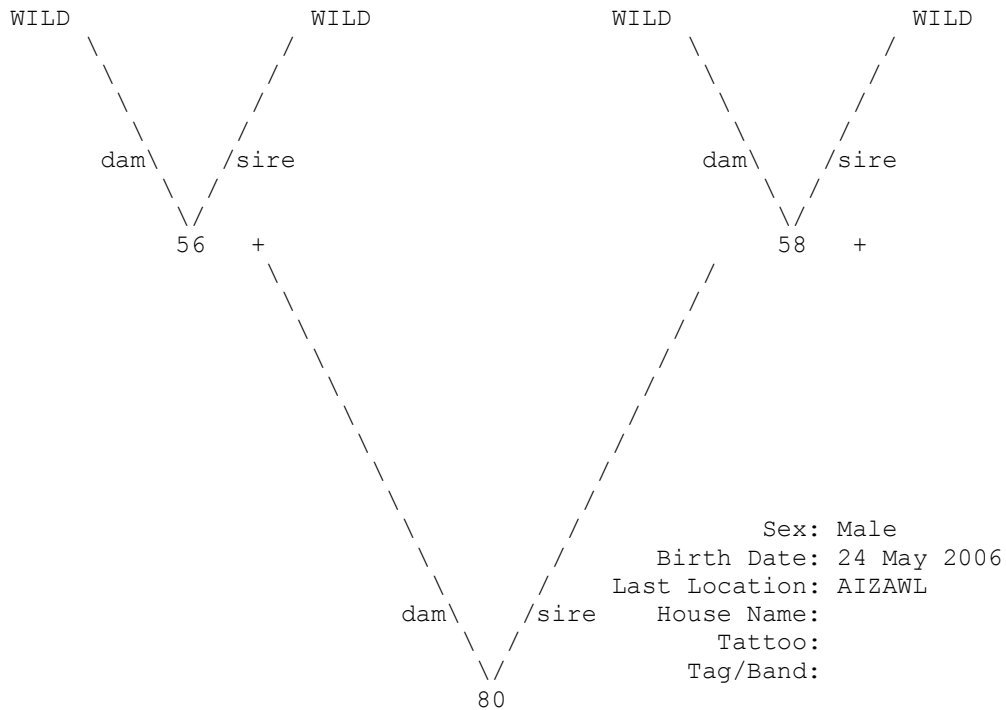
+ Wild-caught...

=====
n Name: MACACA ARCTOIDES Studbook Number: 79 Taxo
=====



+ Wild-caught...

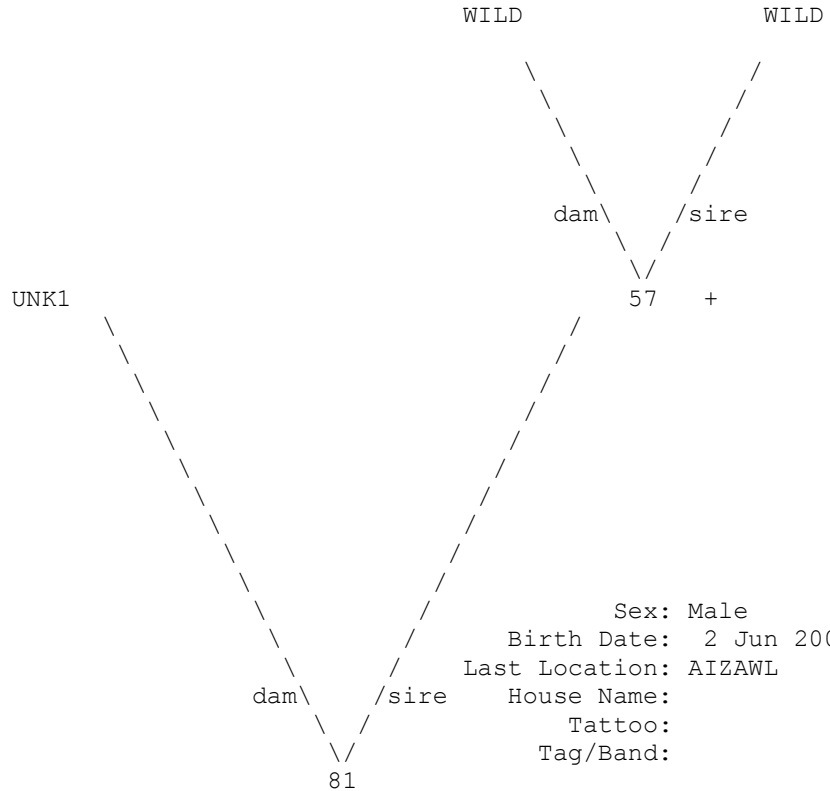
=====
Taxon Name: MACACA ARCTOIDES Studbook Number: 80
=====



+ Wild-caught...

=====
Taxon Name: MACACA ARCTOIDES
=====

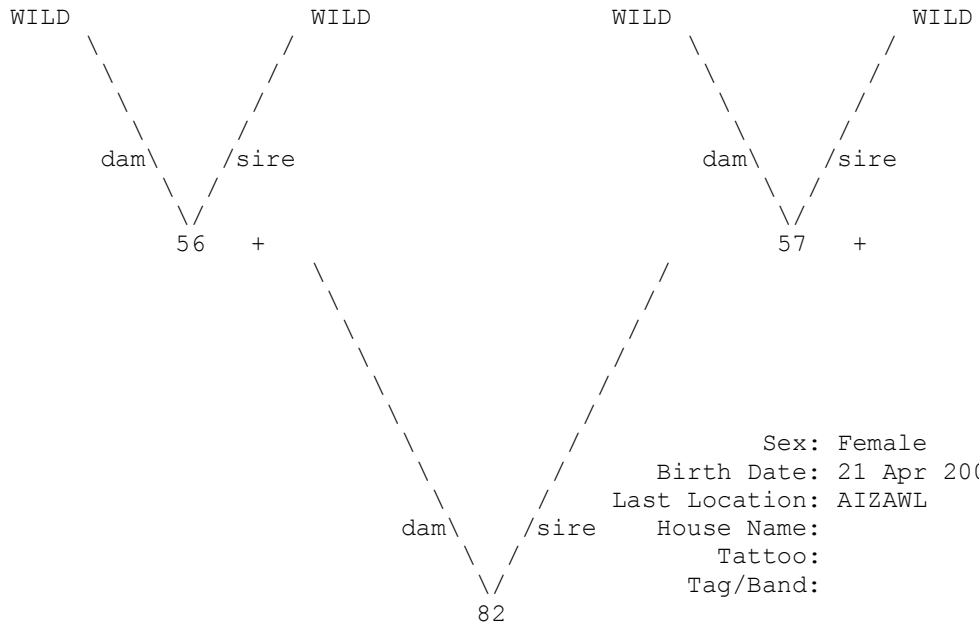
Studbook Number: 81
=====



+ Wild-caught...

=====
Taxon Name: MACACA ARCTOIDES
=====

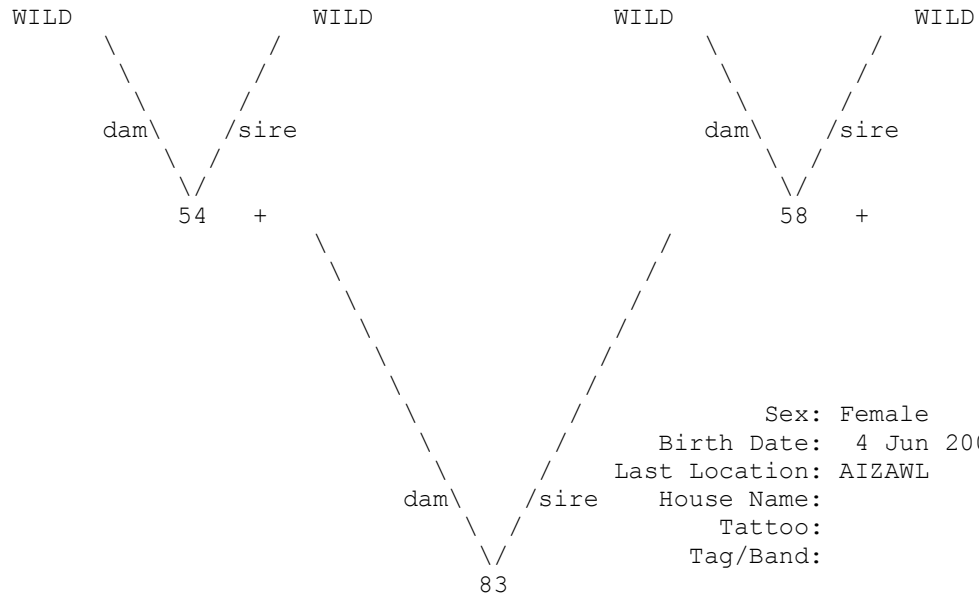
Studbook Number: 82
=====



+ Wild-caught...

=====
Taxon Name: MACACA ARCTOIDES
=====

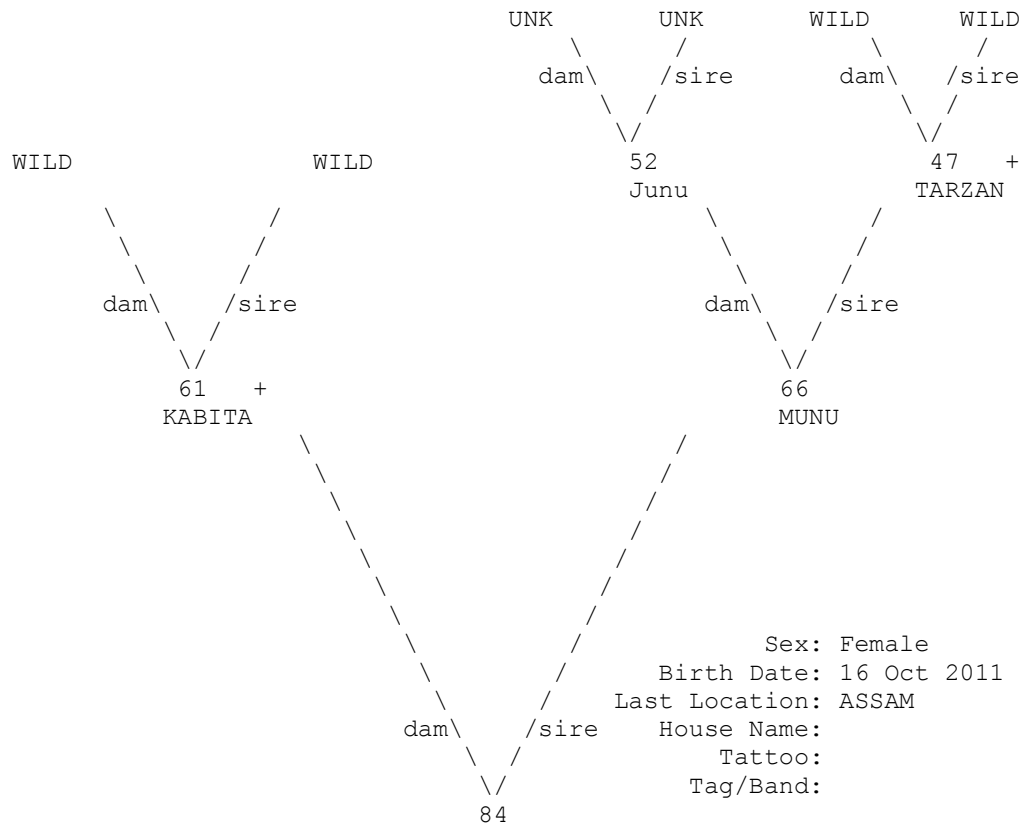
Studbook Number: 83
=====



+ Wild-caught...

=====
Taxon Name: MACACA ARCTOIDES
=====

Studbook Number: 84
=====

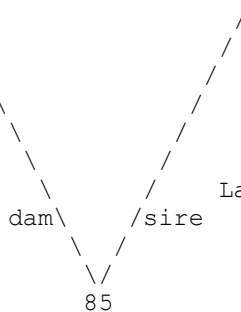


+ Wild-caught...

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 Taxon Name: MACACA ARCTOIDES Studbook Number: 85
 =====



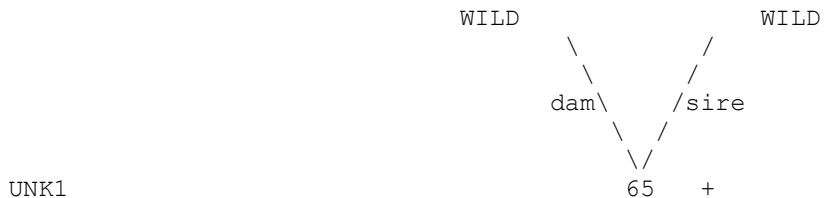
Sex: Female
 Birth Date: 5 Mar 2012
 Last Location: AIZAWL
 House Name:
 Tattoo:
 Tag/Band:



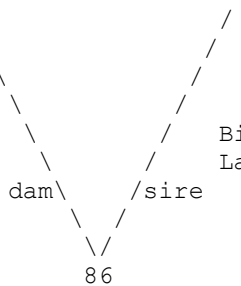
85

+ Wild-caught...

=====
 Taxon Name: MACACA ARCTOIDES Studbook Number: 86
 =====



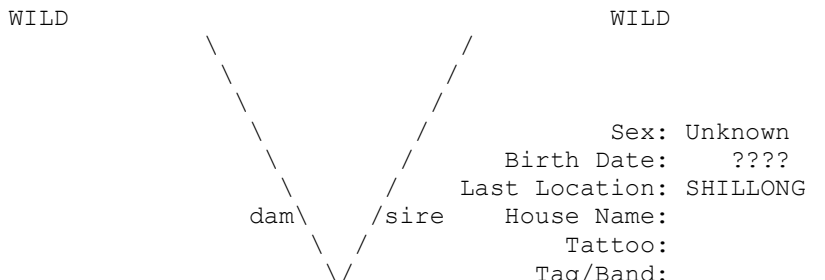
Sex: Male
 Birth Date: 1 Jun 2012
 Last Location: AIZAWL
 House Name:
 Tattoo:
 Tag/Band:



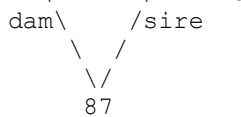
86

+ Wild-caught...

=====
 Taxon Name: MACACA ARCTOIDES Studbook Number: 87
 =====



Sex: Unknown
 Birth Date: ????
 Last Location: SHILLONG
 House Name:
 Tattoo:
 Tag/Band:



87