

NATIONAL STUDBOOK

Indian Pangolin (*Manis crassicaudata*)

Published as an outcome of the Central Zoo Authority sponsored project titled:
“Development and Maintenance of Studbooks for Selected Endangered Species in
Indian Zoos”

Awarded to the Wildlife Institute of India

[Sanction Order: Central Zoo Authority letter no. 9-2/2012-CZA(NA)/418 dated 7th March
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Central Zoo Authority

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Foreword

Habitat loss, fragmentation and degradation coupled with poaching are limiting the growth of wild populations of several species; increasingly rendering them vulnerable to extinction. For species threatened with extinction in their natural habitats ex-situ conservation offers an opportunity for ensuring their long-term survival. Pedigree information contained in studbooks forms the basis for scientific management and ensures long term genetic viability and demographic stability of such populations.

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 endeavour 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 II edition of the National Studbook of Indian Pangolin (*Manis crassicaudata*) in Indian zoos. The recommendations contained in the studbook can form basis for the long term management of the species in captivity. It is hoped that the holding institutions will adopt the recommendations and keep the WII informed of changes in their populations on a regular basis to enable the timely update of the studbook.

(Dr. D.N. Singh, I.F.S.)
Member Secretary
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Species Biology

Pangolins are insectivorous mammals inhabiting tropical and subtropical forests, dry woodlands, and open savannah regions in Africa and Asia (Nowak 1991). The French name “Pangolin” is derived from the Malayan phrase, “pengulin”, which refers to the animal’s unusual defensive posture of rolling up into a tight ball. *Manis crassicaudata* is a medium-sized mammal, with a streamline elongated body and tail covered with large overlapping scales rather than fur. Various anatomical adaptations enable it for an exclusive myrmecophagous diet.

Taxonomy

Kingdom : Animalia
Phylum : Chordata
Subphylum : Vertebrata
Class : Mammalia
Order : Pholidota
Family : Manidae (Gray 1827)
Genus : *Manis* (Linnaeus 1758)
Species : *crassicaudata* (É. Geoffroy Saint-Hilaire 1803)



Pangolins were previously classified with the New-world xenarthrans (anteaters, armadillos and sloths) in the Order Edentata; however, they have now been recognized as taxonomically distinct and the similarities are considered to have resulted from convergent evolution (de Jong 1998, Madsen *et al.* 2001, Murphy *et al.* 2001, Delsuc *et al.* 2001). Taxonomic revisions have placed all pangolins in the order pholidota. The order has limited diversity (Rose 2001) and includes a single family manidae having three extant genera; *Manis* for the Asian pangolins, *Smutsia* for the African ground pangolins and *Phataginus* for the African tree pangolins (Gaudin *et al.* 2009). Molecular genetics based phylogenetic analyses also support the monophyly of the three genera and the basal division between the families Maninae and Smutsiinae (Hassanin *et al.* 2015).

The Genus, *Manis* is characterised by the presence of well developed pinnae, hair layered between scales that are retained in adults (Macdonald 2006) and a median row of scales that continue to the end of the tail (Patterson 1978). Pangolins species extant in India include the Indian or thick-tailed pangolin, *M. crassicaudata* (Geoffroy 1803) and the Chinese or Formosan pangolin, *M. pentadactyla* (Linnaeus 1758) with distribution of both overlapping in northern India (Roberts and Vielliard, 1971).

M. crassicaudata and *M. pentadactyla* can be differentiated with the former having larger scales and smaller ear pinnae, 11-13 rows of body scales compared to 15-18 rows in the latter and a terminal scale on the ventral side of the tail in the former (Ogilvie and Bridgwater, 1967; Pocock, 1924). The latter has a post-anal depression in the skin, and a distinct narrowing of the tail toward the end; both characteristics are absent in *M. crassicaudata* (Pocock, 1924).

Morphology

Indian Pangolin is sexually dimorphic with males being up to 90% heavier than their counterparts (Payne and Francis 1998). The entire body except the foot pads, ventral side of the head and trunk,

and inner surface of the limbs are covered by scales. Parts not covered by scales have a sparse cover of white or gray hairs. The scales are made of fused hair, originate from the thick skin, and continue to grow from the base throughout life (Aiyappan, 1942). The skin and scales make up 1/4 to 1/3 of total body mass (Kingdon, 1974). The scales provide limited insulation and protection from external parasites; however, they require no grooming, deter predators, and protect the animals from underbrush and sharp rocks in the burrow walls. As a defense the Indian pangolin rolls into a tight sphere presenting only its scales to predators (Heath 1995).

Adaptations for myrmecophagy include absence of teeth, a long protrusible and sticky tongue to lap up prey, conical head and nose and absence of external ear (Macdonald 2006, Francis 2008). The ability to close ear canals (Lekagul and McNeely 1988) and specialised muscles that close the nostrils during feeding and thick eye lids (Nowak 1991, Macdonald 2006) are the other adaptations. The forelegs are large with robust claws for digging burrows and excavate nests or mounds (Payne *et al.* 1985, Payne and Francis 1998). The stomach is bi-chambered and specialised to masticate the chitinous exoskeleton of ants and termites (Sweeney 1956, Smithers 1983, Legakul and McNeely 1988, Nowak 1991, Swart *et al.* 1999).

Table 1: Morphometrics of the Indian pangolin*

Characteristics	Range
Head to body length (adult)	60-75 cm Prater (1980)
Head to body length (new-born)	30 cm
Tail length (adult)	40-55 cm
Tail length (new-born)	12.5 cm
Body weight (adult)	8-9 kg
Body weight (new-born)	230-240 gm

Source*: Grzimek (1990)

Distribution range

The distribution of the species extends from eastern Pakistan, through India from the Himalayan foothills, sporadically throughout the plains to southern India (excluding the north-east), southern Nepal and Sri Lanka (Tikader 1983, Schlitter 2005, Srinivasulu and Srinivasulu 2012). Historically, they have been reported from south-west China (Yunnan Province) (Heath 1995) and several districts of Bangladesh; however they are reported to be locally extinct in both countries (Heath 1995).

Habitat

The species has been reported from a variety of habitat types that include open grasslands, scrub and rain forests, and near human settlements (Zoological



Survey of India 2002). In Pakistan Indian pangolins have been reported to prefer hilly terrains as compared to other habitat types (Roberts 1977). The habitat preferences for the species have been found to be closely associated to the presence of plant species like *Zizyphus mauritiana*, *Acacia nilotica*, *Zizyphus nummularia*, *Prosopis cineraria* and *Lantana camara*, possibly due to the availability of termite mounds and ant's colonies on the soil below and on the trunks of these tree species (Mahmood *et al.* 2014).

Behavioural Ecology

The elusive, burrow-dwelling and nocturnal behaviour (Mishra and Panda 2010) of pangolins and their occurrence in relatively low densities, has limited studies on their behavioural-ecology and activity patterns (Prater, 1980). Predominantly terrestrial; however they have been reported to climb trees while chasing ants (Heath 1995) and inhabiting the canopy layer in tropical evergreen rain forests of Sri Lanka (Israel *et al.*, 1987). Locomotion is primarily quadrupedal walking, with back arched and both trunk and tail parallel to above the ground (Israel *et al.* 1987, Prater 2005). Senses of vision and hearing are reported to be poorly developed; however, olfactory senses are well developed (Israel *et al.* 1987). Olfaction is used for locating prey and plays an important role in intra-specific relations (Prater 2005).

Feeding and nutrition

Pangolins are obligate myrmecophages (Redford 1987) foraging on eggs, young and adults of ants and termites (Prater 2005, Roberts 1977, Yang *et al.* 2007, Mahmood *et al.* 2013) with a preference for insect eggs over adults (Prater 2005). The most favoured food sources have been reported to be leaf nests containing eggs and adults of large red ants (Heath 1995, Mahmood *et al.* 2013).

Items such as small pebbles, clay, sand, plant matter swallowed along with the food assist the grinding activity of the stomach (Grzimek 1990, Heath 1995, Macdonald 2006). Being nocturnal, pangolins primarily rely on their sense of smell to locate the nests of termites or ants (Israel *et al.* 1987, Mohapatra and Panda 2014b). Feeding is determined by the availability of ant and termite prey close to the soil surface nest and prey is consumed using their specialised tongue.

These animals have historically been difficult to maintain in captivity, due to their specialist, myrmecophagous diet, limited understanding of their wild social and reproductive behaviour (Challender 2011, Crandall 1964, Tenaza and Schultz 1977, Yang *et al.* 2007, Pattnaik 2008). Dietary husbandry for pangolins with special reference to Taipei Zoo was reviewed by Yang *et al.* (2007) and Hua *et al.* (2015). They concluded that replacement diets with an increase in volume of high protein insects, multivitamin and mineral supplements resulted in improved appetite, palatability with animals adapting to the replacement feed more rapidly. Several zoos have developed recipes for artificial diets, (Chevenix-Trench 1922, Crandall 1964, Ogilve and Bridegwater 1967, Yadav 1973, Ramakantha 1992, Lal-Mohan 1997) but keeping pangolins on such substitute food has been difficult. However, the very first confirmed captive breeding of pangolins (Achariyo and Mohapatra 1978) was recorded on a diet that included live termites.

In India, a feed consisting of red weaver ants (*Oecophylla smaragdina*) with their eggs and alternatively minced boiled poultry eggs, mixed with milk powder, when ants are not available, has been established at the Nandankanan Zoological Park (Mohapatra and Panda 2014a).

Burrowing

Burrows are critical for the species as they provide a stable micro-climate for thermoregulation and micro-habitat for breeding and avoiding bad weather and predators (Prater 2005, Mohapatra and Panda 2013, Mohapatra *et al.* 2014). The burrow depth varying with soil type, ranging from 2 m in rocky soil to 6 m in loose soil (Prater, 1980) with the opening being closed with soil after entry. Burrows vary in different habitats depending on the soil composition; wet soils were preferred for digging by pangolins at Nandankanan (Mohapatra and Panda 2014b). Two main types of burrows have been reported for wild Indian pangolins in Pakistan; feeding burrows (depth= 20.3-36.8 cm, width= 20.3-24.1 cm) and living burrows (depth= 132-157.7 cm, width= 23-30.5 cm) which are abandoned after few months and new ones are dug close to available resources (Mahmood *et al.* 2013).

Under captive conditions in India, four different types of burrows have been observed with variable size and complexity *viz.* Type I- single tunnel with one opening, Type II- single tunnel with opening at both ends, Type III- single branched tunnel with multiple openings and Type IV- reticulated tunnel with multiple openings (Mohapatra *et al.* 2014).

Activity pattern

During a study on the behaviour of six captive Indian pangolins, Mishra and Panda (2010) reported that major proportion of the total active time was spent in walking in the enclosure (59.34±22.33%), followed by feeding (14±4.32%) and other activities like exploration (6.59±3.91%), digging (3.67±3.65%), bipedal stand (2.3±1.73%), secretive (1.84±0.83%), drinking (0.72±0.56%), climbing (0.68±0.64%), coiling (0.61±0.43%) and bathing (0.18±0.06%). While they were recorded to be intermittently active between 17:00-5:00 hours (with a shorter active period ending by 23:00 hours) the peak activity period was recorded between 20:00 to 21:00 hours (Mohapatra and Panda 2014a).

Social interactions

The species is solitary (Roberts 1977), except during mating season, when the sexes occupy the same burrow (Roberts 1977, Prater 2005). Olfactory cues from droppings, urine and secretions from posterior glands are used for marking territories, the latter also serve to carry information about con-specifics, dominance, possible mates and are important in mother-offspring relationships (Grzimek 1990). Pangolin vocalisations, usually not well distinguished (mainly puffs and hisses) are unlikely to be used in intra-specific relationships (Grzimek 1990, Macdonald 2006).

Reproduction

Limited information is available on the reproductive behaviour of Indian pangolins in the wild (Mahmood 2015). Several zoos have maintained the species; however, only a few have been successful in breeding them *viz.* Calcutta zoo, (Jarvis 1965), Oklahoma zoo (Ogilvie and Bridgwater 1967), Nandankanan Zoological Park (Acharjyo and Misra 1972, Acharjyo and Mohapatra 1978, Pattnaik 2008).

Sexual interactions between a mating pair comprise of courtship, approaching, chasing, mounting, copulation and retreat (Mohapatra and Panda 2014b). Copulation takes place in a dorso-lateral mounting position and lasts for 2.5 to 7 minutes. Upon termination of copulation, the pair move away separately and at times retreat to rest. They are believed to reproduce all year round with births

occurring throughout the year, except during May and June (Prakash 1960, Acharjyo and Misra 1972, Acharjyo and Mohapatra 1978, Acharjyo 2000, Prater 2005, Pattnaik 2008). Indian pangolins usually give birth to single offspring (Israel 1987) but twinning has been reported on occasions (Prater 2005). The gestation period for the species has been estimated to be between 65-70 days (Zoological Survey of India 2002) and 80 days (Roberts 1977).

Indian pangolins like Chinese pangolins, do not exhibit external signs of pregnancy (Heath and Vanderlip 1988, Mohapatra and Panda 2014a), and both sexes of the pair occupy the same burrow along with their offspring (Zoological Survey of India 2002). Acharjyo and Misra (1972) noted that newborn pangolins were well developed; weighing around 235 g and measuring about 30 cm in length, with eyes open, soft flexible scales with gray hair interspersed in between and ability to crawl immediately after birth.

Maternal care in the Indian pangolin appears to last for around three months (in captivity) wherein the baby resides inside the burrow (Mohapatra and Panda 2014b). The young is carried onto its mother's tail throughout the period of maternal care during which the mother introduces it to the different parts of the enclosure (Phillips 1928, Israel *et al.* 1987). The mother is usually very protective towards the young and intermittently inspects the baby when it is at a distance (Mohapatra and Panda 2014b). When threatened, she folds her offspring under her body with her tail (Phillips 1928). Young pangolins become independent at five to eight months of age, and are believed to reach sexual maturity at 2 years (Dickman 1984).

Details of the life history traits of the species from various sources are summarized in table 2.

Table 2: Life-history traits of the Indian Pangolin

Age at sexual maturity	2 years (Dickman 1984)
Gestation period	65 - 70 days (Hayssen and Tienhoven 1993; ZSI 2002; Miller and Fowler, 2014); > 80 days (Roberts 1977); 165 days (Panda <i>et al.</i> 2010)
Birth seasonality	Throughout the year except May and June (Pattnaik 2008).
Litter size	1-2 (Israel <i>et al.</i> , 1987; , Roberts 1977; Prater 2005)
Weaning age	5-8 months (Mohapatra and Panda 2014a)
Maximum longevity	In wild – unknown In captivity – > 13.5 years (Jones 1977)

Threats and conservation measures

The species is subject to intense poaching for its meat, alleged medicinal properties and use of scales for curios (CITES 2000, Misra and Hanfee 2000, Challender 2011, Mahmood *et al.* 2012) leading to population declines. The species is therefore listed as endangered in the IUCN Red List of Threatened Species (Baillie *et al.* 2014); under the Schedule I of the Wildlife (Protection) Act 1972 of India and included in Appendix II of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

An action plan for their conservation (Challender 2014) recommends efforts directed at developing an understanding of the species, training of enforcement agencies and stresses on the need for their conservation breeding. The plan emphasizes on the need of developing protocols for their conservation breeding, rehabilitation and reintroduction protocols

Status in captivity

Historically, Indian Pangolins have been maintained in captivity since 1892 (Sanyal 1892), since then many zoos have kept pangolins for brief periods of time. They are considered difficult to maintain and breed in captivity, apparently due to the poor acceptance of captive diets and digestive problems. At present a small captive population of 6 individuals is maintained at Nandankanan Zoological Park (NKZP), India; the coordinating zoo for the conservation breeding of the species (ZIMS data current as on November 2015) and the species is part of the Conservation Breeding Program (CBP) initiated by the Central Zoo Authority, India. Details of the past status of the species in Indian zoos are presented in Table 3.

Table 3: Status of the Indian Pangolin in Indian zoos

Location	Total no. of individuals (M.F.U)	Living Individuals (M.F.U)	Time span during which Indian Pangolins were kept (years)	Births (M.F.U)	Deaths (M.F.U)
Calcutta	2.1.0	0.0.0	1995-99 (5)	0.0.0	2.1.0
Chatbir	0.0.1	0.0.0	2001 (1)	0.0.0	0.0.1
Kanpur	0.2.0	0.0.0	2006 (1)	0.0.0	0.2.0
Madras	1.0.0	0.0.0	2000 (1)	0.0.0	1.0.0
Mangalore	1.0.0	0.0.0	2011 (1)	0.0.0	0.0.0
Nandankanan	14.26.3	2.4.0	1995-15 (21)	7.7.3	10.22.3
Pimpri	0.0.1	0.0.0	2006 (1)	0.0.0	0.0.1

Methods

Pedigree data was collected by means of questionnaires, zoo visits and from the websites of CZA and ZIMS (Zoological Information Management System). Questionnaires were sent to the institutions housing Indian pangolins in India, requesting information for each captive specimen. Data was entered in the Single Population Analysis and Records Keeping System (SPARKS v 1.66) (ISIS 2004). Detailed demographic and genetic analysis was not performed due to the small size of the population [2.4.0 (6)] and unavailability of dates of events and parentage records.

Scope of the studbook and data quality

The National Studbook is a chronology of the population of Indian pangolins (*Manis crassicaudata*.) held in Indian zoos. The

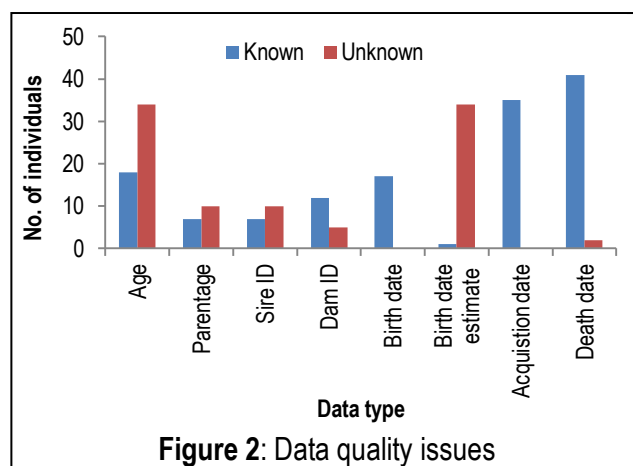


Figure 2: Data quality issues

studbook includes the historical as well as the living list of individuals, current through November 2015. Data used for development of the studbook are based on information made available by the holding zoos and contains historical information from 1995 onwards (CZA website and zoo records). The quality of data with respect to compilation of the studbook is summarized in Figure 2.

The studbook includes a total of 52 individuals. Ages were known for 18 and complete parentages were known for 7 of these specimens. Birth dates were known for all the 17 captive-born individuals while estimated birth date was known for only 1 wild-born pangolin. Dates of acquisition were available for all the 35 wild-born individuals, while death dates were available for 41 out of the 43 mortalities.

ANALYSIS

Historical population

Census trends

The historical population in Indian zoos includes 52 (18.22.5) individuals recorded from seven institutions that includes 35 (11.22.2) wild-born and 17 (7.7.3) captive-born individuals. The origin based census trends of the population (Figure 3) indicate the population till 2005 consisted only of wild origin animals when the first birth occurred. The population subsequent to 2005 also includes only a small proportion of specimens of captive origin. The sex based census trends (Figure 4) indicate a female bias in the population from its inception. The census trends also suggest that the population has persistently remained small with a median of 2 individuals (2.24Mean±1.48SD) per year and shows a declining trend.

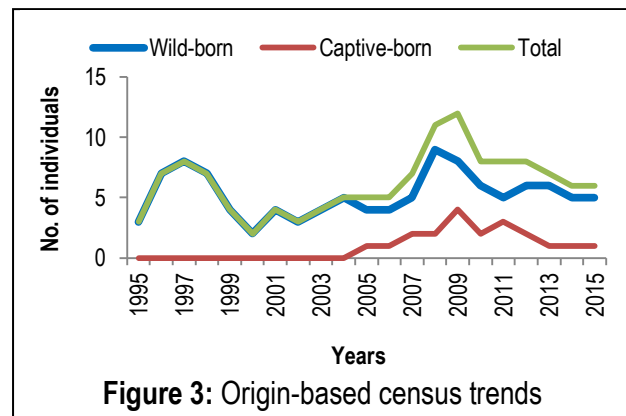


Figure 3: Origin-based census trends

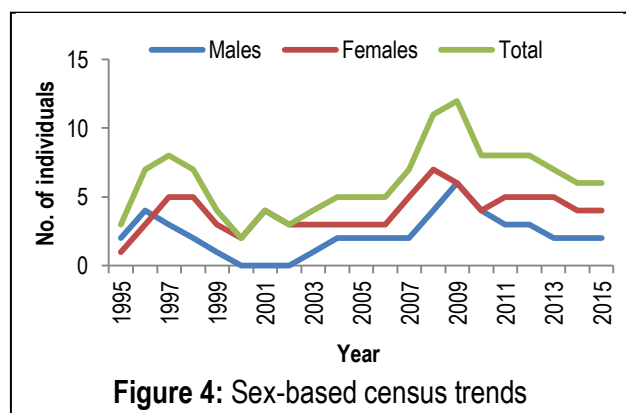


Figure 4: Sex-based census trends

A peak of 12 individuals was reached in the year 2009; thereafter the population has been declining steadily despite attempts to increase the breeding potential. The decline in population may be attributed to mortalities exceeding births in the population (births n=4; and mortalities n=12) during the past 6 years. The historical population is summarized in table 4 and the specimen-wise details of the historical population are presented in Appendix I.

Table 4: Summary of the historical population

	Males	Females	Unknown	Total
Total studbook size	18	29	5	52
Total number of acquisitions from wild	11	22	2	35
Total number of births	7	7	3	17
Total number of deaths	13	25	5	43

	Males	Females	Unknown	Total
Total number of Lost to follow ups (Ltf)	1	0	0	1
Total number of escaped individuals	2	0	0	2
Total number of breeding individuals	3	7		10
Wild-born that have bred	3	7		10
Captive-born that have bred	0	0		0

Living population

As on November, 2015, the captive population of Indian Pangolins consists of 6 (2.4.0) animals including 1 (1.0.0) captive-born and 5 (1.4.0) wild-born individuals housed in one facility. The living population is summarized in table 5 and details are presented in Appendix II.

Table 5: Summary of the living population

	Male	Female	Unknown	Total
Total number of individuals	2	4	0	6
Total number of wild-born individuals	1	4	0	5
Total number of captive-born individuals	1	0	0	1
Total number of breeding individuals	1	3		4
Wild-born that have bred	1	3		4
Captive-born that have bred	0	0		0

Age distribution

The age-structure of the population is depicted in Figure 5. The ages of 5 out of the 6 living individuals were not known; however, based on the dates of entry in the zoo, the captive longevity of the wild-born individuals was calculated. The living population consists mostly of adult pangolins in the age class 7-15 years with a deficit of animals in the lower age classes and a female biased sex-ratio. Breeding records indicate that four wild-born individuals have bred in the past but

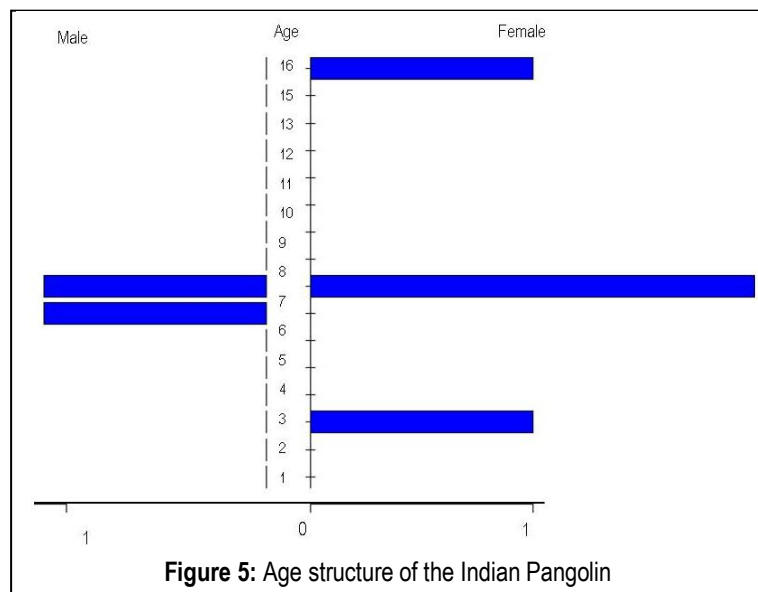


Figure 5: Age structure of the Indian Pangolin

due to the high rate of infant mortality, had no reproductive success so far. These attributes are suggestive of a declining population and are a concern for future viability.

Limitations

Paucity of data for events and parentage, and the small population size limit further demographic and genetic analysis. It also limits the establishment of targets for population management and pairing choices that can be exercised.

Conclusions and Recommendations

Indian pangolin is severely threatened with extinction due to intense poaching and is accordingly listed as Endangered in the IUCN Red List. The survival of the species is therefore dependent on intensive interventions that include intensive protection of surviving populations and *ex-situ* management. A review of literature has; however, revealed the challenges of captive husbandry particularly nutrition to be a major limitation for the effective management of the species in captivity.

Nandankanan Zoological Park, Bhubaneswar is the lone captive facility holding a breeding population; however, a review of the population indicates the following:

- a. Small population size of the captive population.
- b. Female biased sex ratio and an ageing population trend.
- c. Poor reproductive output of the captive population that does not compensate the mortality rate.

The above factors are suggestive of a declining population that is unlikely to fulfil the objectives of the *ex-situ* conservation program for the species.

The population trends and review of literature suggest the need for intensive efforts focussed on establishing husbandry protocols for effective *ex-situ* management of the species. The efforts should be directed at providing:

- i. Appropriate housing that ensures minimal stress for the animals.
- ii. Meeting nutritional requirements while ensuring palatability and digestibility.
- iii. Health care focused at addressing the high mortality of captive born individuals.

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Historical Population of *Manis crassicaudata*

Sl. No.	National Studbook No.	Local ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
1.	1	Unnamed	M	????	Wild	Wild	India Calcutta	~ Apr 1995 ~ Apr 1995 20-Aug-98	Capture Transfer Death
2.	2	Unnamed	M	????	Wild	Wild	India Calcutta	~ Jun 1995 ~ Jun 1995 31-Aug-99	Capture Transfer Death
3.	3	Unnamed	F	????	Wild	Wild	India Nandankanan	30-Jul-95 30-Jul-95 06-May-99	Capture Transfer Death
4.	4	Murali	M	????	Wild	Wild	India Nandankanan India	22-Mar-96 22-Mar-96 21-May-00	Capture Transfer Release
5.	5	Sumati	F	????	Wild	Wild	India Nandankanan India Nandankanan	27-Mar-96 27-Mar-96 21-May-00 31-Aug-00 31-Aug-00 ????	Capture Transfer Release Capture Transfer Death
6.	6	Unnamed	M	????	Wild	Wild	India Nandankanan	18-Jul-96 18-Jul-96 02-Oct-97	Capture Transfer Death
7.	7	Unnamed	F	????	Wild	Wild	India Nandankanan	27-Jul-96 27-Jul-96 01-Dec-96	Capture Transfer Death
8.	8	Unnamed	F	????	Wild	Wild	India Nandankanan	09-Oct-96 09-Oct-96 21-Apr-97	Capture Transfer Death
9.	9	Unnamed	F	????	Wild	Wild	India Nandankanan	14-Mar-97 14-Mar-97 05-May-02	Capture Transfer Death
10.	10	Unnamed	F	????	Wild	Wild	India Calcutta	~ Jun 1997 ~ Jun 1997 28-Sep-99	Capture Transfer Death
11.	11	Unnamed	F	????	Wild	Wild	India Nandankanan	26-Jul-97 26-Jul-97 19-Aug-97	Capture Transfer Death
12.	12	Unnamed	F	????	Wild	Wild	India Nandankanan	06-Nov-97 06-Nov-97 25-Mar-98	Capture Transfer Death
13.	13	Unnamed	?	03-Jan-98	4	5	Nandankanan	03-Jan-98 03-Jan-98	Birth Death
14.	14	Unnamed	F	????	Wild	Wild	India Nandankanan	26-Oct-98 26-Oct-98 26-Mar-99	Capture Transfer Death
15.	15	Unnamed	?	19-Jan-99	4	5	Nandankanan	19-Jan-99 19-Jan-99	Birth Death
16.	16	Unnamed	F	????	Wild	Wild	India Nandankanan	15-Jun-99 15-Jun-99 16-Apr-00	Capture Transfer Death
17.	17	Unnamed	F	????	Wild	Wild	India Nandankanan	11-Aug-99 11-Aug-99 11-Aug-99	Capture Transfer Death
18.	18	Unnamed AAZP1	M	????	Wild	Wild	India Madras	12-Mar-00 12-Mar-00	Capture Transfer

Sl. No.	National Studbook No.	Local ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
								01-Nov-00	Death
19.	19	Unnamed PNG-1 0006A2AA6F	F	????	Wild	Wild	India Nandankanan	16-Jul-00 16-Jul-00	Capture Transfer
20.	20	Unnamed	M	07-Jan-01	Unk	5	Nandankanan	07-Jan-01 22-Jun-01	Birth Death
21.	21	Unnamed	?	????	Wild	Wild	India Chatbir Z	~ 2001 ~ 2001 ~ 2001	Capture Transfer Death
22.	22	Unnamed PNG-6 98102057373	F	????	Wild	Wild	India Nandankanan	25-Mar-01 25-Mar-01 19-Apr-09	Capture Transfer Death
23.	23	Unnamed PNG-2 0006A2ACA3	F	????	Wild	Wild	India Nandankanan	05-Aug-01 05-Aug-01 03-Nov-10	Capture Transfer Death
24.	24	Unnamed	F	????	Wild	Wild	India Nandankanan	17-Mar-03 17-Mar-03 ????	Capture Transfer Death
25.	25	Unnamed PNG-7 0006A2923840	M	????	Wild	Wild	India Nandankanan	14-Apr-03 14-Apr-03 09-Jan-11	Capture Transfer Death
26.	26	Unnamed	F	24-Oct-03	Unk	24	Nandankanan	24-Oct-03 04-Dec-03	Birth Death
27.	27	Unnamed	M	????	Wild	Wild	India Nandankanan India	29-Dec-04 29-Dec-04 03-Feb-05	Capture Transfer Release
28.	28	Unnamed 9810205778	M	22-Sep-05	Unk	Unk	Nandankanan	22-Sep-05 25-Jul-10	Birth Death
29.	29	Unnamed	F	08-Dec-05	Unk	Unk	Nandankanan	08-Dec-05 09-Dec-05	Birth Death
30.	30	Unnamed	F	02-Feb-06	Unk	Unk	Nandankanan	02-Feb-06 07-Feb-06	Birth Death
31.	31	Unnamed	F	????	Wild	Wild	India Kanpur	~ 2006 ~ 2006 ~ 2006	Capture Transfer Death
32.	32	Unnamed	F	????	Wild	Wild	India Kanpur	~ 2006 ~ 2006 ~ 2006	Capture Transfer Death
33.	33	Unnamed	?	????	Wild	Wild	India Pimpri India	19-Nov-06 19-Nov-06 21-Nov-06	Capture Transfer Release
34.	34	Unnamed	M	11-Dec-06	Unk	Unk	Nandankanan	11-Dec-06 22-Dec-06	Birth Death
35.	35	Unnamed	M	14-Jan-07	Unk	23	Nandankanan	14-Jan-07 14-Jan-07	Birth Death
36.	36	Unnamed PNG-3 0006A283F9	F	????	Wild	Wild	India Nandankanan	09-Nov-07 09-Nov-07 08-Nov-14	Capture Transfer Death
37.	37	Unnamed PNG-6A 98102057484	F	16-Nov-07	25	22	Nandankanan	16-Nov-07 24-Mar-10	Birth Death
38.	38	Unnamed PNG-4 0006A2A395	F	????	Wild	Wild	India Nandankanan	02-Jan-08 02-Jan-08	Capture Transfer
39.	39	Unnamed PNG-5 0006A2A13A	M	????	Wild	38	India Nandankanan	02-Jan-08 02-Jan-08 18-Nov-10	Capture Transfer Death

Sl. No.	National Studbook No.	Local ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
40.	40	Unnamed PNG-2A	F	04-Mar-08	25	23	Nandankanan	04-Mar-08 08-Mar-08	Birth Death
41.	41	Unnamed	?	22-Apr-08	Unk	Unk	Nandankanan	22-Apr-08 22-Apr-08	Birth Death
42.	42	Unnamed PNG-4A	F	22-Apr-08	Unk	38	Nandankanan	22-Apr-08 22-Apr-08	Birth Death
43.	43	Unnamed PNG-9 98102056160	F	????	Wild	Wild	India Nandankanan	17-Sep-08 17-Sep-08	Capture Transfer
44.	44	Unnamed PNG-8 98102058378	M	????	Wild	Wild	India Nandankanan	20-Sep-08 20-Sep-08	Capture Transfer
45.	45	Unnamed 98102055473	M	17-Jul-09	25	23	Nandankanan	17-Jul-09	Birth
46.	46	Unnamed 00071515FE	M	28-Aug-09	25	38	Nandankanan	28-Aug-09 24-Aug-13	Birth Death
47.	47	Unnamed	F	03-Aug-11	Unk	43	Nandankanan	03-Aug-11 01-May-12	Birth Death
48.	48	Unnamed 100114	M	~ 2008	Wild	Wild	India Mangalore	06-Oct-11 06-Oct-11	Capture Transfer
49.	49	Unnamed	M	????	Wild	Wild	India Nandankanan	11-Oct-11 11-Oct-11 13-Oct-11	Capture Transfer Death
50.	50	Unnamed	F	????	Wild	Wild	India Nandankanan	06-Jul-12 06-Jul-12 29-Jul-13	Capture Transfer Death
51.	51	Unnamed 00074D5A63	F	????	Wild	Wild	India Nandankanan	03-Apr-13 03-Apr-13	Capture Transfer
52.	52	Unnamed	M	03-Nov-14	44	51	Nandankanan	03-Nov-14 08-Nov-14	Birth Death
TOTALS: 18.29.5 (52)									

Living Population of *Manis crassicaudata*

Sl. No.	National Studbook No.	Local ID	Sex	Birth Date	Sire	Dam	Location	Date	Event
Nandankanan Biological Park, Bhubaneswar									
1.	19	Unnamed PNG-10 0006A2AA6F	F	????	Wild	Wild	India Nandankanan	16-Jul-00 16-Jul-00	Capture Transfer
2.	38	Unnamed PNG-4 0006A2A395	F	????	Wild	Wild	India Nandankanan	02-Jan-08 02-Jan-08	Capture Transfer
3.	43	Unnamed PNG-9 98102056160	F	????	Wild	Wild	India Nandankanan	17-Sep-08 17-Sep-08	Capture Transfer
4.	44	Unnamed PNG-8 98102058378	M	????	Wild	Wild	India Nandankanan	20-Sep-08 20-Sep-08	Capture Transfer
5.	45	Unnamed 98102055473	M	17-Jul-09	25	23	Nandankanan	17-Jul-09	Birth
6.	51	Unnamed 00074D5A63	F	????	Wild	Wild	India Nandankanan	03-Apr-13 03-Apr-13	Capture Transfer
Totals: 2.4.0 (6)									
TOTALS: 2.4.0 (6)									
1 Institution									


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=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00006
=====
WILD                                                    WILD
                                                    Sex: Male
                                                    Birth Date:   ????
                                                    Last Location: NANDANKAN (dead)
dam \      / Last Location: NANDANKAN (dead)
   \    /  sire  House Name:
    \  /      Tattoo:
     \ /       Tag/Band:
      V
    00006

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=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00007
=====
WILD                                                    WILD
                                                    Sex: Female
                                                    Birth Date:   ????
                                                    Last Location: NANDANKAN (dead)
dam \      / Last Location: NANDANKAN (dead)
   \    /  sire  House Name:
    \  /      Tattoo:
     \ /       Tag/Band:
      V
    00007

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=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00008
=====
WILD                                                    WILD
                                                    Sex: Female
                                                    Birth Date:   ????
                                                    Last Location: NANDANKAN (dead)
dam \      / Last Location: NANDANKAN (dead)
   \    /  sire  House Name:
    \  /      Tattoo:
     \ /       Tag/Band:
      V
    00008

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```

=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00009
=====
WILD                                                    WILD
                                                    Sex: Female
                                                    Birth Date:   ????
                                                    Last Location: NANDANKAN (dead)
dam \      / Last Location: NANDANKAN (dead)
   \    /  sire  House Name:
    \  /      Tattoo:
     \ /       Tag/Band:
      V
    00009

```

```

=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00010
=====
WILD                                                    WILD
                                                    Sex: Female
                                                    Birth Date:   ????
                                                    Last Location: CALCUTTA (dead)
dam \      / Last Location: CALCUTTA (dead)
   \    /  sire  House Name:
    \  /      Tattoo:
     \ /       Tag/Band:
      V
    00010

```

```

=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00011
=====
WILD                                                  WILD
              \      /                               Sex: Female
              \    /                               Birth Date:   ???
              dam\ /sire Last Location: NANDANKAN (dead)
              \  /                               House Name:
              \ /                               Tattoo:
              00011                            Tag/Band:

```

```

=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00012
=====
WILD                                                  WILD
              \      /                               Sex: Female
              \    /                               Birth Date:   ???
              dam\ /sire Last Location: NANDANKAN (dead)
              \  /                               House Name:
              \ /                               Tattoo:
              00012                            Tag/Band:

```

```

=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00013
=====
WILD          WILD          WILD          WILD
  dam\        /sire        dam\        /sire
  \  /        \  /        \  /        \  /
  00005 +    00004 +
  SUMATI          MURALI
                Sex: Unknown
                Birth Date: 3 Jan 1998
                Last Location: NANDANKAN (dead)
                House Name:
                Tattoo:
                Tag/Band:
+ Wild-caught...
                00013

```

```

=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00014
=====
WILD                                                  WILD
              \      /                               Sex: Female
              \    /                               Birth Date:   ???
              dam\ /sire Last Location: NANDANKAN (dead)
              \  /                               House Name:
              \ /                               Tattoo:
              00014                            Tag/Band:

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=====
Taxon Name: MANIS CRASSICAUDATA Studbook Number: 00015
=====

```
WILD dam\ /sire WILD dam\ /sire WILD dam\ /sire WILD
      \ /      \ /      \ /      \ /
      00005 +    00004 +
      SUMATI      MURALI
                  Sex: Unknown
                  Birth Date: 19 Jan 1999
                  Last Location: NANDANKAN (dead)
                  House Name:
                  Tattoo:
                  Tag/Band:
+ Wild-caught... 00015
```

=====
Taxon Name: MANIS CRASSICAUDATA Studbook Number: 00016
=====

```
WILD dam\ /sire WILD
      \ /      \ /
      00016      Sex: Female
                  Birth Date: ????
                  Last Location: NANDANKAN (dead)
                  House Name:
                  Tattoo:
                  Tag/Band:
```

=====
Taxon Name: MANIS CRASSICAUDATA Studbook Number: 00017
=====

```
WILD dam\ /sire WILD
      \ /      \ /
      00017      Sex: Female
                  Birth Date: ????
                  Last Location: NANDANKAN (dead)
                  House Name:
                  Tattoo:
                  Tag/Band:
```

=====
Taxon Name: MANIS CRASSICAUDATA Studbook Number: 00018
=====

```
WILD dam\ /sire WILD
      \ /      \ /
      00018      Sex: Male
                  Birth Date: ????
                  Last Location: MADRAS (dead)
                  House Name:
                  Tattoo:
                  Tag/Band:
```

=====
Taxon Name: MANIS CRASSICAUDATA Studbook Number: 00019
=====

```
WILD dam\ /sire WILD
      \ /      \ /
      00019      Sex: Female
                  Birth Date: ????
                  Last Location: NANDANKAN
                  House Name:
                  Tattoo:
                  Tag/Band:
```



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=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00025
=====
WILD                                                    WILD
                                                    Sex: Male
                                                    Birth Date:     ????
                                                    Last Location: NANDANKAN (dead)
dam \      /sire  House Name:
   \      /      Tattoo:
    \    /      Tag/Band:
     \  /
      \ /
       V
      00025

```

```

=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00026
=====
WILD      WILD
dam \      /sire
   \      /
    \    /
     \  /
      \ /
       V
      00024 +
+ Wild-caught...
                                                    UNK
                                                    Sex: Female
                                                    Birth Date: 24 Oct 2003
                                                    Last Location: NANDANKAN (dead)
dam \      /sire  House Name:
   \      /      Tattoo:
    \    /      Tag/Band:
     \  /
      \ /
       V
      00026

```

```

=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00027
=====
WILD                                                    WILD
                                                    Sex: Male
                                                    Birth Date:     ????
                                                    Last Location: INDIA
dam \      /sire  House Name:
   \      /      Tattoo:
    \    /      Tag/Band:
     \  /
      \ /
       V
      00027

```

```

=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00028
=====
UNK                                                    UNK
                                                    Sex: Male
                                                    Birth Date: 22 Sep 2005
                                                    Last Location: NANDANKAN (dead)
dam \      /sire  House Name:
   \      /      Tattoo:
    \    /      Tag/Band:
     \  /
      \ /
       V
      00028

```

```

=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00029
=====
UNK                                                    UNK
                                                    Sex: Female
                                                    Birth Date: 8 Dec 2005
                                                    Last Location: NANDANKAN (dead)
dam \      /sire  House Name:
   \      /      Tattoo:
    \    /      Tag/Band:
     \  /
      \ /
       V
      00029

```



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=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00043
=====
WILD
dam\  \  /sire
  \  /
   \  /
    00043
Sex: Female
Birth Date:     ????
Last Location:  NANDANKAN
House Name:
Tattoo:
Tag/Band:

```

```

=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00044
=====
WILD
dam\  \  /sire
  \  /
   \  /
    00044
Sex: Male
Birth Date:     ????
Last Location:  NANDANKAN
House Name:
Tattoo:
Tag/Band:

```

```

=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00045
=====
WILD dam\  \  /sire WILD
  \  /
   \  /
    00023 +
+ Wild-caught...
dam\  \  /sire
  \  /
   \  /
    00045
Sex: Male
Birth Date: 17 Jul 2009
Last Location: NANDANKAN
House Name:
Tattoo:
Tag/Band:

```

```

=====
Taxon Name: MANIS CRASSICAUDATA                      Studbook Number: 00046
=====
WILD dam\  \  /sire WILD
  \  /
   \  /
    00038 +
+ Wild-caught...
dam\  \  /sire
  \  /
   \  /
    00025 +
Sex: Male
Birth Date: 28 Aug 2009
Last Location: NANDANKAN (dead)
House Name:
Tattoo:
Tag/Band:

```

=====
Taxon Name: MANIS CRASSICAUDATA Studbook Number: 00047
=====

WILD WILD
dam\ /sire
00043 + UNK
Sex: Female
Birth Date: 3 Aug 2011
Last Location: NANDANKAN (dead)
House Name:
Tattoo:
Tag/Band:
+ Wild-caught... 00047

=====
Taxon Name: MANIS CRASSICAUDATA Studbook Number: 00048
=====

WILD WILD
Sex: Male
Birth Date: ~ 2008
Last Location: MANGALORE
House Name:
Tattoo:
Tag/Band:
00048

=====
Taxon Name: MANIS CRASSICAUDATA Studbook Number: 00049
=====

WILD WILD
Sex: Male
Birth Date: ????
Last Location: NANDANKAN (dead)
House Name:
Tattoo:
Tag/Band:
00049

=====
Taxon Name: MANIS CRASSICAUDATA Studbook Number: 00050
=====

WILD WILD
Sex: Female
Birth Date: ????
Last Location: NANDANKAN (dead)
House Name:
Tattoo:
Tag/Band:
00050

=====
Taxon Name: MANIS CRASSICAUDATA Studbook Number: 00051
=====

WILD WILD
Sex: Female
Birth Date: ????
Last Location: NANDANKAN
House Name:
Tattoo:
Tag/Band:
00051

```
=====
Taxon Name: MANIS CRASSICAUDATA                               Studbook Number: 00052
=====
```

```

      WILD                WILD                WILD                WILD
      dam\                /sire                dam\                /sire
      \  \                /  /                \  \                /  /
      00051  +                00044  +
                                  Sex: Male
                                  Birth Date: 3 Nov 2014
                                  Last Location: NANDANKAN (dead)
                                  House Name:
                                  Tattoo:
                                  Tag/Band:
+ Wild-caught...
                                  \  \
                                  /  /
                                  dam\  /sire
                                  \  \
                                  00052

```