

Zoo animals held in India 2011

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There were 198 recognized zoos (including circuses) in India as of March 31st, 2011. Zoos are classified according to Rule 9 of Recognition of Zoo Rules, 1992, amended in 2009 (CZA 2009), into large, medium, small and mini zoos based on defined criteria. There were 7 large, 16 medium, 48 small, 86 mini zoos, 18 rescue centres and 23 circuses.

The Central Zoo Authority maintains an inventory of the animals housed at these zoos which is updated and published every year. It is compiled from the quarterly reports sent by the recognised zoos to the Authority. The inventory report includes information on the number of species housed in the zoo, the sex ratio, their birth and mortality figures.

The reports from all zoos have been included in this publication except for eight zoos which did not submit their inventory reports. Zoos in the states of Jammu and Kashmir, Himachal Pradesh, Uttarkhand, Uttar Pradesh, Haryana, Punjab and Madhya Pradesh were considered to be in the North region, zoos in the states of Rajasthan, Gujarat, Maharashtra were considered to be in the Western region, zoos in the states of West Bengal, Orissa, Bihar, Jharkhand and Chattisgarh were considered into be in the Eastern region, zoos in Assam, Meghalaya, Nagaland, Mizoram, Manipur, Tripura and Arunachal Pradesh were considered to be in the North-east region, zoos of Andhra Pradesh, Tamil Nadu, Karnataka and Kerala were considered to be in the South region and zoos in the Andaman Nicobar island were considered to be in the Island region.

Zoos exist all over the country and represent the rich faunal diversity of India. A good number of zoos also house foreign, exotic, animals. This inventory for the year April 2010 to March 2011 has been divided into three parts. Part 'A' gives the details of the birds and animals which are included in Schedules I & II of the Wild Life (Protection) Act 1972; these birds and animals are considered endangered and are accorded the highest level of protection under the law. Part 'B' lists all birds and animals, other than the endangered species, which are native to India and Part 'C' gives details of the foreign, exotic, animals kept in Indian zoos.

The inventories in 'A' & 'B' of the publication are sub-divided into two parts; part I contains the status of species in various zoos and part II contains the profiles of individuals of the endangered species which have been identified/ marked and have their pedigree/ history cards prepared. The process of marking as well as preparation of animal history cards of the endangered species has recently been initiated in zoos.

There are over 170 major zoos in the country which house over 46,003 animals of various taxonomic orders including exotic fauna. The mammals form the largest numbers (44%) of the captive animals followed by birds (38%) and reptiles (18%). There just one amphibian and no species of Fish or of lower orders. There are 18 rescue centres where the rescued wild animals are housed till they able to released back in the wild. There are 23 Circuses recognized by the Central Zoo Authority, which have few animals (N= 237), mostly mammals and birds.

Table 1 (a) No. of animals housed in various Recognised Indian Zoos

Class of animals	Number of Animals in April 2010			Number of animals in March 2011		
	No. of Endangered	Others	Total Animals	No. of Endangered	Others	Total Animals
Amphibian	13		13	23		23
Reptile	5157	2709	7866	5473	2743	8216
Bird	1840	15025	16865	1850	15572	17422
Mammal	6534	13524	20058	6631	13711	20342
Grand total	13544	31258	44802	13977	32026	46003

Mortality of Animals at Various Zoo

The number of animals in the zoos showed a gradual increase in number over the years. There was a 5% increase in the number of animals in 2010-2011 from the year 2009-2010 (Table 1 a). The mortality and birth rates remained fairly constant over the years.

Fig. 1. No of mortalities and births recorded in recognized zoos



On an average the percentage mortality recorded among the various classes of animals was 5.27 and was highest in mammals (6.76%) and lowest in reptiles (3.73%). The percentage of mortality appeared to be low in all the classes. The mortality was lower in reptiles compared to 2009-2010.

The main cause of mortality appeared to be old age and senility (33%) in the zoo animals. Respiratory problems was the second most important cause of mortality (21%) followed by infighting and injuries (12%).

Fig. 2. Causes of mortality in various classes of animals in the year 2010-11 (N=3262)

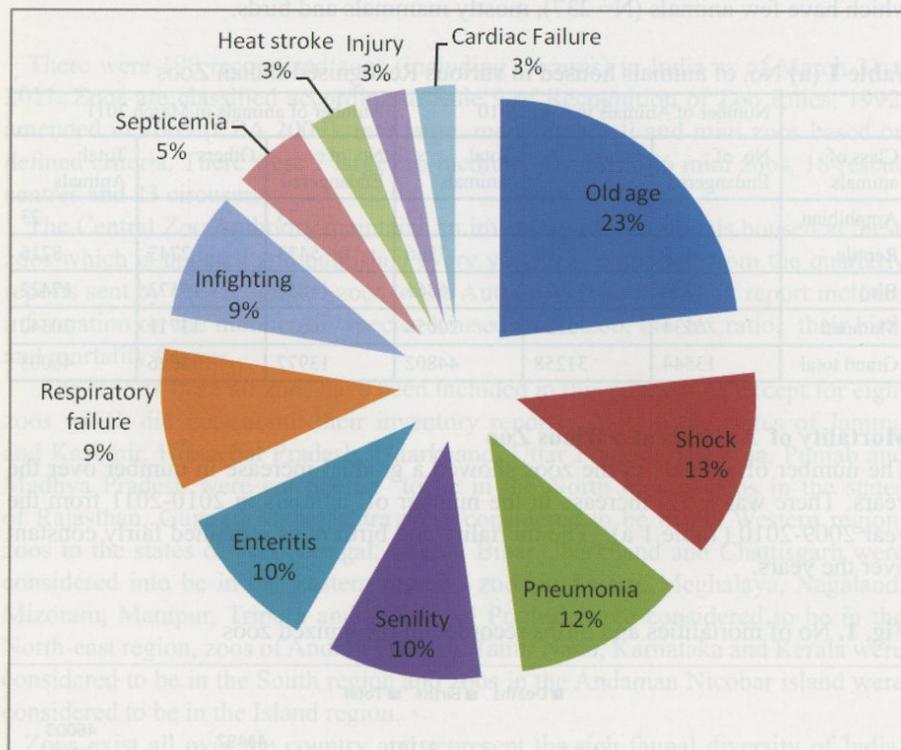
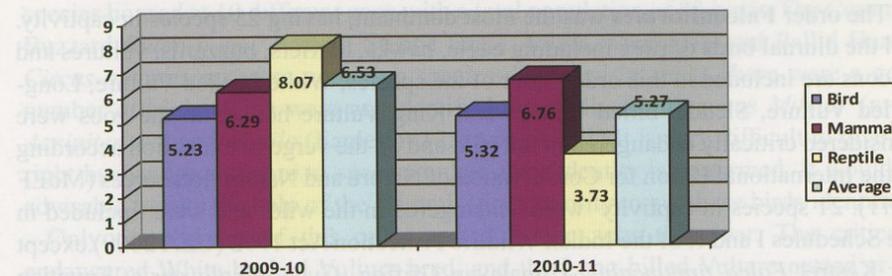


Table. 1(b) The percentage mortality recorded in various animal classes during the year 2010-11

Class	% Mortality
Birds	5.32
Mammals	6.76
Reptiles	3.73
Average	5.27 (N= 3262)

Fig. 3 Percentage mortality recorded in various classes of animals during various years



India is a mega-diversity country and is among the top ten nations endowed with the world's richest biodiversity. Its immense biological diversity represents about 7% of the world's flora and 6.5% of the world's fauna. There are about 614 species of amphibians and reptiles, 1300 species of birds and 350 species of mammals in India. Among the larger animals, 173 species of mammals, 78 species of birds and 15 species of reptiles are considered threatened (Islam and Rahmani 2004). The following describes the biodiversity housed in Indian zoos.

Avifauna:

India has a rich avian diversity and over 1300 species representing 22 taxonomic orders are recorded from the country (Rasmussen and Anderton 2005, Manakandan et. al. 2011). 79 species are endemic to India (BNHS Envis Centre). There are 13 critically endangered species according to the IUCN red data list (MoEF 2011). Over 7444 birds of 153 species (12%, n=1300) from 16 taxonomic orders which occur within the country were housed at 198 zoos in the country. The Indian Pea Fowl *Pavo cristatus* was displayed in the most number of zoos (39% n=198) with 906 birds in captivity. 26 species of birds were recorded from one zoo. The Rose-ringed Parakeet *Psittacula krameri* had the largest number of individuals in captivity (n=976 birds) in 43 zoos. 21 species were recorded from the zoos of all the five regions including East, West, North, South, North East and Islands and 35 species were recorded in zoos from only one region.

Five critically endangered species according to IUCN criteria, White-backed Vulture *Gyps bengalensis*, Long-billed Vulture *Gyps indicus*, Slender-billed Vulture *Gyp tenuirostris*, King Vulture *Sarcogyps calvus* and Forest Spotted Owlet *Athene blewitt* were housed at the zoos (MoEF and ZSI 2011). There were 37 endangered species displayed at zoos which were on the Schedules I and II of the Wildlife Protection Act 1972 (Appendix.1).

Three species, Grey Jungle Fowl *Gallus sonneratii*, Red Spur Fowl *Galloperidix lunulata* and Blue Winged Parakeet *Psittacula columboides* which are endemic to India were housed in the zoos (BNHS Envis centre).

Only 33 of the 153 species housed at the zoos were recorded breeding. Peafowl was recorded breeding at the most number of zoos (n=29) and the Night Heron was the most prolific breeder with 63 hatchings (Appendix.1).

The order **Falconiformes** was the most dominant, having 25 species in captivity. All the diurnal birds of prey including eagle, hawks, harriers, buzzards, vultures and falcons are included in this order. Four of the species, White-backed Vulture, Long-billed Vulture, Slender-billed Vulture and King Vulture housed in the zoos were considered critically endangered in the wild and on the verge of extinction according to the International Union for Conservation of Nature and Natural Resources (MoEF 2011). 21 species in captivity were endangered in the wild and were included in the Schedules I and II of the Indian Wildlife Protection Act 1972 (CZA 2009) except for Kestrel *Falco tinnunculus*, Himalayan Griffon, *Gyps himalayensis*, Egyptian Vulture *Neophron percnopterus* and Black Vulture *Aegyps monachus*. The animals listed in the Schedules I and II of the act are considered to be highly endangered and get the highest level of protection.



White-backed vulture *Gyps bengalensis* (Photo: Brij Kishor Gupta)

The Black Kite *Milvus migrans* was the most common species of raptor in captivity with 172 birds housed in 24 zoos, followed by the White-backed Vulture with 147 birds in 9 zoos. The Crested Serpent Eagle *Spilornis cheela* was the next popular species housed at 10 different zoos with a total population of 23 birds. The Common Buzzard *Buteo buteo*, Eastern Steppe Eagle *Aquila nipalensis*, and Pallid Harrier *Circus macrororurus* were wintering species displayed in zoos. There were a good number of birds which were not identified especially of the genus *Milvus* (n=5), *Accipiter* n=4 and *Aquila* (Eagle) n=12. (Appendix.1) It is very difficult to give the right husbandry and care to species unless their identity is confirmed. It would be advisable to take the help of the Central Zoo Authority to get these birds identified.

Only two species of this order nested in the zoos this year. The critically endangered White-backed Vulture bred, and the Long-billed Vulture nested at the Vulture Conservation Breeding Centre, Pinjore, Haryana.

Over 69 species of raptors are reported from India but only 36% (n=25) were represented in the zoos. The birds of prey are fairly easy to house and efforts should be made to have as many species housed as possible. Special efforts should be made to house endangered species found in the local area.

The **Ciconiiformes** was the second most represented order with 20 species of birds housed in the zoos. This family consists of egrets, heron, bitterns, storks, ibises and spoonbills. Two species, Greater white spoonbill and Eastern white stork, were considered endangered in the wild. Three species housed at zoos, Bittern *Ixobrychus* spp, White-stork *Ciconia ciconia* and Eastern or Oriental stork *Ciconia boyciana* were wintering birds in the country. The White stork bred in a zoo.

These piscivorous birds were found to be popular with a good number of zoos. Painted stork *Mycteria leucocephala*, (n=26 zoos) White Ibis *Threskiornis melanocephalus* (n=26) and Night Heron *Nycticorax nycticorax* (n=20) were popular but the Grey heron *Ardea cinerea* (n=10), Black-necked stork *Ephippiorhynchus asiaticus* (n=16) and Spoonbill *Platalea leucorodia* (n=17) were also seen in a number of zoos. Seven species nested in captivity in various zoos. The Night heron and Painted stork were the most prolific breeders followed by White Ibis and White Spoonbill (Appendix.1).

The White Stork and Eastern White Stork were the two wintering species of this order housed in the captivity. The White Stork bred at Sarnath Deer Park, Varanasi.

The order **Anseriformes** was represented by 13 species of ducks and geese. The Ruddy shelduck *Tadorna ferruginea* was the most popular species of the order housed in the zoos followed by the Comb duck *Sarkidiornis melanotos*. Both the species are resident in the country. The Lesser whistling teal *Dendrocygna javanica* and Spotbilled duck *Anas poecilorhynchus* were other resident ducks in the zoos but were displayed in only 7 zoos each. The other common resident duck, Cotton teal *Nettapus coromandelianus*, was not reported from any of the zoos.

Nine species of ducks were winter migrants to the country. Of them, Mallard *Anas platyrhynchos* was the most popular species kept in captivity. No geese were reported from any of the zoos. The only endemic species, Andaman teal *Anas*

albugularis, was also not represented in the zoos. Only the Spot-billed and Comb duck were recorded breeding in a few zoos. Both species were housed in zoos in all five regions of the country.

There were 20 species from the order **Galliformes** housed in captivity. The order consists of members of the partridge, quail, spur fowl and pheasant families. Two species, Red Spurfowl *Galloperdix spadicea* and Grey Junglefowl *Gallus sonneratii*, are endemic to India (BNHS Envis Centre Database). 9 species were considered to be endangered in the wild. Almost all the species are ground dwelling.

The Indian Peafowl which is also the national bird, was the most popular species of this order in captivity. It was housed in 78 zoos and had 956 individuals in captivity. Over 158 individuals were white in colour and probably albino. The Kalij Pheasant *Lophura leucomelans* was the second most popular species and was housed in 26 zoos. The Red Jungle Fowl *Gallus gallus* was also found in 26 zoos and had a captive population of 328 birds. It was however recorded nesting in only 7 zoos (Appendix.1). 11 species of Galliformes were recorded nesting in various zoos. The Indian Peacock was recorded nesting in 19 zoos.



Kalij Pheasant *Lophura leucomelans* (Male in front, female behind)

The **Gruiformes** is represented by three families in India, Turnicidae, Gruidae and Rallidae. Only birds of families Gruidae and Rallidae were represented in the zoos. There were four species of Cranes and five species of rails. The Black necked Crane was the only endangered species of the order housed in captivity (Appendix.1). The bird was kept in a Maitri Baugh Zoo, Bhilli, Chattisgarh.

There were four species of cranes of which two were resident and two migratory. Sarus crane *Grus antigone* the tallest flying bird, which is a resident species was seen in the highest number of zoos (nos 18) in good numbers. It was the only crane recorded nesting. None of the other species of this family were observed nesting in the zoos (Appendix.1).

The Charadriiformes, which is represented by 12 families in India was very poorly represented in the zoos. There were only three species from two families which included the Red-wattled and Yellow-wattled Lapwings (Appendix.1). Zoos should make efforts to get more species of this interesting family.

The Order **Columbiformes** had seven species kept in the zoos. The family of doves and pigeons was also very poorly represented in captivity. Nicobar Pigeon *Ducula nicobarica* was the only endemic species of the family housed in the zoos. Spotted Dove *Streptopelia chilensis* and Yellow-footed Green Pigeon *Treron phoenicoptera* were the most common species of this family in the zoos and were housed in five zoos. None of the species were however recorded breeding in zoos (Appendix.1). Doves and Pigeons are the most prolific breeders in the wild and it is surprising that very few breed in captivity.

The order Psittaciformes was represented by nine species of parakeets and parrots. The Lorikeet *Loriculus vernailis* was the only hanging parrot kept and breeding in the zoos and the Blue-winged Parakeet *Psittacula columboides* was the only endemic parakeet housed in the zoos.

The Rose-ringed Parakeet *Psittacula krameri* was the most common parakeet of Indian zoos and was housed in 43 zoos with over 976 individuals followed by Alexandrine Parakeet *Psittacula eupatria* which had 427 individuals in captivity and was housed in 37 zoos. There were about 470 individuals of unidentified parakeets in 24 zoos. Six species bred at the zoos including the unidentified parakeets (Appendix.1). It is important that these species are identified as soon as possible.

The order **Cuculiformes** largely consisted of Cuckoo species. Only the Koel *Eudynamis scolopacea* was housed in eleven zoos. No breeding was recorded. The Crow Pheasant *Centropus sinensis* was recorded only at one zoo (Appendix.1).

The order **Strigiformes** consists of two families of Owls, Tytonidae and Strigidae, and was represented by 13 species. One species, the Forest Spotted Owlet *Athene blewitt* is considered to be critically endangered in the wild and was kept in Maitri Baugh zoo, Bhillai, Chattisgarh. The Barn owl was the most common owl housed in the zoos. It was displayed in 30 zoos and it had 113 individuals in captivity. This species feeds mainly on rodents and is common in cities. The Brown Fish Owl *Ketupa zeylonensis* and the Mottled Wood Owl *Strix ocellata* were also in a few zoos. Only the Brown Fish Owl was recorded breeding in one zoo (Appendix.1).

Owls are fairly easy to keep in captivity and breed with little effort. Efforts should be made to house more owl species in zoos because they are very attractive species for the visitors. The Conservation Breeding Programme for the critically endangered Forest Spotted Owlet should be initiated forthwith in zoos which falls within its distribution range.

The order **Coraciiformes** has five families recorded from India. Two families, Alcedinidae (King-fishers) and Bucerotidae (Hornbills), were represented by one species of Kingfisher and four species of Hornbills in the zoos. All the species of Hornbills were considered endangered in the wild, The Indian Pied Hornbill *Anthracoceros coronatus* was the most popular species housed in 13 zoos followed by Common Grey Hornbill *Ocyrceros biostris* and Great Pied Hornbill *Buceros bicornis*. None of the species were recorded nesting in the zoos. Efforts should be made to provide the right environment to the birds to breed in captivity.

The order **Piciformes** is represented by the families, Capitonidae, Indicatoridae and Picidae in India. The Great Barbet *Megalimia virens* was the sole representative of this order in the zoos. No woodpeckers were housed in the zoos (Appendix.1). The species of this order are very colourful and would probably attract visitors to the zoo. They are easy to keep with little understanding of their ecology.

The order **Passeriformes** is represented by 43 families in the country but only five families, Pycnonotidae, Muscicapidae, Sturnidae, Dicruridae and Corvidae, with 12 species were recorded in captivity. The Hill myna *Gracula religiosa* was the most common species of this family in captivity (Appendix.1). It would be good to keep all the mynas and starling species in captivity as they require little husbandry and care. Most of them are still common and it would be good to develop husbandry and care protocols based on the experience of keeping these species in captivity.

Only 12 % of the Indian avifauna diversity is housed in the zoos. Only 6% (n=79) endemic and 38% (n=13) critically endangered species were in captivity. Mostly big, conspicuous and common birds like cranes, storks, herons, flamingos, pheasants and birds of prey are housed in captivity. The Rails, Plovers and Sandpipers, Bustards, quails and partridges and the passerines are poorly represented. Attempts must be made to keep insectivorous species like bee-eaters, fly catchers and chats. Although they are difficult to keep, with the provision of the right food, they could be housed and bred in captivity as has been done in zoos in other parts of the world. Every zoo should endeavour to house species found in their region and specially the endangered and endemic. It would be good to develop husbandry and care protocols for the different avifauna families. The collection plan should only include birds found in the region and for ones where the husbandry and care protocol have been developed. Only 23% (n=145) of the species housed at the centres were recorded breeding which reflects poorly on housing, husbandry and care of the species. Generally the species breed when the housing and nutrition conditions are good in captivity. So it is very urgent that the facilities in the zoos are developed keeping the biology and ecology of the bird in mind. Very few species are housed in a way which could be self sustaining with a planned breeding objective.

Besides education and entertainment, zoos play a very important role in the ex-situ conservation of species. With rapid habitat degradation due to human activities, a lot of species are declining rapidly and many are on the verge of extinction. Ex-situ conservation has now become an important if not the only tool to save species from going extinct. The Central Zoo Authority has initiated a Conservation Breeding Programme for 73 endangered species, including birds in zoos. It is important that zoos should strive to keep as many as possible local, endemic and endangered species and develop protocols for housing, husbandry and care and breeding programmes. It is vital that all the individuals are marked with identification and are kept in a naturalistic environment as far as possible. The naturalistic environment should be created taking into consideration the birds' biology and ecology and not whether humans like it or not. The zoos should develop capacity to house and breed species so that when there is a need for the Conservation Breeding Programme to be taken up, the zoo expertise will come in very useful.

Mammalian Fauna:

Over 350 species of mammals are recorded from India (Nambir 2000) of which 10 species are considered critically endangered (MoEF 2011). Over 19,996 individuals of 88 species of mammals are housed in the 198 recognised zoos in the country. 74 species are endangered in the wild and need protection (Appendix.2). From the 13 taxonomic orders and 44 families of mammals reported from the country 10 taxonomic orders are represented in Zoos (Nambir 2000). There are no mammals of the taxonomic order **Scandentia** (Tree shrews), **Cetacea** (Whales, Dolphins and Porpoises) or the order **Sirenia** (Dugongidae) represented in the collections of the zoos (Appendix.2).

Only four species in captivity are endemic to India; Bonnet Macaque *Macaca radiata*, Lion-tailed Macaque, *Macaca silenus* and Indian Giant Squirrel, *Ratufa indica* although there are 47 species of mammals which are endemic (Wilson & Reeder 2005). Ten species of mammals including 2 species of Shrews and 2 species of rats are classified as critically endangered and are on the verge of extinction according to IUCN red data book. None of the ten species of mammals which are critically endangered globally as identified by International Union for Conservation of Nature and Natural resources were in any of the Zoos in the country (MoEF 2011). However, Pigmy Hog, *Porcula salvania* one of the species which is globally critically endangered is kept in captivity at Basistha, Guwahati, Assam as part of a Conservation Breeding Programme.

The **Carnivora** was the most dominant order represented by 22 species which included the families of dog, bear, panda, otter and marten, civet cat, mongoose, Hynae and cat, followed by the order **Artiodactyla** represented by 22 species of the families of wild pig, mouse deer, musk deer, deer, and bovidae and the order **Primate** with 15 species including families of Loris, Macaques and Langurs, and Gibbons (Appendix.2).

The Felidae and Cercopithecidae were the most represented taxonomic families

within the zoos with 12 species followed by the family Bovidae with 11 species (Appendix.2). The family Bovidae had the largest number of individuals and over 59% of mammals housed in zoos were from this family. The Cheetah or Spotted Deer *Axis axis* was the most popular mammal in Indian zoos and were to be found in 117 zoos with total of eight thousand five hundred and five (nos 8505) individuals in captivity (Appendix.2). The species was found in zoos in all of the regions of the country. The species is a prolific breeder and is very adaptable and very attractive because of its golden spots. The Sambar *Cervus unicolor* (n=90) of the same family had the second highest number (n=2055) in captivity (Appendix.2).



Sambar *Cervus unicolor* (male)

The Leopard *Panthera pardus* was the most common predator in the zoos. 69 zoos housed over 400 animals of this species. A large number of Leopards were rescued animals because of the increasing man-animal conflict as man is constantly encroaching upon its habitat. The Rhesus Monkey *Macaca mulatta* was the commonest member of Cercopithecidae family with a population of 612 animals in 58 zoos. The commonest wild member of dog family, Jackal was the most popular canid in the zoos, 242 individuals of this species were housed in 51 zoos.

15 species of Primates were housed in various zoos of which 14 were endangered. The Rhesus Macaque was found in the most number of zoos (n=58) and also had the highest population in captivity of all the primates. Two endemic species of monkeys, the Bonnet and Lion-tailed were on display in different zoos in different regions. Three species, Golden Langur, Crab-eating monkey and Spectacled Leaf Monkey, which have restricted distribution in the wild were both found in one zoo. The Bonnet Macaque, Rhesus Macaque, Assamese Macaque and Common Langur are thriving in the human environment and most of them have come as rescued animals to the zoos.

Eight of the Primates breed in the zoos. The Rhesus and Bonnet Macaque were the most prolific breeders and bred in a number of zoos. The Central Zoo Authority has instructed zoos to restrict their breeding as they multiply quickly and there is no place to house them. The Hoolock Gibbon, *Hylobates hoolock* only has a small population in India and it is bred in Assam state Zoo, Guwahati and at Biological Park, Itanagar Arunachal Pradesh (Appendix.2).



Hoolock Gibbon, *Hylobates hoolock* (Female)

The dog family Canidae was represented by six species and all were considered endangered in wild. It does not appear to be a very popular family with the zoos. The Jackal was kept in only 25% of the zoos followed by the Wolf in just 7.5% of the zoos. All except the Red Fox, *Vulpes vulpes* bred in the zoos (Appendix.2).

The bear or the family Ursidae was represented by four species. The Himalayan Black Bear was seen in a good number of zoos in different regions and was recorded breeding. It appears to be highly adaptable as was observed breeding in tropical areas, although the species naturally inhabits temperate regions. Three species were recorded breeding except the Malayan Sun Bear *Helarctos malayanus*, which was being kept only in one zoo. This species has a very restricted distribution in the wild and is found only in north-east India.

The Endangered Red Panda *Ailurus fulgens* of the Aliuropodidae family was kept in two high altitude zoos and was found to be breeding (Appendix.2).

The Mustelid family was represented by five species. All the species are endangered which includes three species of Otters, one species of Marten and a species of Ratel. Very few zoos displayed these species. Only the Common Otter *Lutra lutra* was recorded breeding (Appendix.2). These are largely fish eaters and need specialised enclosures for housing.

The family Viveridae contains four species of civets and a species of Binturong and are all considered endangered. Only the Common Palm Civet *Paradoxurus hermaphroditus* was housed by many zoos in different regions and was recorded breeding in captivity (Appendix.2).

The Common Mongoose was the sole representative of the family Hesperidae in the zoos. It was seen in a few zoos but was not recorded breeding.

The family Hyaenidae was represented by its sole member, the Striped Hyaena. It was on display in about half of the zoos but was recorded breeding in only two zoos (Appendix.2).

In all 12 species of the cat family were housed in the zoos. All the cats housed in the zoo had endangered status in the wild and need protection. The Leopard was the most common cat, housed in over 69 (34%) zoos, followed by the Tiger which was displayed in 54 zoos and had over 370 individuals in captivity. There were 91 White-tigers housed in 21 zoos of the country. Their conservation value is not very high but they are very popular display animals. There were also about 280 hybrid lions housed in various captive facilities. Unfortunately, four zoos have bred them this year. These animals were mostly rescued from circuses and need to be phased out and only kept on welfare grounds. Zoos should ensure that no breeding takes place among these individuals as they have no conservation value. The lesser cats had a good representation in captivity. The Leopard cat *Felis bengalensis* and Jungle cat *Felis chaus* were the most common lesser cats displayed in the zoos. The Rusty Spotted cat *Prionailurus rubiginosus* has a very restricted distribution and was housed in only two zoos. The Cheetah *Acinonyx jubatus* has become extinct in India but individuals were brought from South Africa to Junagarh, Hyderabad and Mysore (where it bred) for exhibition and possible Conservation Breeding Programme.

The Asian Elephant *Elephas maximus* is the only representative of the order Proboscidea and family Elephantidae and was a popular exhibit in the zoos. The species bred in two zoos this year (Appendix.2). The Central Zoo Authority has issued a directive to the zoos not to keep elephants in the zoos but instead send them to elephant camps and rescue centres. Some zoos have surrendered their animals but most of the zoos have not done so yet. It is a huge animal which requires specialised facilities for holding in the zoo, which many zoos lack. Feeding the elephant is a huge expense which many zoos find it difficult to meet.

The Asiatic Wild Ass *Equus hemionus* represented the family Equidae. Only 15 individuals were in captivity in two zoos. The species also bred in the zoos (Appendix.2).

The One-horned Rhinoceros, *Rhinoceros unicornis*, the representative of the flagship species of the terai grassland ecosystem was housed in 11 zoos. There are 31 individuals of this species in captivity housed in 31 different zoos. No breeding of the species was recorded this year (Appendix.2).



Pigmy Hog (*Porcula sylvatica*)

The order Artiodactyla had the second highest number of species in the zoos. Except for the Wild Boar *Sus scrofa*, which is an omnivorous species, all the other species are typically herbivores. Except for the Barking deer all animals of this order are gregarious. Musk Deer *Moschus leucogaster* of the family Moschidae is probably the rarest of the species in captivity of this order. Only one animal is kept in one zoo. The Pigmy Hog of the family Suidae is the only globally critically endangered member of this order and was bred at the Pigmy Hog breeding centre at Vasistha, Guwahati, Assam and some have been released.

The family Cervidae of this order had six species on display in zoos. Two of the species, the Brow-antler Deer *Cervus eldi* and Swamp Deer *Rucervus duvaucelli*, are endangered in wild. The Cheetal deer was housed in the most number of zoos (59%, n=198) and had the highest number of animals in captivity (n=8505) (Appendix.2). All the members of this family except Barking Deer are gregarious and live in large herds.

The Family Bovidae had the most number of species on display in captivity. All accept the Blue Bull *Boselaphus tragocamelius* and Goral *Nemorhaedus goral* are considered endangered in the wild. A good population (n=1803) of Black Buck was seen in a number of zoos (35%, n=198). There were very few individuals of Yak *Bos grunniens*, Wild Buffalo *Bubalis bubalis* and Blue Sheep *Pseudois nayaur*.

The Order Pholidota was represented by a family Manidae. Two species of Ant eaters were on display of this family (Appendix.2). Both the species were known to be endangered in the wild. Very few zoos were recorded housing the species. The Nandankanan Zoo, Orissa, has a captive breeding programme of the Indian Pangolin

Manis crassicaudata. It has bred in the zoo though it did not breed this year. They are very selective feeders and prefer mostly the red ants.

The order Rodentia was represented by three families. Two species representing the family Sciuridae of Giant Squirrels were housed in the zoos. The Indian Giant Squirrel *Ratufa indica* which is an endemic species was housed in 15 zoos. It was also recorded breeding in one of the zoos. The Grizzled Giant Squirrel *Ratufa macroura* was kept in only one zoo. The Giant Flying Squirrel *Petaurista philippensis* was the only species of family Pteromyidae and was housed in three zoos in the country in different regions. It is considered to be endangered in the wild.

The family Hystricidae was represented by five species of porcupines. Two species are considered endangered. The Indian Porcupine was seen in a good numbers in 21% of the zoos. It bred in 15 zoos. Other species were recorded in a few zoos (Appendix.2).

The order Lagomorpha was represented by only one species of family Leporidae. The Black-naped hare was housed in three zoos but was not recorded breeding.

There were only two species of the order Insectivora in captivity. The Pale Hedge Hog *Paraechinus micropus* and Hedge Hog *Hemiechinus auritus* were housed in only one zoo and were not recorded breeding.

Only 25% (n=350) of the mammalian diversity found in the wild was housed in the zoos in India. The mega fauna of Indian wildlife was well represented in the zoos across the country. The Elephants, Rhinoceros, Bison, Tiger, Himalayan and Sloth Bear were housed in good numbers. The common and abundantly found wild ungulates were in good number specially those which do not require any special husbandry and care. There was however hardly any representation of lesser mammals. The rodents were very poorly represented. Only 8.5% (n=47) of endemic mammals were represented in the zoos. None of the ten critically endangered mammals were housed in the zoos. It is important that the zoos keep the endemic and critically endangered species which could besides educating the visitors could help initiate ex-situ conservation efforts to prevent their extinction. There did not appear to be a systematic plan for housing a viable number of animals of each species so far. With the writing up of a master plan and collection plan it is hoped that animals will be kept in numbers which will be best for the species conservation and availability of space. In quite a few cases it appears animals are kept just because the zoo could acquire them, either as rescued animals or in an exchange with other zoos.

The information given in the inventory did not give much of an idea about the longevity of the animals. There is very little information on this subject for most animals in the wild or in captivity. Zoos could compile the information on the number of years animals were in captivity and submit it with the inventory record. The White-backed vultures in Hyderabad zoo are known to have been in captivity for over thirty years (Director zoo pers. comms). This information on the survival of species is new to science and will be helpful in its conservation breeding programme. Such information could also be collected on other species through collaborative efforts of the zoos.

Reptilian Fauna non-native Fauna

Forty species of snakes, twenty species of turtle and tortoise, six species of lizards and a species of chameleon formed the reptilian captive fauna of the zoos. The Star Tortoise *Geochelone elegans* was the most popular exhibit among tortoises and turtles and was housed at 40 zoos with 1142 individuals. Among lizards, the Indian Monitor Lizard *Varanus bengalensis* was seen in the most number of zoos (n=25) with a population of 68 individuals in captivity. Over 2700 individuals of Mugger *Crocodylus palustris* were in 68 zoos. The Indian Rock Python *Python molurus* was the commonest snake kept in captivity in 59 zoos with 290 individuals (Appendix.3).

The Gharial or the Long Snouted Crocodile was the only critically endangered reptile housed in the zoos (MoEF 2011). 27 species of the reptiles recorded were considered endangered in the wild. Six species were critically endangered including two species of sea turtle, one species of river terrapain, one species of roof turtle, one lizard and a crocodile. None of these species were represented in the zoos.

Of the 20 species of turtle and tortoise recorded, ten species were endangered in the wild and were placed in the Schedule I and II of the Wildlife Protection act. 1972. The Star Tortoise and the Indian Soft Shelled Turtle was seen in the zoos of all five regions (East, West, North, South, North-East and Island). Four species were found only in zoos of one region. The zoos in South and North-East India had the maximum number of species of turtles and tortoise (N=13) whereas the North region had the least (N=3). The natural distribution of most of the species is in south, south-east and western region. The Crowned Roof Turtle had the maximum young hatched during the year (n=29). 7 species were recorded breeding but only in a small number of zoos.

Six species of Lizards were recorded housed in the zoos. Five species were endangered in the wild. The monitor lizards were the most popular exhibits in the zoos. Only the Water monitor lizard was recorded breeding and only in one zoo. All the species were recorded in the zoos of South India and four in Eastern India. The zoos in North had just one species. Two species, Common Indian Monitor Lizard and Water Monitor Lizard was found in all of the five regions including Island region. The Rock Lizard was seen only in the zoos of South India.

The Indian Chameleon was recorded only in 4 zoos in the country. No breeding of the species was recorded. The animals were seen in zoos of East India and South India. This interesting animal could become a popular exhibit in most of the zoo with proper husbandry and care.

There were four species of crocodiles recorded in the zoos. The Mugger was the most common reptile on display in the zoos. 2255 animals were recorded in 68 zoos. The critically endangered species of Long-Snouted Crocodile *Gavialis gangeticus* was housed in 46 zoos and there were over 500 individuals. The Gharial was seen in zoos of all five regions but not in Island. The Salt Water Crocodile was housed in zoos of all the regions except north India. All the species are endangered in the wild and were in the schedules of the wildlife protection act 1972.

8 families of snakes are reported for India (Whitaker and Captain 2004, Smith 1943) Only four families were represented in captivity. The family Columbridae was the most dominant in captivity. The status of nine species of snakes was considered endangered in the wild according to the Wildlife Protection Act 1972. The most number of species of snake were found in South Indian zoos (n=27) followed by zoos in West (n=23) and East (n=22). The lowest number of species were recorded in zoos in North India. Only the Rat Snake was seen in zoos of all the five regions of the country.

All the five known venomous snakes, the King Cobra, Cobra, Saw Scaled Viper, Russell's Viper and Common Krait were found to be housed in a number of zoos.

The family Columbridae had the most representation in the zoos with about 24 species (The identification of some of the species is not clear) This family includes Trinket Snake, Rat Snake, Kukri snake, Flying snake, Wolf snake, Keelback snakes, Tree snake, Royal snake, Cat Snake, Vine Snake and Water Snake. The Rat Snake *Ptyas mucosus*, Trinket Snake *Elaphe radiate* and Checkered Keelback were the common snakes in this family. 4 species bred in the zoos this year (Appendix.3).

The family Pythonidae was represented by three taxa of Pythons, two species and one sub-species. Pythons are the most popular exhibit in the zoos.

The family Boidae was represented by four taxa. The Red Sand Boa was the commonest sand boa housed in the zoos.

The family Elapidae was represented by six taxa. All of them were venomous snakes. There were two species of Krait and four species of Cobras.

The family Hydrophiidae was represented by three sea snakes and all of them are venomous. They were displayed in a very few zoos of the Southern region.

The family Viperidae consists of true Vipers and Pit Vipers. There were two species of true vipers and three species of Pit Vipers representing this family. All the snakes of this family are highly venomous. Only Russell's Viper was considered endangered in the wild (Appendix.3).

Amphibian Fauna

The amphibians were represented by only one species of Himalayan Newt *Tylotriton verrucosus* housed in only one zoo and was recorded breeding (Appendix.3). The species is endangered. 19 species of frogs are critically endangered and are on the verge of extinction according to IUCN (MoEF 2011). None of these species are housed in any of the zoos in the country.

It is high time that zoos took the role of ex-situ conservation of species seriously, not only of mega and charismatic fauna but also of smaller and lesser known species as they are an important part of biodiversity as much as any other group of animals. The housing of amphibians requires special skills because the temperature and humidity has to be controlled but keeping them in zoos in their natural areas of distribution could be achieved easily.

Exotic Species or non-native Fauna:

A good number of exotic species were housed in various zoos around the country. There are 80 species of birds, 35 species of mammals and 15 species of reptiles.

Among the birds, the Parrots were the most popular with 11 species, followed by Macaws with 10 species and Cockatoo with 8 species. There were two big flightless birds, Cassowary and Emu housed in a good number of zoos.

Among the mammals, the Hippopotamus was the most popular and was housed in 30 zoos and had a captive population of 104 animals. The dwarf Hippopotamus was housed in a few zoos. There were seven species of monkeys, four species of great apes including Oran tan, Chimpanzee, Gorilla and Baboon, two species each of Deer and Lemur, three species of large cats including African Lion, Siberian Tiger and Jaguar, three species of Rhinoceros, two species of Zebra and one species each of Giraffe, European Brown Bear, Cape Buffalo, African Elephant, Tapir and Meer cat.

Among reptiles, there were 11 species of Crocodile and most of them were housed in zoos in South and East India and a few in West India. There were two species of Caiman and a species each of Iguana and Gaint Tortoise.

Housing exotic animals has some educational and entertainment value but has least importance in the conservation of species. Housing exotic animals could be a source of emerging disease in our wild animals and humans too. Keeping non-native species is also expensive and difficult to maintain.

Only a small percentage of wildlife of the country is represented in the zoos in the country. Only 12% species of birds and 25% species of mammals are housed in zoos. The percentage of reptiles housed is even smaller. There is just one amphibian housed and no fish or lower forms of the animals housed in the zoos. A large number of birds, reptiles and amphibians are endemic to this country. 13 species of birds, 10 species of mammals, 6 species of reptiles, 20 species of amphibians, 5 species of fish and 2 species of spider and a species of coral are critically endangered and are on the verge of extinction. The lesser known Indian fauna is also very attractive and would make good display animals, but of course will require additional facilities. Getting experience of keeping as many native species as possible will equip the zoos to initiate conservation measures if the population status of species gets endangered in the wild. The resources should not be wasted in housing exotic animals.

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Red panda *Ailurus fulgens* (Photo: Brij Kishor Gupta)

Appendix 1: Inventory of Birds Housed at Various Zoos 2010-2011

Note: The species in bold are endangered

Name	Scientific name	No. Zoos	No. animals	Births
Rosy Pelican	<i>Pelecanus onocrotalus</i>	38	254	14
Dalmatian Pelican	<i>Pelecanus crispus</i>	1	1	0
Cormorants	<i>Phalacrocorax spp.</i>	2	2	0
Little Cormorants	<i>Phalacrocorax niger</i>	5	26	0
Darter	<i>Anhinga melanogaster</i>	1	2	0
Cattle Egret	<i>Bubulcus ibis</i>	7	37	0
Great White Egret	<i>Ardea alba</i>	3	3	0
Little Egret	<i>Egretta garzetta</i>	8	103	4
Grey Heron	<i>Ardea cinerea</i>	10	58	3
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	20	429	63
Western Reef Egret	<i>Egretta gularis</i>	1	1	0
Indian Pond Heron	<i>Ardeola grayii</i>	5	25	0
Indian Purple Heron	<i>Ardea purpurea</i>	3	5	0
Bittern	<i>Ixobrychus spp</i>	1	1	0
Greater Adjutant Stork	<i>Leptoptilos dubius</i>	16	24	0
Lesser Adjutant Stork	<i>Leptoptilos javanicus</i>	7	10	0
Black Necked Stork	<i>Ephippiorhynchus asiaticus</i>	11	16	0
Asian Openbill	<i>Anastomus oscitans</i>	2	3	0
Painted Stork	<i>Mycteria leucocephala</i>	26	415	32
White-necked Stork	<i>Ciconia episcopus</i>	9	16	0
European White Stork	<i>Ciconia ciconia</i>	11	19	1
Oriental White Stork	<i>Ciconia boyciana</i>	1	1	0
Black Ibis	<i>Pseudibis papillosa</i>	6	9	0
Black-headed Ibis	<i>Threskiornis melanocephalus</i>	26	331	23
Eurasian Spoonbill	<i>Platela leucorodia</i>	17	136	17
Greater Flamingo	<i>Phoenicopterus roseus</i>	12	29	0
Lesser Flamingo	<i>Phoeniconaias minor</i>	2	3	0
Ruddy Shelduck	<i>Tadorna ferruginea</i>	15	52	0
Comb Duck	<i>Sarkidiornis melanotos</i>	12	99	14
Mallard	<i>Anas platyrhynchos</i>	7	34	0
Northern Pintail	<i>Anas acuta</i>	2	2	0
Northern Shoveller	<i>Anas clypeata</i>	2	5	0
Spotbill	<i>Anas poecilorhyncha</i>	7	37	5
Gadwall	<i>Anas strepera</i>	2	2	0
Common Pochard	<i>Aythya ferina</i>	4	12	0

Red Crested Pochard	<i>Netta rufina</i>	3	6	0
Ferruginous Pochard	<i>Aythya nyroca</i>	1	11	0
Common Teal	<i>Anas crecca</i>	2	7	0
Garganey Teal	<i>Anas querquedula</i>	1	1	0
Lesser Whistling Teal	<i>Dendrocygna javanica</i>	7	33	0
White-bellied Sea Eagle	<i>Haliaeetus leucogaster</i>	3	4	0
Common Buzzard	<i>Buteo buteo</i>	1	3	0
White-eyed Bzzard	<i>Butastur teesa</i>	1	1	0
Eagle	<i>Unidentified</i>	12	21	0
Crested Serpent Eagle	<i>Spilornis cheela</i>	10	23	0
Eastern Steppe Eagle	<i>Aquila nipalensis</i>	3	4	0
Tawny Eagle	<i>Aquila rapax</i>	2	3	0
Laggar Falcon	<i>Falco jugger</i>	1	2	0
Montagu's Harrier	<i>Circus pygargus</i>	1	1	0
Accipiter spp	<i>Accipiter</i>	4	4	0
Milvus spp.	<i>Milvus spp</i>	5	18	0
Black-winged Kite	<i>Elanus caeruleus</i>	2	6	0
Brahminy Kite	<i>Haliastur indus</i>	10	34	0
Black Kite	<i>Milvus migrans</i>	24	172	0
Shikra	<i>Accipiter badius</i>	7	19	0
Red-headed Vulture	<i>Sarcogyps calvus</i>	3	3	0
White-backed Vulture	<i>Gyps bengalensis</i>	9	147	7
Long-billed Vulture	<i>Gyps indicus</i>	4	73	8
Slender-billed Vulture	<i>Gyps tenuirostris</i>	1	18	0
Himalayan Griffon	<i>Gyps himalayensis</i>	5	9	0
Egyptian Vulture	<i>Neophron percnopterus</i>	4	7	0
Black Vulture	<i>Aegyptius monachus</i>	5	5	0
Accipiter spp	<i>Accipiter</i>	4	4	0
Vulture (Unidentified)		4	5	0
Kestrel	<i>Falco naumanni</i>	1	1	0
Black Francolin	<i>Francolinus francolinus</i>	5	10	0
Grey Francolin	<i>Francolinus pondicerianus</i>	19	71	2
Chukar Partridge	<i>Alectoris chukur</i>	3	6	0
Hill Partridge	<i>Arborophila torqueola</i>	2	1	0
Swamp Partridge	<i>Francolinus gularis</i>	2	8	0
Jungle Bush Quail	<i>Perdica asiatica</i>	3	12	0
Red Jungle Fowl	<i>Gallus gallus</i>	26	328	28
Painted Spurfowl	<i>Galloperdix lumulata</i>	1	3	0
Red Spurfowl	<i>Galloperdix spadicea</i>	6	15	2
Grey Jungle Fowl	<i>Gallus sonneratii</i>	5	64	3

Green Peafowl	<i>Pavo muticus</i>	4	9	0
Peafowl	<i>Pavo cristatus</i>	78	748	29
Peafowl (White)	<i>Pavo cristatus</i>	32	158	9
Cheer Pheasant	<i>Catreus wallichii</i>	4	33	4
Peacock Grey Pheasant	<i>Polyplectron bicalcaratum</i>	7	29	1
Humes Bar-backed Pheasant	<i>Symanticus humiae</i>	2	13	0
Kalij Pheasant	<i>Lophura leucomelanos</i>	27	154	19
Monal Pheasant	<i>Lophophorus impejanus</i>	8	37	5
Satyr Tragopan	<i>Tragopan satyra</i>	3	3	0
Western Tragopan	<i>Tragopan melanocephalus</i>	2	21	1
Black-necked Crane	<i>Grus nigricollis</i>	1	1	0
Demoiselle Crane	<i>Grus virgo</i>	9	19	0
Common Cranes	<i>Grus grus</i>	5	8	0
Sarus Crane	<i>Grus antigone</i>	18	56	4
Water Cock	<i>Gallixrex cinerea</i>	1	1	0
Common Coot	<i>Fulca atra</i>	5	11	0
Purple Moorhen	<i>Porphyrio porphyrio</i>	1	11	0
Common Moorhen	<i>Gallinula chloropus</i>	6	31	0
White-breasted Waterhen	<i>Amarurornis phoenicurus</i>	1	3	0
Yellow Wattled Lapwing	<i>Vanellus malabaricus</i>	1	1	0
Red Wattled Lapwing	<i>Vanellus indicus</i>	2	3	0
Brown Headed Gull	<i>Larus brunnicephalus</i>	2	2	0
Eurasian collared dove	<i>Streptopelia decaocto</i>	3	8	0
Oriental Turtle Dove	<i>Streptopelia orientalis</i>	2	21	6
Spotted Dove	<i>Streptopelia chinensis</i>	5	57	0
Yellow-footed Green Pigeon	<i>Treron phoenicopterus</i>	5	21	0
Nicobar Pigeon	<i>Caloenas nicobarica</i>	3	23	2
Green Imperial Pigeon	<i>Ducula aenea</i>	3	9	0
Pied Imperial Pigeon	<i>Ducula bicolor</i>	2	10	0
Indian hanging parrot	<i>Loriculus vernailis</i>	2	18	2
Parakeet spp	<i>Psittacula spp</i>	24	471	2
Alexandrine Parakeet	<i>Psittacula eupatria</i>	37	427	30
Rosy-headed Parakeet	<i>Psittacula roseata</i>	1	5	0
Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	19	113	2
Blue-winged Parakeet	<i>Psittacula columboides</i>	4	20	0
Red Breasted Parakeet	<i>Psittacula alexandri</i>	11	62	3
Rose-ringed Parakeet	<i>Psittacula krameri</i>	43	976	14
White-ringed neck Parakeet	<i>Psittacula</i>	2	2	0
Slaty-headed Parakeet	<i>Psittacula himalayana</i>	3	13	0
Koel	<i>Eudynamys scolopaceus</i>	11	23	0

Greater Coucal	<i>Centropus sinensis</i>	1		0
Barn Owl	<i>Tyto alba</i>	30	113	0
Grass Owl	<i>Tyto longimembris</i>	1	1	0
Barred Eagle Owl	<i>Bubo sumatranus</i>	4	5	0
Brown Fish Owl	<i>Ketupa zeylonensis</i>	11	41	1
Tawny Fish Owl	<i>Bubo flavipes</i>	1		
Brown Wood Owl	<i>Strix leptogrammica</i>	3	5	0
Eurasian Eagle Owl	<i>Bubo bubo</i>	9	22	0
Greater Horned Owl	<i>Bubo virginianus</i>	8	12	0
Mottled Wood Owl	<i>Strix ocellata</i>	11	17	0
Scops Owl	<i>Otus spp.</i>	3	12	0
Jungle Owlet	<i>Glaucidium radiatum</i>	2	3	0
Spotted Owlet	<i>Athene brama</i>	2	13	0
Forest Spotted Owlet	<i>Heteroglaux blewitti</i>	1	4	0
White-breasted Kingfisher	<i>Halcyon smyrnensis</i>	2	2	0
Common Grey Hornbill	<i>Ocyroceros birostris</i>	9	20	0
Great Pied Hornbill	<i>Buceros bicornis</i>	8	10	0
Oriental Pied Hornbill	<i>Anthraceroceros albirostris</i>	13	30	0
Malabar Pied Hornbill	<i>Anthraceroceros coronatus</i>	5	7	0
Rufous-necked Hornbill	<i>Aceros nipalensis</i>	2	5	0
Great Barbet	<i>Megalaima virens</i>	2	3	0
Red-vented Bulbul	<i>Pynonotus cafer</i>	4	11	0
Red-whiskered Bulbul	<i>Pynonotus jocosus</i>	2	6	0
Indian Robin	<i>Saxicoloides fulicatus</i>	2	3	0
Common Babbler	<i>Turdoides caudata</i>	3	13	0
Red Avadavat	<i>Amandava amandava</i>	7	473	0
Spotted Munia	<i>Lonchura punctulata</i>	2	3	0
White-throated Munia	<i>Euodice malabarica</i>	1	4	0
Black-headed Munia	<i>Lonchura malacca</i>	4	13	1
House Sparrow	<i>Passer domesticus</i>	2	15	0
Baya Weaver Bird	<i>Ploceus philippinus</i>	2	3	0
Common Myna	<i>Acridotheres tristis</i>	4	7	0
Rosy Starling	<i>Strumus roseus</i>	2	8	0
Hill Myna	<i>Gracula religiosa</i>	17	62	0
Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>	1	2	0
Red-billed Blue Magpie	<i>Urocissa erythrorhyncha</i>	2	2	0
House Crow	<i>Corvus splendens</i>	1	1	0

Appendix 2: Inventory of Mammals Housed in Various Zoos in India 2010-2011
Note: Species in bold are endangered based on the Wildlife Protection Act. 1972

Name	Scientific name	No. Zoos	No. animals	Births
Pale Hedge Hog	<i>Paraechinus micropus</i>	1	3	0
Hedge Hog	<i>Hemiechinus auritus</i>	1	1	0
Indian Flying Fox	<i>Pteropus giganteus</i>	2	23	0
Bengal Slow Loris	<i>Nycticebus bengalensis</i>	9	41	0
Slender Loris	<i>Loris tardigradus</i>	4	4	0
Bonnet Macaque	<i>Macaca radiata</i>	38	352	23
Rhesus Macaque	<i>Macaca mulatta</i>	58	612	20
Assamese Macaque	<i>Macaca assamensis</i>	14	67	0
Liontailed Macaque	<i>Macaca silenus</i>	13	58	3
Common Langur	<i>Semnopithecus entellus</i>	37	118	6
Capped Langur	<i>Trachypithecus pileatus</i>	6	8	0
Golden Langur	<i>Trachypithecus geei</i>	1	7	2
Nilgiri Langur	<i>Trachypithecus johnii</i>	6	23	0
Crab eating Monkey	<i>Macaca fascicularis</i>	1	10	0
Pig-tailed Macaque	<i>Macaca nemestrina</i>	6	35	2
Stump tailed Macaque	<i>Macaca arctoides</i>	12	52	0
Phayre's Leaf Monkey	<i>Trachypithecus phayrei</i>	1	12	2
Hoolock Gibbon	<i>Hylobates hoolock</i>	9	41	2
Indian Wolf	<i>Canis lupus pallipes</i>	11	38	12
Tibetan Wolf	<i>Canis lupus chanco</i>	4	25	4
Golden Jackal	<i>Canis aureus</i>	51	242	17
Red Fox	<i>Vulpes vulpes</i>	1	3	0
Indian Fox	<i>Vulpes bengalensis</i>	11	38	1
Dhole	<i>Cuon alpinus</i>	6	25	2
Sloth Bear	<i>Melursus ursinus</i>	41	594	2
Brown Bear	<i>Ursus arctos</i>	1	4	1
Himalayan Black Bear	<i>Ursus thibetanus</i>	56	224	2
Malayan Sun Bear	<i>Helarctos malayanus</i>	2	4	0
Red Panda	<i>Ailurus fulgens</i>	2	25	5
Common Otter	<i>Lutra lutra</i>	6	20	3

Smooth Indian Otter	<i>Lutrogale perspicillata</i>	3	5	0
Indian small clawed otter	<i>Aonyx cinerea</i>	1	1	0
Yellow-throated Marten	<i>Martes flavigula</i>	4	5	0
Ratel	<i>Mellivora capensis</i>	6	8	0
Large Indian Civet	<i>Viverra zibetha</i>	3	4	0
Small Indian Civet	<i>Viverricula indica</i>	12	19	0
Common Palm Civet	<i>Paradoxurus hermaphroditus</i>	42	164	5
Himalayan Palm Civet	<i>Paguma larvata</i>	7	13	0
Binturong	<i>Arctictis binturong albifrons</i>	4	10	0
Common Mongoose	<i>Herpestes edwardsi</i>	9	25	0
Striped Hyena	<i>Hyaena hyaena</i>	37	102	3
Tiger	<i>Panthera tigris</i>	54	283	15
White Tiger		21	91	9
Lion	<i>Panthera leo</i>	17	145	22
Leopard	<i>Panthera pardus</i>	69	407	15
Black Leopard		2	2	0
Snow Leopard	<i>Panthera uncia</i>	4	10	0
Clouded Leopard	<i>Pardofelis nebulosa</i>	6	20	4
Golden Cat	<i>Catopuma temmincki</i>	1	2	0
Leopard Cat	<i>Prionailurus bengalensis</i>	23	84	4
Fishing Cat	<i>Felis viverrina</i>	3	7	0
Jungle Cat	<i>Felis chaus</i>	21	72	1
Rusty Spotted Cat	<i>Prionailurus rubiginosus</i>	2	6	0
Cheetah	<i>Acinonyx jubatus</i>	2	4	0
Lion (hybrid)		36	280	15
Asian Elephant	<i>Elephas maximus</i>	44	147	3
Asiatic Wild Ass	<i>Equus hemionus khur</i>	3	15	3
One-horned Rhinoceros	<i>Rhinoceros unicornis</i>	11	31	0
Wild Boar	<i>Sus scrofa</i>	24	163	3
Andaman Wild Pig	<i>Sus andamanensis</i>	1	2	0
Mouse Deer/ Indian spotted chevrotain	<i>Moschiola indica</i>	6	23	5
Musk Deer	<i>Moschus leucogaster</i>	1	1	0
Manipur Brow-antlered Deer	<i>Cervus eldii</i>	16	181	17

Swamp Deer/ Barasingha	<i>Cervus duvaucelii</i>	15	164	22
Sambar	<i>Cervus unicolor</i>	90	2055	151
Hog-Deer	<i>Axis porcinus</i>	32	418	59
Cheetal	<i>Axis axis</i>	117	8505	806
Barking Deer	<i>Muntiacus muntjak</i>	58	558	60
Chinkara	<i>Gazellae bennettii</i>	18	141	38
Black Buck	<i>Antilope cervicapra</i>	71	1803	217
Black Buck (White)		10	95	
Fourhorned Antelope/ Chowsingha	<i>Tetracerus quadricornis</i>	28	181	27
Nilgai or Blue Bull	<i>Boselaphus tragocamelus</i>	49	502	16
Gaur	<i>Bos gaurus</i>	14	82	13
Yak	<i>Bos grunniens</i>	1	2	0
Bharal or Blue Sheep	<i>Pseudois nayaur nayayr</i>	1	6	2
Himalayan Tahr	<i>Hemitragus jemlahicus</i>	2	7	0
Serow	<i>Naemorhaedus sumatraensis</i>	4	4	0
Goral	<i>Naemorhaedus goral</i>	12	51	7
Indian Pangolin	<i>Manis crassicaudata</i>	3	5	0
Chinese Pangolin	<i>Manis pentadactyla</i>	1	1	0
Indian Giant Squirrel	<i>Ratufa indica</i>	15	38	1
Grizzled Giant Squirrel	<i>Ratufa macroura</i>	1	2	0
Large brown squirrel/ Giant Flying Squirrel	<i>Petaurista philippensis</i>	4	3	0
Bengal/ Bush tailed Porcupine	<i>Atherurus macrourus assamensis</i>	9	65	0
Himalayan Crestless/ Malayan Porcupine	<i>Hystrix brachyura hodgsoni</i>	3	7	0
Indian Porcupine	<i>Hystrix indica</i>	43	220	15
Indian Porcupine(White)		3	3	0
Bush Tailed Porcupine	<i>Atherurus macrourus</i>	3	8	2
Black naped Hare	<i>Lepus nigricollis</i>	3	7	0

Appendix 3: Inventory of Reptiles and Amphibians housed at Various Zoos in India 2010-2011

Note: The endangered species are marked in Bold

Name	Scientific name	No. Zoos	No. animals	Births
Chitra Riverine Turtle	<i>Chitra indica</i>	1	3	0
Pond Turtle	<i>Melanochelys trijuga</i>	2	25	0
Malayan Box Turtle	<i>Cuora amboinensis kamaroma</i>	3	15	0
Madras Pond Turtle		2	50	0
Turtle (unidentified)		19	161	1
Indian Star Tortoise	<i>Geochelone elegans</i>	40	1142	0
Tortoise (Unidentified)	<i>Geochelone sp.</i>	27	244	2
Sawback Terrapin	<i>Kachuga tentoria circumdata</i>	1	10	1
Red Eared Terrapin	<i>Pseudemys scripta elegans</i>	4	163	0
Pond Trijuga Terrapin	<i>Kachuga trijuga trijuga</i>	1	3	0
Deccan Sawback Terrapin	<i>Kachuga tentoria tentoria</i>	1	2	0
Eastern Hill Terrapin	<i>Melanochelys tricarinata</i>	1	3	0
River Terrapin	<i>Batagur baska</i>	5	32	0
Spotted Black Terrapin	<i>Geoclemys hamiltoni</i>	1	6	0
Crowned Roof Turtle	<i>Hardella thurjii</i>	1	79	1
Indian softshell Turtle	<i>Lissemys punctata</i>	19	548	1
Ganges softshell Turtle	<i>Aspiderates gangeticus</i>	7	60	0
Indian Black Turtle	<i>Melanochelys trijuga</i>	5	47	1
Indian Roofed Turtle	<i>Kachuga tecta</i>	5	41	1
Indian Tent Turtle	<i>Pangshu tentoria</i>	3	7	0
Indian Peacock softshell Turtle	<i>Aspideretes hurum</i>	1	5	0
Rock Lizard	<i>Psammophilus blanfordanus</i>	3	10	0
Golden gecko	<i>Gekko ulikovskii</i>	2	12	0
Bengal Monitor	<i>Varanus bengalensis</i>	25	68	0
Yellow Monitor	<i>Varanus flavescens</i>	2	28	0
Water Monitor	<i>Varanus salvator</i>	9	39	1
Indian Chameleon	<i>Chameleon zeylanicus</i>	4	12	0
Gharial	<i>Gavialis gangeticus</i>	46	506	5
Mugger Crocodile	<i>Crocodylus palustris</i>	68	2755	2

Saltwater Crocodile	<i>Crocodylus porosus</i>	11	43	0
Burmese python	<i>Python molurus bivittatus</i>	2	5	0
Indian Rock Python	<i>Python molurus molurus</i>	59	290	1
Reticulated Python	<i>Python reticulatus</i>	8	30	0
Red Sand Boa	<i>Eryx johnii</i>	18	58	0
Common Sand Boa	<i>Gongylophis conicus</i>	23	92	1
Russells Boa	<i>Eryx canicus</i>	2	12	1
Rough-tailed Sand Boa	<i>Gongylophis conicus</i>	2	19	1
Copper headed Trinket Snake	<i>Coelognathus radiatus</i>	19	29	0
Indian Rat Snake	<i>Ptyas mucosa</i>	35	228	1
Banded Racer	<i>Coluber fasciolatus</i>	1	4	0
Banded Racer	<i>Argyrogaena fasciolata</i>	2	4	0
Common Kukri Snake	<i>Oligodon arnensis</i>	3	5	0
Kukri Snake		1	2	0
Ornate Flying Snake	<i>Chrysopelea ornata</i>	3	8	0
Common Wolf Snake	<i>Lycodon aulicus</i>	8	28	1
Checkered keelback	<i>Xenochrophis piscator</i>	17	126	3
Olive keelback	<i>Atretium schistosum</i>	2	10	0
Striped Keelback Snake	<i>Amphiesma stolatum</i>	9	52	3
Green Keel Back	<i>Macropisthodon plumbicolor</i>	3	12	0
Painted Bronze-back	<i>Dendrelaphis pictus</i>	1	2	0
Diadem Snake	<i>Spalerosophis diadema</i>	2	3	0
Ornamental Snake		2	11	0
Raj Snake		1	2	0
Common Bronzeback	<i>Dendrelaphis tristis</i>	5	14	0
Golden Tree Snake		1	1	0
Forsten Cat Snake	<i>Boiga forsteni</i>	2	4	0
Common Cat Snake	<i>Boiga trigonata</i>	6	12	0
Common Vine Snake	<i>Ahaetulla nasuta</i>	5	24	0
Dog faced Water Snake	<i>Cerberus rynchops</i>	1	5	0
Rainbow Water Snake	<i>Enhydryis enhydryis</i>	6	63	0
Doria's Green Snake	<i>Cyclophiops doriae</i>	5	25	0
Banded Krait	<i>Bungarus fasciatus</i>	6	38	0
Common Krait	<i>Bungarus caeruleus</i>	20	51	0

Caspian Cobra	<i>Naja oxiana</i>	2	3	0
Indian Cobra	<i>Naja naja</i>	34	227	
King Cobra	<i>Ophiophagus hannah</i>	11	36	0
Monocled Cobra	<i>Naja kaouthia</i>	7	112	0
Yellow Sea Snake	<i>Hydrophis spiralis</i>	1	1	0
Slender Sea Snake	<i>Hydrophis gracilis</i>	1	2	0
Saw Scaled Viper	<i>Echis carinatus</i>	7	24	0
Malabar Pit Viper	<i>Trimeresurus malbaricus</i>	2	2	0
Hump Nosed Pit Viper	<i>Hypnale hypnale</i>	2	6	0
Bamboo Pit Viper	<i>Trimeresurus gramineus</i>	5	9	0
Russell's Viper	<i>Daboia russellii</i>	29	115	1
Himalayan Newt	<i>Tylototriton verrucosus</i>	1	23	1



Rearing of the Hydromedusa *Nemopsis dofleini* in an Aquarium at the Marine Science Museum, Fukushima, Japan

Hydrozoan adults of *Nemopsis dofleini* Maas were collected on 10 May 2009 from the Onahama seashore, Fukushima Prefecture. The 18 collected females had many planula larvae brooded on the manubrium. The next day about 5,000 planulae ranging 0.1-0.2 mm in diameter were released. Five hundred sample planulae were moved to glass petri dishes and reared at 5°C, 10°C, 15°C and 20°C. The planulae



at 10°C showed the best attaching during the initial seven-day period. Also, comparing between glass petri dishes, plastic petri dishes and shells of the pearl oyster *Pinctada martensii* planulae attached to the pearl oyster shells earliest during the initial seven days. This suggests that the best attaching conditions for planulae of *Nemopsis dofleini* in aquariums is the use of pearl oyster shells at KTC. When the temperature was raised from 10°C to 14°C 10 days after the planulae attached to the pearl oyster shells, medusa-budding was seen 28 days later. Newly released medusae were

moved to a 350 mm round tank at 10°C and fed rotifers, *Brachionus sp.*, and *Artemia nauplii*. They brooded eggs and planulae on the manubrium 53 days later when the medusae were about 9 mm in bell diameter, indicating that the reared individuals had matured sexually.

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