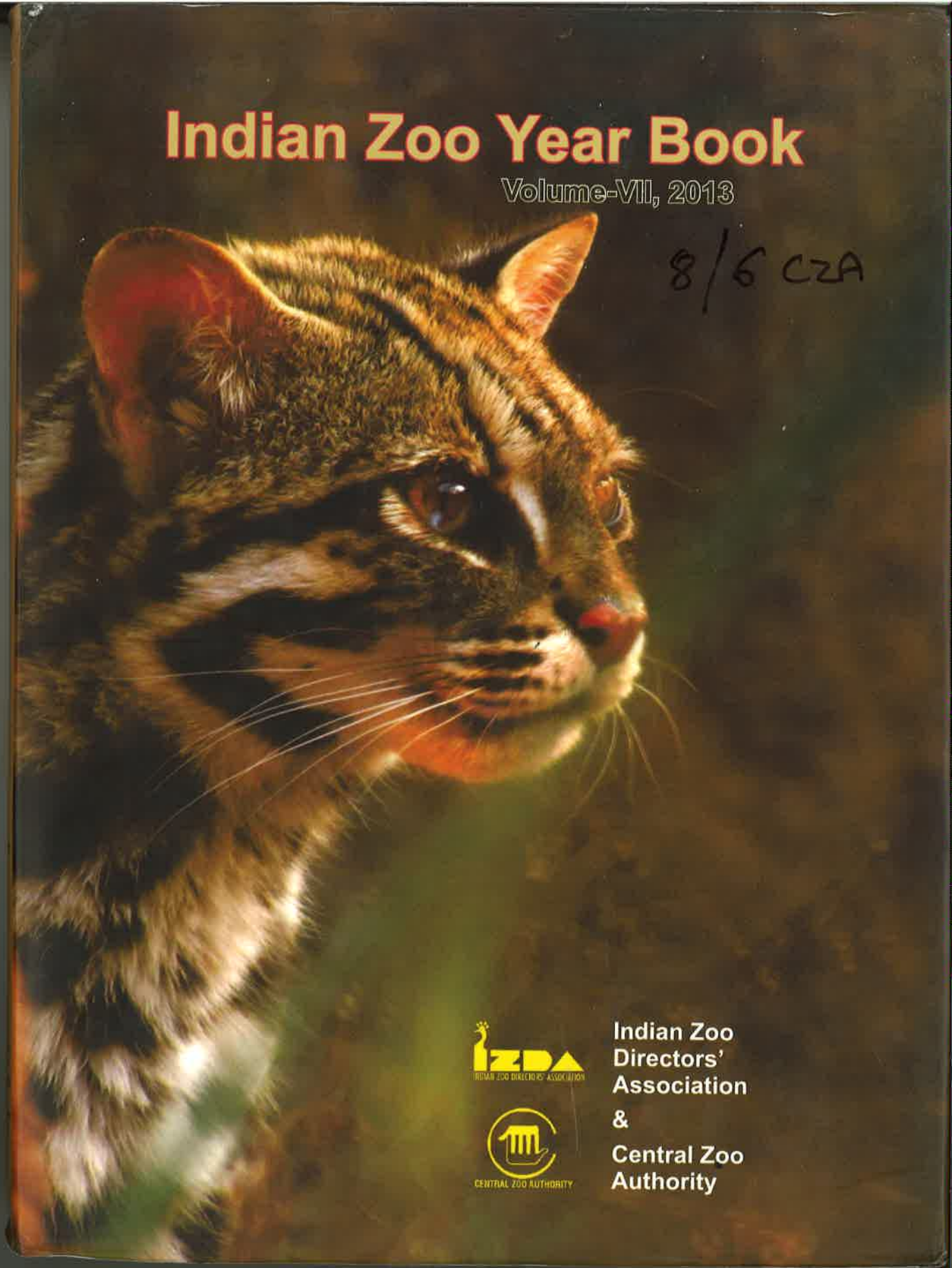
Indian Zoo Year Book

Volume-VII, 2013



Indian Zoo Directors' Association

&

Central Zoo Authority

INDIAN ZOO YEAR BOOK

VOLUME - VII, 2013

Editors

L.N. Acharjyo
S. Panda

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PREFACE

The zoo movement in India is now more than 150 years old. In the intervening years, it has been possible to gather lot many information about the practices for management of zoo inmates. Simultaneously zoo personnel/ managers have enriched their knowledge on various aspects of zoo life and were able to disseminate their learning among the fraternity so that each passing year opens up the never ending Pandora's box of zoo animal science and towards that end, the publication of Indian Zoo Year Book has its humble contribution.

The first volume of Indian Zoo Year Book was published in 1996 and since then it has been possible to bring out six more volumes, including the present volume. Though the publication is supposed to be a yearly event but several odds came in the way of its regular publication. The contributors and zoo fraternity will condone this lapse with their goodness. In spite of the above short comings, we have made sturdy progress towards the goal we all have initially envisaged.

In the coming years, zoos in India and elsewhere shall have greater role and responsibility in conservation breeding, feeding and general management of wild animals specially in captivity and above all educating the public about their specific responsibility in securing the welfare of animal kingdom and preservation of balanced ecosystem, where everyone of us can live in peace without encroaching on others' territory. The joy and impact of watching wild animals both in the wild and in captivity is profound. Let us keep it up.

Perhaps the Year Book has imbibed a measure of ownership and bonding as otherwise the response we received for publication of the Zoo Year Book would not have been there. Besides, we would very much appreciate our readers to forward suggestions for its material improvement. Nevertheless, the Zoo Year Book was able to store and disseminate the knowledge for today and also for posterity.

We appreciate and thank all the contributors who have facilitated the publication of the present volume of Indian Zoo Year Book.

The publication of Indian Zoo Year Book would not have been possible without the generous support of Central Zoo Authority and Senior Zoo Personnel, present and past. We thank them all for making this endeavour a success.

Assistance rendered by Dr. D.N. Mohanty and Dr. N. Sahoo for their help in editing some of the papers are duly acknowledged.

We record our sincere appreciation of the assistance extended by Sri R. K. Mohapatra in preparation of the edited manuscripts.

Editors

CONTENTS

the life time care of wild animals, prior permission from the Central Zoo Authority and Hon'ble Supreme Court is mandatory.

The rescue centres provide these animals all care under the expert veterinarians and wildlife biologists working with them, who are responsible to see that their appropriate housing/ natural diet schedule are met, their screening from any disease and subsequent medication for the same if required. The newly received animals are housed for first 30 days in quarantine (isolation areas) located away from the existing animals and are being supervised. The newly arrived animals are kept away so as to avoid any infection that they might be carrying as they are coming from different places and ruling out that other healthy inmates housed at the rescue centre does not get any infection.

Once the veterinary doctor is sure that such animals have recovered from shock or injury and found medically and physically fit, the prescribed procedure of the Government and the IUCN (International Union for Conservation of Nature) for their rehabilitation into the wild is followed while releasing the animals back to their natural habitat.

The animals which are found physically unfit for release into the wild, it may be due to the reason that they are blind or lost a limb or in case of birds, lost a wing and thus they may not be able to survive in the wild if released. Thus such animals are housed in large naturalistic off-exhibit enclosures for their life time care in the rescue centre.

There are rescue centres established for animals received from circuses too. Exhibition and performance of five species namely lion, tiger, bear, panther and monkey by the circuses is banned in 1998 by the Ministry of Social Justice and Empowerment, Government of India. More than 400 lions and 100 tigers held by the circuses were rescued and rehabilitated in the life time care facility at seven places established by the Central Zoo Authority, Ministry of Environment and Forests in the off-exhibit areas of Indira Gandhi Zoological Park, Vishakhapatnam, Sri Venkateswara Zoological Park, Tirupati, Arignar Anna Zoological Park, Vandalur, Chennai, Bannerghatta Biological Park, Bangalore, Nahargarh Biological Park, Jaipur, Van Vihar National Park Zoo, Bhopal and South Khairabari Rescue and Rehabilitation Centre in Cooch Behar District of West Bengal during the year 200-2001. The animals are housed in large, naturalistic enclosures. All veterinary care has been provided to the animals kept in these rescue centres. At present there are 215 lions and 42 tigers surviving in these centres.

The Central Zoo Authority at many times had also facilitates rescue and rehabilitation of animals seized from the traders nationally as well as internationally by CITES authorities, Wildlife Crime Control Bureau, and Enforcement agencies. Around 1830 Star tortoises were seized by CITES authorities of Singapore during 2002-2003. Upon seizure, the consignment

was flown back to India. Thereafter, these animals were quarantined at Nehru Zoological Park, Hyderabad and released back to the wild on 15th November 2003 after determining their range (origin) through DNA mapping conducted by the Laboratory for Conservation of Endangered Species (LaCONES)) of the Centre for Cellular and Molecular Biology (CCMB), Hyderabad. In another episode 599 star tortoises seized by the Government of Malaysia were brought back to India by the Wildlife Enforcement Agencies and were kept in Arignar Anna Zoological Park, Vandalur, Chennai and later on the animals were rehabilitated back to the wild.

During 2011, the Deputy Director, Wildlife Crime Control Bureau, Southern Region, Chennai had received consignment of star tortoise (599) from Indonesia and from this consignment over 150 died due to retained yolk sacks. The animals are housed now at Arignar Anna Zoological Park, Vandalur, Chennai in off exhibit area. The animals are undergoing treatment. Their rehabilitation programme to wild is being worked out in detail in collaboration with Wildlife Trust of India, Noida. The genetic study of these animals is underway at LaCONES, Hyderabad. The site for the release is being identified by the officials of the forest department of Tamilnadu, officials of Arignar Anna Zoological Park, Vandalur, Chennai and Wildlife Trust of India.

Orphaned bear cubs being fed at Centre for Bear Rehabilitation and Conservation, Seijosa, Arunachal Pradesh

These rescue and rehabilitation centres not only achieve the objectives of animal welfare and their well being, but also provides opportunity to study their behaviour and biology. They also convey the message among general public as how to deal with such situations, whom to inform and how to take care of such animals.

SENSITIVITY OF LABORATORY TESTS FOR DIAGNOSIS OF FELINE PANLEUKOPAENIA

N. Sahoo[1], S.K.Sahu[2], A. Kharate[3], H.K.Panda[1], P.K.Roy[2], M. Dash[1] and A.K.Das[2]

Introduction

Feline panleukopaenia (FPL) infection is a highly contagious viral disease of wild carnivores i.e., lion, tiger, hyena, leopard, jungle cat and honey badger. It is widely prevalent throughout the world including India and arguably the most important of all feline viral diseases (Murphy *et al.*, 1999). Clinically, the disease is characterized by sudden onset of gastroenteritis with fever and anorexia. High rate of mortality is not uncommon among young growing animals. Rao *et al.* (1995) reported death of 18 big cats (10 lion cubs, 1 juvenile white tiger, 5 white tiger cubs and 2 yearling leopards) during the outbreaks of FPL in Nandankanan Zoological Park, Odisha between October 1993 and January 1994. The clinical signs, necropsy lesions and histological changes though suggestive but are not confirmatory of FPL. The diseases akin to FPL are the infections caused by rota, corona, ancylostoma, ehrlichia and clostridial organisms. A number of tests are employed to differentiate this fatal but vaccine-preventable disease with variable degree of sensitivity and specificity. Needless to mention that status of the FPL should be explored in zoos to chalk out suitable preventive protocol among susceptible species. With the above facts in the backdrop, a research work was undertaken during the recent past to study the efficacy of laboratory tests such as haemagglutination (HA), haemagglutination inhibition (HI), micro serum neutralisation test (Micro-SNT) and indirect enzyme linked immuno sorbent assay (ELISA), fluorescent antibody technique (FAT) and cytopathic effects (CPE) to identify either antigens or antibodies against feline panleukopaenia in tigers and lions of Nandankanan Zoological Park.

Materials and methods

A total of 36 adult large cats (26 tigers and 10 lions) of Nandankanan Zoological Park were included for collection of different bio-samples for the above said purpose. Approximately three milliliter of blood samples were collected from each individual animal while inside the squeeze cage for regular health monitoring programme purposes. The

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serum thus harvested and inactivated in serological water bath maintained at 56 C for 30minutes was subsequently stored at -20°C for HI, micro-SNT and ELISA.

Haemagglutination inhibition (HI) test was carried out as per the method of Johnson (1967) using 96 well U-bottom micro titer plate and one per cent porcine red blood corpuscle (PRBC) suspension. Indirect ELISA was performed in the present study according to the method of Voller *et al.* (1976). The procedure described by Joo *et al.* (1975) was followed for micro-SNT. The vaccine Fel-O-Vax[4] was used as source of known antigen i.e., feline panleukopaenia virus (FPLV).

Fresh faecal samples of such animals were collected properly in a sterile sample collecting vial early in the morning from the enclosures/cages. About 1.0 gm of faecal samples was triturated with sterile sand and phosphate buffer solution (pH 7.2). It was centrifuged at 2500 rpm for 30 minutes. The supernatant was taken as test antigen for HA. The samples found positive to HA were subjected to cytopathic study. The Madin Darbey Bovine Kidney (MDBK) cell line was selected for the cell culture study. The MDBK cell line was obtained from the division of virology, Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh. Physico-chemical properties like nucleic acid type determination, thermo stability, cationic stabilization, stability to pH and effect of formalin were studied on the harvested virus sample in MDBK cell line. The tissue culture infective dose ($TCID_{50}$) of the virus sample was calculated by the method of Reed and Muench (1938).

The Haemagglutination test was performed as per the method of Konishi *et al.* (1975) in 96 well U-bottom micro titre plates. A two-fold serial dilution (50µl) of test faecal sample was made starting from an initial 1:10 dilution in ice cold phosphate buffer saline (PBS). Fifty micro litre of one per cent porcine red blood corpuscle (PRBC) suspension was added to each well. Control wells were included with positive control antigen using Fel-O-Vax. The plate was incubated at 4°C for 2-4 hours. The result was read after the pig RBC control was settled completely.

Direct fluorescent antibody test was performed using anti feline panleukopenia virus mouse monoclonal antiserum conjugated to fluoro-isothiocyanate (FITC)[5]. Smears from faecal samples, infected tissues and cover slip preparations were fixed on slides for 20 minutes in acetone/methanol (75/25) at 4°C. Slides were stained with 75 µl conjugate and incubated for one hour at 37°C in humid chamber. After rinsing they were mounted with FA mounting fluid and viewed under fluorescence microscope at 100X using 520nm filter.

[4] Manufactured by M/S Fort Dodge Laboratories, Fort Dodge Animal Health, A Division of Wyeth, Fort Dodge, IOWA, 50501USA.

[5] Manufactured by VMRD laboratory, P.O. Box no. 502, WA 99163 USA. Supplied by Genetix Biotech Asia Pvt. Ltd., 71/1, Najafgarh Road, New Delhi-110 015.

Results and discussion

The tigers and lions showing positive reactions to the above mentioned tests were depicted in the Table.

Table. Comparative sensitivity of HA, HI, FAT, micro-SNT and indirect ELISA against feline panleukopenia in large cats

Animals	Number of samples screened	Number of samples positive to FPL infection				
		HA/Cytopathic study	HI	FAT	micro-SNT	ELISA
Tiger	26	9	11	13	12	19
Lion	10	6	3	9	4	7
Total	36	15 (41.6%)	14 (38.8%)	22 (61.1%)	16 (44.4%)	26 (72.2%)

N.B. Figures in parentheses indicate percentage of infection.

The results on cell culture revealed characteristic cytopathic effects (CPE) like rounding, granulation of cell, syncytia development and characteristic intranuclear basophilic inclusion bodies. At 72 hours post-infection, more cells were found to be rounded and there was development of syncytia. With the progress in incubation period to 96 hours and 120 hours, more than 90 per cent of cells revealed intense CPE like rounding, syncytia and lysis of cells.

Various cell culture systems have been used by various workers. Buonavoglia *et al.* (1991) used Crandell feline kidney (CRFK) cells with similar cytopathic effects as mentioned above. Likewise Miyazawa *et al.* (1999) had used both CRFK and feline T-lymphoblastoid cells and observed similar cytopathic effects. Probably it is the first report on the use of MDBK cell for adaptation and propagation of FPL virus. Characterization by physicochemical methods like 5-iodo-2-deoxy uridine (IUDR) treatment of MDBK cell infected with FPLV isolates revealed inhibition of CPE thereby confirming the isolates to be a DNA virus. MDBK propagated third passaged virus withstand a temperature of 60 C for 30 minutes without decrease in $TCID_{50}$. This indicated thermostable nature of FPL virus.

Feline panleukopaenia virus is capable of agglutinating porcine erythrocytes. Results of Haemagglutination (HA) test recorded FPL in 41.6% (15/36) cases. This observation is in agreement with the findings of earlier investigators like Goto *et al.* (1974).

Faecal samples when subjected to direct FAT using fluoro-isothiocyanate (FITC) tagged monoclonal antibody against FPL virus revealed positive fluorescence in 61.1 % (22/

36) animals. Csiza *et al.* (1972) observed fluorescence in cat's purkinje cell of cerebellum. Carlson *et al.* (1978) recorded fluorescence in tissue samples like thymus, lymph node and spleen of the cats after 2-6 days of inoculation with feline panleukopenia virus. In another study conducted by the authors on the intestinal tissues preserved in deep freeze following postmortem examination also showed fluorescence.

Of the 36 samples processed for FPL, 26 (72.2%) samples were found seropositive by indirect ELISA as compared to 14 (38.8%) samples in HI test and 16 (44.4%) samples in micro-SNT. This shows the superiority of indirect ELISA in terms of sensitivity over HI test and micro-SNT. Literatures are meager on the use of indirect-ELISA for seroprevalence of FPLV. The report on the use of double antibody sandwich-ELISA from infected mink serum by Rivera *et al.* (1987) and in a similar fashion Veijalainen *et al.* (1986) recorded the sensitivity of ELISA over other tests such as HA and latex agglutination test.

Vaccination against the Feline panleukopenia at Nandankanan Zoological Park is being carried out with the inactivated vaccine (Felo-O-Vax) with the standard cat dose i.e., one single dose vaccine per animal. Vaccination to lion, tiger, leopard, jungle cat and leopard-cat is started at eight weeks with a booster vaccination at 12 weeks, 16 weeks and 6 months of age followed by annual vaccination. Nandankanan Zoological Park has never experienced incidence of FPL after introduction of this vaccination protocol. It could be otherwise interpreted that the adopted immunization procedure provides appreciable protection against the disease. Similar study was carried out by Bush *et al* in the year 1981 at National Zoological Park, Washington DC in 27 non-domestic felids consisting of 7 species to assess safety and efficacy of the same vaccine. The standard domestic cat dose was administered in 19 animals and double this dose was administered in eight others. The animals were vaccinated either once, twice or thrice at 4 weeks interval. No significant increase in the anti-body titre was observed by doubling the vaccine dose. Optimal response could be obtained by using the domestic cat vaccination protocol. Felo-O-Vax, being a mixed vaccine, also confers protection against rhino- tracheitis and caliciviral disease. However, sero-prevalence studies may be attempted to ascertain their status in the zoo.

All the tigers and lions included in the study were apparently healthy and under routine vaccination protocol, but antibodies could not be detected in some cases. This could be attributed to the variation in immune response of individual animal. Further, shedding of the feline panleukopaenia virus in the faecal samples of the healthy animals as recorded could be corroborated with the observation made by Bush *et al.* (1981) that FPLV may persist in the area of outbreak for a prolonged period and continue to be excreted in the faeces of immunized animals. Though the exact status of each tiger or lion was beyond the purview of the investigation, it could be interpreted that the faecal samples of large cats

(tigers and lions) had feline panleukopaenia virus with or without corresponding antibodies in the serum and such animals could be a potential source of infection to other susceptible hosts.

Feline panleukopaenia virus (FPLV) in wild carnivores and canine parvovirus (CPV) in pet dogs are members of the feline parvovirus subgroup (Mochizuki *et al.*, 1996) and are classified as autonomous parvoviruses of the family Parvoviridae. Epidemiological studies on these two diseases may be carried out simultaneously to unveil their relationship in the area of interest.

Acknowledgement

The authors are grateful to the authority of Nandankanan Zoological Park for providing necessary facilities to carry out the research work.

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BABESIOSIS IN A WHITE TIGRESS (*Panthera tigris tigris*) – A CASE REPORT

Nighot N.K.[1], C. S. Mote[1], R.V. Jadhav[1], B. K. More[2], Natasha Bansal[1] and Chirantana Mathkari[1]

Introduction

Babesiosis, a haemoprotozan tick borne infection caused by *Babesia Sp.* is a serious disease reported amongst domestic animals with clinical signs such as high fever, haemolytic crisis, haemoglobinuria, jaundice, anaemia and death. Although babesiosis is commonly reported in bovines with economic losses, scanty literature is available regarding its occurrence, clinico-therapeutic aspects of wild and captive wild animals infested with babesiosis. Only few reports are available on occurrence of babesiosis in big cats (lion, tiger and leopard) with successful therapeutic management (Kinge *et al.* 2010; Khurana, 1969; Sinha *et al.* 2000; Upadhye and Dhoot, 2000). *Babesia cati, B. felis, B. harpailuri* and *B. pantherae* are known to infect wild cats (Swarup *et al.* 2009). The present article reports on the clinico-pathological aspects of babesiosis with successful therapeutic management in a white tigress.

Case History

A 13 years old white tigress (*Panthera tigris tigris*) named "Gypsi" of Rajiv Gandhi Zoological Park and Wildlife Research Center, Pune was found infested with babesiosis on peripheral blood smear examination on the 3rd day of illness. The tigress showed the clinical signs of high fever (103 F) with partial anorexia and dullness for three days. The animal appeared disturbed and scared with behavioural changes like biting the inanimate objects, vacant looks and staring. Dietary changes were made by supplying chicken meat instead of beef. The other clinical signs observed in babesiosis like jaundice and haemoglobinuria were not observed till the fourth day of illness.

The complete blood count was performed four times on 2nd, 4th, 8th and 15th day during the course of illness. The intra–erythrocytic organisms of *Babesia Sp.*, either single or double, were detected on day 4 of infection (Fig. 1a and b). Marked haematological

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[2] K.N.P. College of Veterinary Science, Shirwal, Satara-412801.

alterations were noted on the 4th day as compared to observations recorded on the 2nd day. The haemoglobin (gm/dl) levels decreased from 14.9 (day 2) to 11.8 (day 4) along with reduction in haematocrit (%) from 39 (day 2) to 35 (day 4) indicative of progression towards anaemic status. Similar reduction were noted in total erythrocyte count (millions/cmm) from 7.2 (day 2) to 6.18 (day 4). A notable increase in total leukocyte count (thousands/cmm) from 16,400 (on day 2) to 19,500 (on day 4) was reported with neutrophilia (79%) and eosinophilia (5%). Details of haematological report are shown in Table. Marked thrombocytosis (on smear) with clumping and presence of large granular changes was also observed on 2nd and 4th day of infection.

The biochemical investigations on the 4th day showed elevated levels of liver function tests like total bilirubin (2.21 mg/dl), SGOT (158 IU/L), SGPT (228 IU/L) and alkaline phosphatase (74 IU/L) with decreased levels of albumin (2.8 gm/dl) and normal total protein (6.45 gm/dl). The increased levels were attributed to hepatic dysfunction accompanied with anorexia and muscular degeneration. Kidney function tests showed mild elevation of serum creatinine (2.02 mg/dl) and Blood Urea Nitrogen (BUN) (10.13 mg/dl) within referral range (Table). Similar observations were reported by Kinge *et al.* (2010) with decreased levels of total protein and albumin indicative of mild liver damage in acute phase of babesiosis in a lioness.

Use of commonly available drug, Diminazene aceturate is contraindicated in wild felines which may lead into fatal damage to kidney, liver and brain (Swarup *et al.* 2009). They further state that Primaquin is the drug of choice in feline babesiosis. But Primaquin, having low lethal margin with smaller dose and route of administration (as *per os)* was not considered suitable for therapeutic use in this case. Hence, Imidocarb (Inj. Imizol[3]) @ 2 mg/kg body weight was used as the drug of choice for treatment in this case on 4th day and was repeated after a week. Imidocarb has been demonstrated highly curative and prophylactic against all *Babesia* Sp. In felids good response is obtained when it is administered @ 2mg/kg body weight (Swarup *et al.* 2009). Similar therapeutic dose (0.5 to 1.0 mg/kg) has been reported by Arora (1994). The treatment was supported with administration of 10 % Dextrose saline and Vit. B-complex (Inj. Livobex[4]).

The blood examination on 8th and 15th day showed absence of organisms from blood with restoration of blood values to referral range with normal food intake and absence of clinical signs with normal behaviour.

[3] Inj. Imizol-Schering-Plough Animal Health Corp, Union, NJ. 07083, Germany.

[4] Inj. Livobex – TTK Healthcare Ltd., Vijaywada, India.

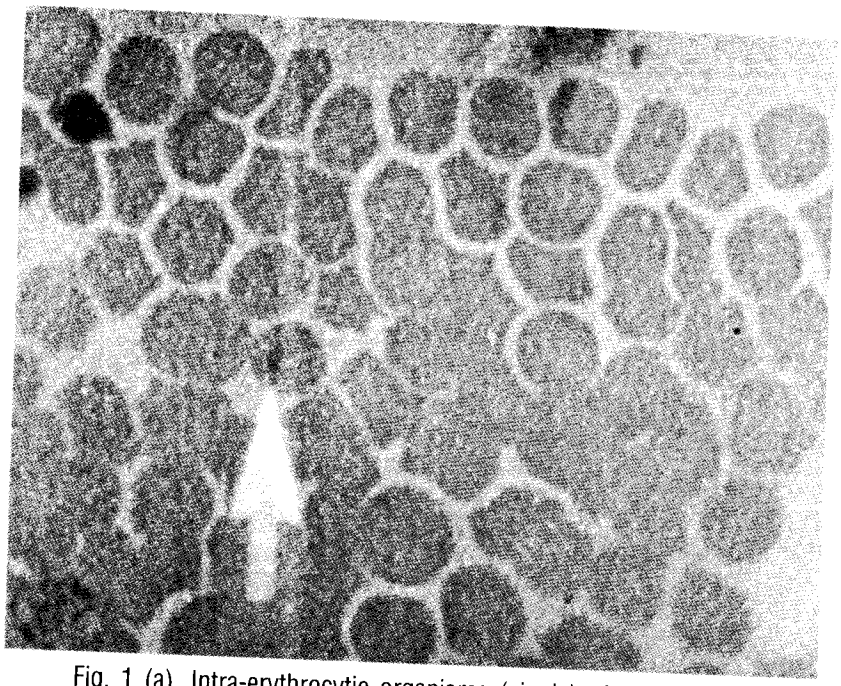

Fig. 1 (a). Intra-erythrocytic organisms (single) of *Babesia Sp.*

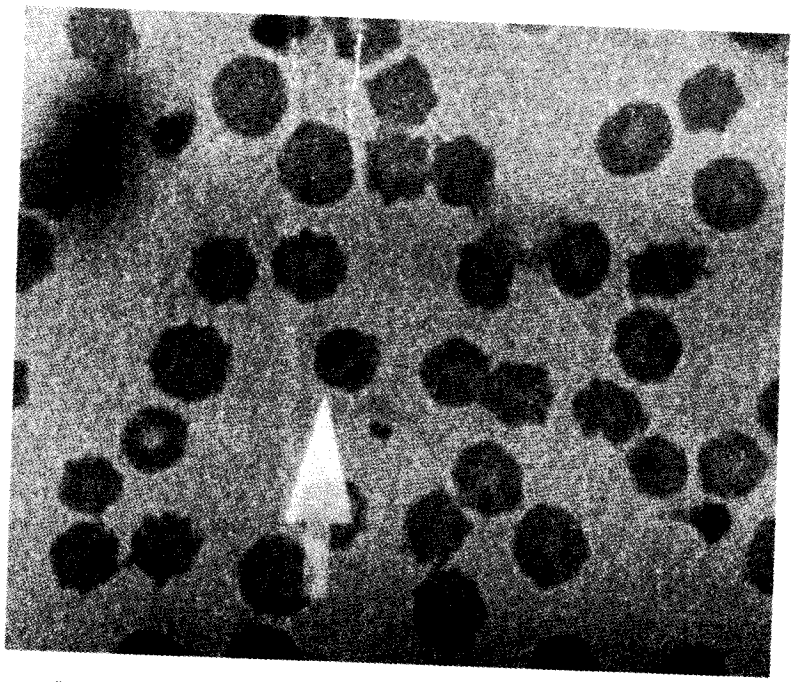

Fig.1 (b). Intra-erythrocytic ornarisms (doube) of *Babesia Sp.*

Table: Blood examination, liver and kidney function tests of a white tigress "Gypsi"

Paremeter	Unit	Value			
Days	-	2nd day	4th day	8th day	15th day
Hb	gm /dl	14.9	11.8	12.6	12
PCV	%	39	35	34	40
WBC	X 10^3 /ul	16400	19500	17200	12600
RBC	X 10^6 /ul	7.2	6.18	6.8	7
ESR	mm/hr	9	20	35	–
Platelet	X 10^3 /ul				
Diffrential count					
Neutrophils	%	79	-	76	73
Bands		12	70	9	2
Mature neutrophils		63		65	71
Lymphocytes	%	14	25	15	23
Monocytes	%	2	2	3	2
Eosinophils	%	5	3	6	2
Platelet			41		52
Liver function test					
Triglycarides	mg/dl	-	-	-	21.8
Serum Bilirubin	mg/dl		2.21	0.305	0.26
SGOT	IU/L		158	33.68	23.36
SGPT	IU/L		228	58.47	43.12
Sr. Alkaline	IU/L		74	16.51	23.33
Serum proteins					
Total protein	gm%		6.45	5.71	6.21
Globulin	gm%			1.22	2.2
Albumin	gm%		2.8	3.22	3.44
A:G					
Kidney function test					
BUN	mgs%			10.13	17.26
Creatinine	mgs%			2.02	0

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HAND-REARING OF RESCUED INDIAN PANGOLIN (*Manis crassicaudata*) AT NANDANKANAN ZOOLOGICAL PARK, ODISHA

R. K. Mohapatra, S. Panda, S. K. Sahu, P. K. Roy, K. L. Purohit and C. R. Mishra

Abstract

Nandankanan Zoological Park, Odisha received a rescued baby Indian pangolin (*Manis crassicaudata*) at an estimated age of 4 weeks on 3rd July 2012. Preparations were made for hand-rearing. This paper describes housing, feeding, veterinary care and behavioural management carried out during hand-rearing of the rescued Indian pangolin.

Introduction

Pangolins are toothless small mammals belonging to the Family Manidae of Order Pholidota. They have overlapping horny scales on their body, protrusible long tongue, prehensile tail and usually roll up into a ball when threatened. Indian pangolin (*Manis crassicaudata*) is one of the eight pangolin species of the world. They are nocturnal and have burrowing habit and distributed throughout peninsular India (Mishra and Panda, 2010; Prater, 2005; Heath, 1995). The average life span of Indian pangolin is about 13.5 years (Heath, 1995). Pangolin populations are increasingly under threat throughout their range due to domestic and international demand for live pangolin, their skin, scales and meat (Mahmood *et al.* 2012; Mishra and Panda, 2012). The biology of Indian pangolin, particularly with low reproductive rates and wide distribution, make them vulnerable to over-exploitation. Considering the vulnerability, the species is included in the Schedule-I of Wildlife (Protection) Act, 1972. Nandankanan Zoological Park, Odisha (NKZP) is the only zoo in India where the conservation breeding of this threatened species is being attempted. A Pangolin Conservation Breeding Center (PCBC) with specially designed enclosures was established in 2008 for successful upkeep and breeding of Indian pangolin in NKZP.

Hand-rearing is an important aspect of management of endangered population maintained in captivity, especially in species which give birth to single young and which have long inter-birth intervals (Kirkwood *et al.* 1989). Hand-rearing a wild animal is usually a challenging process, which can have a very low success rate and therefore, requires comprehensive knowledge and fine care (Robbins, 1993). The protocol for hand-rearing of young animals vary with the species involved to be reared, their age at the time of receipt,

Nandankanan Zoological Park, Mayur Bhawan, Janpath, Saheed Nagar, Bhubaneswar- 751007, Odisha

whether they have received colostrum or not and the general health status of the young (Senthilkumar and Thirumurugan, 2006). The present study discusses about the successful hand-rearing procedure of a rescued baby Indian pangolin (*Manis crassicaudata*) at NKZP. The details of hand-rearing are discussed in brief as follows.

Housing

A rescued baby Indian pangolin from Sambalpur Wildlife Division, Odisha was received at NKZP on 3rd July 2012. The baby pangolin measured 37cm tip to tip with 16 cm tail and weighed 410g. Achariyo and Misra (1972) reported that a new born young measured 30 cm from tip to tip including a 12.5 cm long tail and weighed 235g. Considering the above report, the age of this baby pangolin was estimated to be about four weeks when received. The baby pangolin was kept in a box having 60X40X30 cm dimensions in the keeper's room at PCBC. Cotton towels were given to rest over it. The baby was found sleeping over it and hides within these towels. The environmental temperature and humidity measured was 21-30^0 C and 55-89% respectively during the hand-rearing period (3rd July 2012 – 31st December 2012)

Feeding

The baby pangolin reached NKZP at 5 am on 3rd July, 2012. The animal was not accepting the adult pangolin feed i.e., red weaver ants and eggs on arrival in the park. However, the baby showed little acceptance to the cow's milk. So reconstituted 'Royal Canin baby dog milk'[1] was given as feed up to the age of 29 weeks. Feeding bottles and utensils used for the purpose were sterilized before each feeding. The reconstituted milk feed with the help of a feeding bottle was attempted but not easily accepted by the baby pangolin. Therefore, the nipple of the feeding bottle was carefully inserted into the mouth of the baby pangolin for feeding the reconstituted milk with difficulty. From the third day onwards the baby pangolin has readily accepted the feeding bottle with reconstituted milk easily and from 7th day it was looking for the feeding bottle. When it was hungry, the abdomen was shrivelled which become distended after feeding. Feed intake increased day by day with age. It was easy to insert the nipple of feeding bottle into the pangolin's mouth from a side. Every alternative day, a small quantity of red weaver ants with eggs (2-5g) was kept inside the resting box to test its acceptance from the fifth week onwards. The growth parameters i.e., body weight and size was recorded at weekly intervals. The analysis of red weaver ants and eggs used as adult pangolin feed was carried out at Central Poultry Development Organization, Bhubaneswar, Odisha and the results are- 15% crude protein, 5.48% crude

[1] Manufactered by: Royal Canin, 650, De La Petite, Almargues, camargues. BP4-30470, France. Royal Canin baby dog milk powder contains 31% crude protein, 37% crude fat, 4.5% moisture and 6% ash.

fat, 72.78% moisture and 6.13% ash. Medicine given, excreta (colour and consistency of faeces and urine), important physical and behavioural development were also recorded.

Veterinary care

There were few veterinary problems encountered during this hand-rearing practice. At the time of receipt the pangolin was infested with ecto-parasites (ticks) which were removed manually followed by local application of antiseptic ointment. On 39th day of hand-rearing microscopic examination of faecal sample revealed the presence of *Strongyloides* sp. eggs. Deworming was carried out by oral administration of 10mg of 'albendazole' (Zentel)[2] suspension. From the second day of deworming, the faecal sample was found negative for the same eggs. On 66th day of hand-rearing, a swelling was observed at neck region leading to difficulty in protrusion of tongue. Oral administration of antibiotic 'Cephalexin' (Ceff DT 250)[3] at a dose rate of 50 mg for consecutive 5 days was effective to cure the symptoms. Partial anorexia developed during 5th and 12th week of rearing. Liver stimulant (Liv-52 drop)[4] at the rate of 10drops per day was administered orally for 15 consecutive days to improve appetite, digestion and assimilation process. All oral administration of medicines was carried out through the reconstituted milk. On 103rd day the pangolin was observed with itching and irritation resulting into wound at the base of the ear and at the genitalia. External application of Dermanol[5], a herbal skin cream was effective in healing the wound. The pangolin was mopped with Dettol[6] with appropriate dilution at every week end to prevent any skin infection. On 119th day it sustained an injury between the claws of right forelimb during digging. The wound was dressed regularly with Betadine [7] lotion till complete healing.

Behavioural management

To facilitate exhibition of a range of natural behaviour, the baby pangolin was allowed to move and explore the lawn present in front of the PCBC on every afternoon under close observation where it had free access to soil and vegetation. It exhibited walking, running, digging, and climbing behaviour when released in lawn. It was accustomed to defecate and urinate outside its resting box. On 109th day, it exhibited back ward movement with dragging the towels inside the resting box in a circular path, which supposed to be a stereotypic behaviour. Thereafter the pangolin was provided with empty feeding bottle to

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[2] Lupin Ltd., 159, C.S.T. Road, Kalina. Santacruz (E), Mumbai- 400 098.
[3] Glaxo Smith Kline pharmaceutical Ltd. Dr. Annie Besant Road, Mumbai-400 030.
[4] The Himalaya Drug Company, 182-Village Gurumajra, Kishanpura, Himachal Pradesh.
[5] Indian Herbs Research and Supply Co. Ltd. Darra Shivpuri, Sharanpur- 247 001 (U.P).
[6] Reckitt Benckiser (India) Ltd. 61 and 62, Hootagalli Ind. Area, Mysore- 570 018.
[7] Win-Medicare Pvt. Ltd. 1400, Modi Tower, 98, Nehru Place. New Delhi- 110 019.

play and explore. The housing facility was also modified to provide more space to the animal. Since the pangolin was not fully independent from the milk feed, it was not released to pangolin enclosure with soil as substrate rather housed in a enclosure with concrete substrate, so that the animal can easily be retrieved for frequent feeding. The pangolin with its resting box was placed inside the enclosure of 3.0m X 4.0m X 3.5m dimensions. The door of the resting box was kept open, so that the animal can move in and out of the box as and when desired. The nipple of the feeding bottle was removed and the red weaver ants with eggs were placed inside the bottle. The baby pangolin used to take the ants from the bottle directly with the help of its tongue. It helped in exhibition of play and explorative behaviour in feeding. The provision of more space and providing ant feed in feeding bottle resulted in alleviation of the stereotypic behaviour like, backward/circular movement.

Results and Discussion

Feeding schedule and growth parameters such as body weight and size as recorded up to 30 weeks of age are given in Table. The young pangolin had very little contact with people besides its keeper. Feeding attempts by an unfamiliar person would not achieve the intake of its full diet. The young pangolin started feeding adult pangolin feed i.e., red weaver ants from 108th day of hand-rearing when it was 1350g in weight and 53.5cm in length from tip to tip including 21cm tail. Initially, the faecal matter of the baby pangolin was semi-solid and yellow in colour on milk diet. The excreta became solid and black in colour as it started taking the red weaver ant as feed. The pangolin had shown less interest in milk as it started feeding red weaver ants. The growth rate in weight and size are given (Fig. 1a and b). Body weight of an animal is associated with many features of physiology, ecology and life history and is also an indicator of overall physical condition (Petters, 1983). Hand-rearing is not been attempted often in different species in captivity but only taken up if the young is a rescued one / weak / rejected by its mother or death of the mother (Kirkwood *et al.* 1989; Selvam *et al.*, 2005; Mishra *et al.* 2010). Process of hand-rearing requires a sound knowledge of animal's biology and behavioural needs of the species. The lack of appropriate stimulus to exhibit species-specific behaviour, inadequate space and lack of structural complexity in the captive environment may contribute to boredom and initiation of stereotypic behaviour (Carlstead, 1996). Mason (1991) defined stereotypic behaviour as repetitive and invariant, spatially restricted and apparently functionless behaviour.

Mishra and Panda (2010) reported repetitive movement in circular and in a shape of '8' in captive adult pangolins. Foraging, exploratory and play behaviours have been known to interrupt stereotypic patterns (Carlstead, 1998). In the present study the stereotypic movement exhibited by baby pangolin was alleviated by behavioural management. Hand-

Table. Feeding schedule and growth rate of baby Indian pangolin

Estimated age in weeks	'Royal Canin baby dog milk' (RCBDM)				Red weaver ants and eggs		Body growth	
	RCBDM powder(in g) / 20ml water	Feed intake (in ml) / day	Feed intake (in ml)/ week	Feedings per day	Feed intake (in g) / day	Feed intake (in g)/ week	Weight (in g)	Length (in cm)
4†							410	36
5	1.5	15-90	414	5-6			435	37
6	1.5	85-95	640	5-6			510	37.5
7	2	70-95	592	5-6			585	38
8	2	55-90	552	4-5			650	40
9	2.5	60-125	625	4-5			715	42
10	2.5	62-92	504	4-5			805	44
11	3	70-90	573	4-5			880	45
12	3	65-103	612	4			950	46
13	3.5	63-88	546	4			1020	47
14	3.5	68-90	543	4			1090	48
15	4	55-75	445	4			1155	49
16	4	61-82	517	3-4			1205	50
17	4	52-70	432	3-4			1242	51
18	4	50-80	471	3-4			1275	52
19	4	51-80	441	3			1320	53
20	4	40-70	376	3	12	84	1355	54
21	4	55-80	430	2-3	24	168	1390	54.5
22	4	45-65	403	2-3	100	700	1420	55
23	4	50-80	415	2	110	770	1450	56
24	4	40	280	2	110	770	1460	57
25	4	20	140	2	125	875	1475	57
26	4	20	140	2	125	875	1490	57.5
27	4	20	140	2	125	875	1505	58
28	4	20	140	2	125	875	1522	58
29	4	20	140	2	150	1050	1535	59
30	0	0	0	0	160	1120	1550	59.5

†Date of receipt of baby Indian pangolin at NKZP (3rd July 2012).

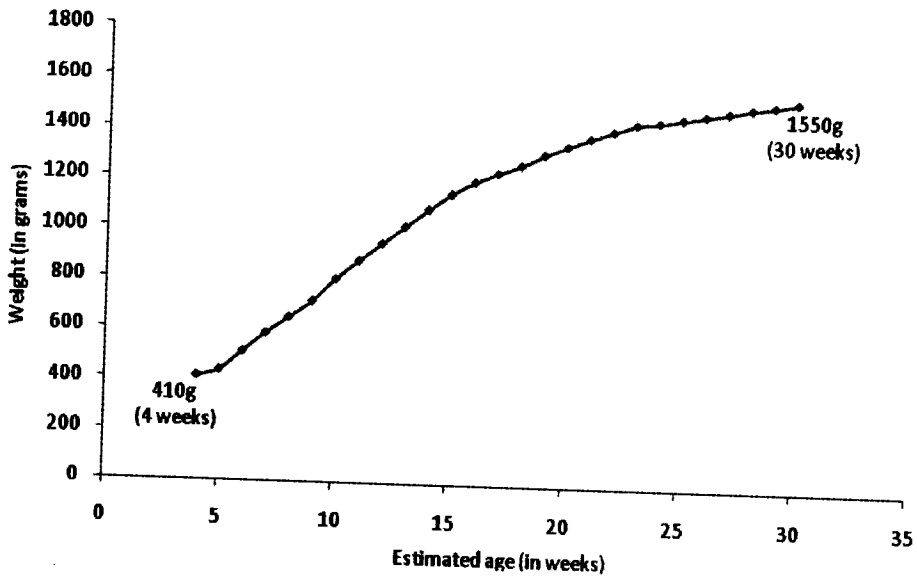

Figure 1 (a). Growth in body weight of hand-reared baby Indian pangolin

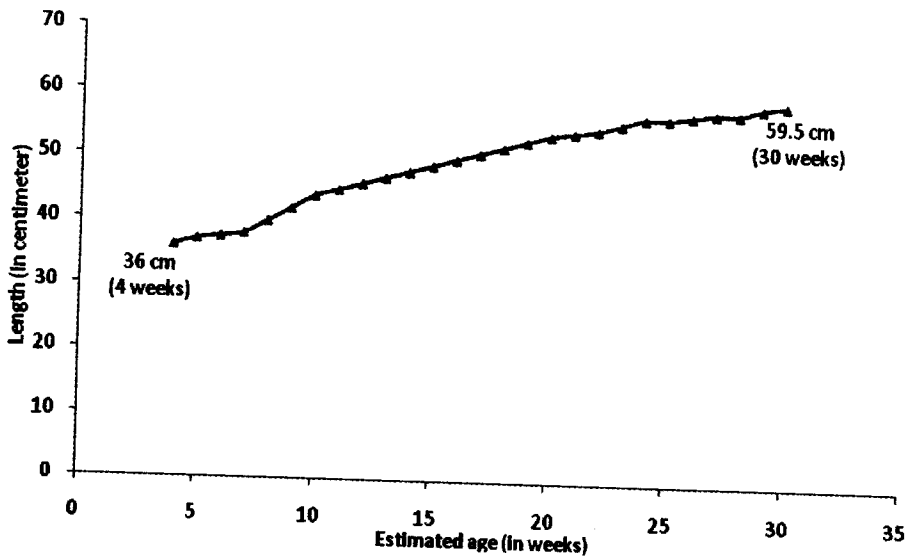

Figure 1(b). Growth in body length of hand-reared baby Indian pangolin

rearing of abandoned, orphaned or rescued young ones of wild mammals is one of the important and difficult tasks for the zoo animal care takers. Although some species differences may exist, the techniques used for hand-rearing of the baby Indian pangolin could be applied to other pangolin species as well. 'Royal Canin baby dog milk' proved to be a suitable substitute diet for hand-rearing of Indian pangolin.

Conclusion

First few days of hand-rearing were very crucial. The nipple of feeding bottle should be narrow enough to facilitate oral administration during feeding. The feeding position and the viscosity of the milk feed are also important. Care should be taken during handling of the animal with a minimal stress. The behavioural needs of the animal may be taken into consideration for hand-rearing. The dedication of the workers including animal keepers was a key factor for successful hand-rearing. Much knowledge has been gained regarding the care and up-keep including feeding protocols of this species in captivity which can be refined during future studies. The present hand-rearing of baby Indian pangolin appears to be first of its kind in any Indian zoo and the present paper enrich our knowledge towards conservation of Indian pangolins.

Acknowledgement

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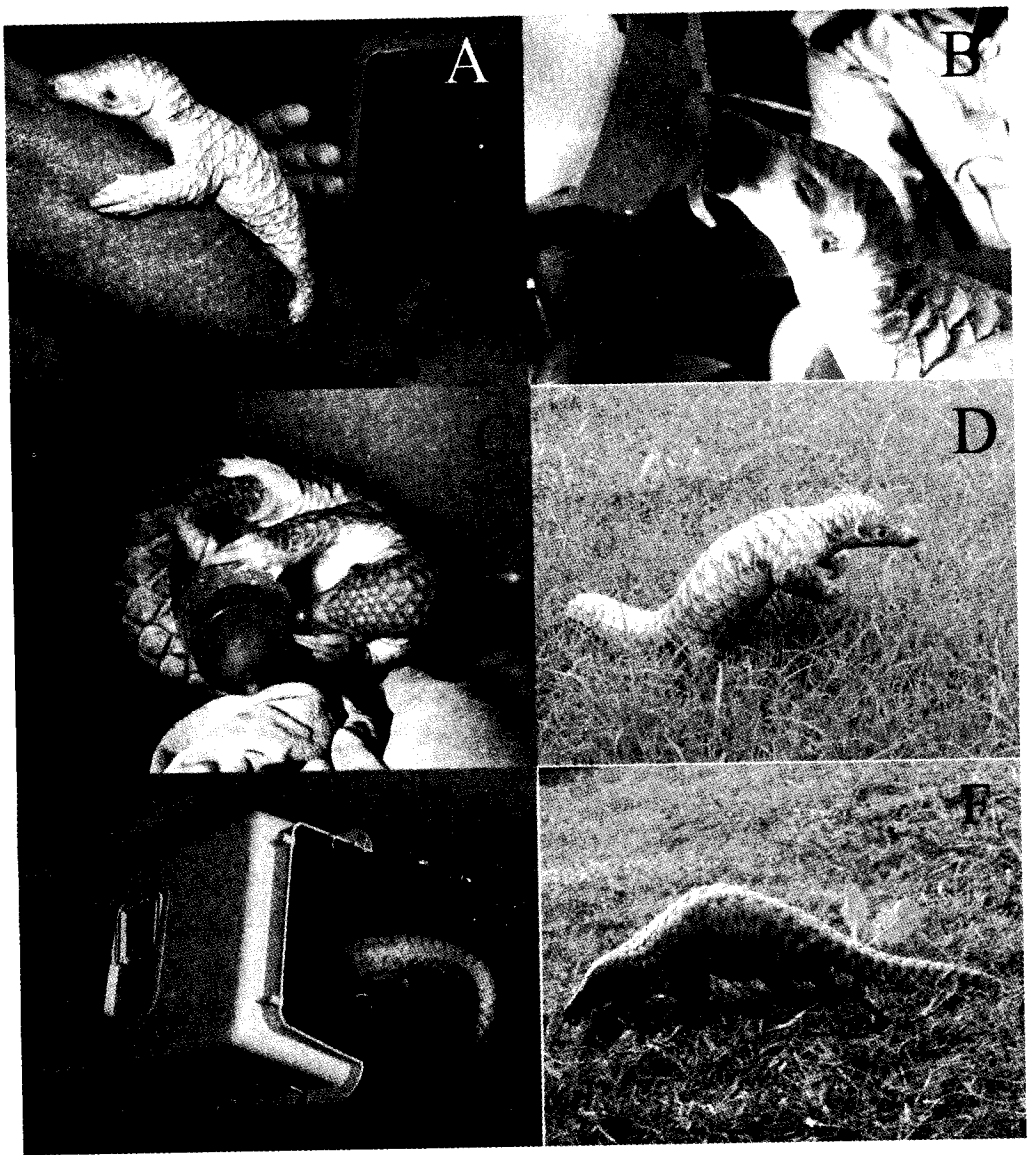

(A) Rescued baby Indian pangolin on arrival at NKZP (estimated age- 4 weeks) (B) Reconstituted milk being fed with the help of a feeding bottle (C) Playing with feeding bottle (D) Exploring lawn in front of PCBC (E) Feeding red weaver ant inside the resting box (F) Indian pangolin at an estimated age of 30 weeks.

CAPTIVE BREEDING OF INDIAN CHEVROTAIN OR MOUSE-DEER (*Tragulus meminna*) IN NEHRU ZOOLOGICAL PARK, HYDERABAD

P. Swapna and M. Sandeep

Introduction

The chevrotains had a wide distribution during the Oligocene and Miocene periods but at present their distribution is restricted to the forests of west Africa and south-east Asia. There are only four living species of chevrotains in the world. Only one species, the water chevrotain (*Hyemoschus aquaticus*) is found in west Africa. The rest three species of chevrotains found in south-east Asia are the larger Malayan chevrotain (*Tragulus napu*), the lesser Malayan chevrotain (*Tragulus javanicus*) and the Indian chevrotain or mouse-deer (*Tragulus meminna).*

The mouse-deer is the smallest of all deer and described under the family-Tragulidae and order- Artiodactyla. As the name indicates, its face and body resembles a mouse and toes look like that of deer. They are unchanged in 25-30 million years of evolution and hence they are called as 'living fossils'.

The Indian chevrotain or mouse-deer occurs in southern Indian and Sri Lanka at elevations up to 1850 meters. This species has no front teeth (incisors) in the upper jaw like other ruminants (Prater, 1998). It has a three chambered stomach instead of the usual four chambers as in the members of family-Camelidae but still capable of rumination. Antlers are not present in both sexes but the upper canines of males are lengthened as tusks (Crandall, 1965). This is a very timid nocturnal animal and disappears in dense vegetation at the slightest disturbance. The males live solitary except during mating season. Adult mouse-deer measures 25-30cm in shoulder height and weighs about 2.5-4Kg. The weight and size at birth of four new born mouse-deer fawns have been given as 288-382g and 26.5-30.5cm in total length respectively (Acharjyo and Mishra, 1981). It lives only for 4-5 years but in captivity it can live for more than 5 years. An adult male wild mouse-deer received at the Nandankanan Zoological Park, Odisha lived for 7 years 3 months and 29 days in captivity and the estimated age at the time of death was about 10 years (Acharjyo and Misra, 1971). This study was undertaken to provide information on some aspects of breeding habits of mouse-deer observed at Nehru Zoological Park, Hyderabad during the

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period from March, 2010 to December, 2012. For the purpose of this study, data have been collected from our own observation. Assistance of some of the zoo staff were also availed for this study. The observations of earlier workers have been cited.

Materials and methods

The Central Zoo Authority has allotted conservation breeding of mouse-deer to Nehru Zoological Park, Hyderabad (NZP) as a part of the conservation of endangered species programme. The conservation breeding centre (CBC) of mouse-deer at NZP was started from 3rd March, 2010 with six (2 males and 4 females) mouse-deer as founder stock. Later on three (one male and two females) from Tirupati and one male from Visakhapatnam were procured.

They were kept in an enclosure having four chambers, each measuring 15X8 meters in size (total area of the enclosure- 480 sq.m.). Each chamber is planted with bamboo, *Acalhypha* and palm. Due to overcrowding and to avoid infighting between males, these four chambers were again sub-divided to accommodate the increasing number of mouse-deer. At present, there are 35 (10males:19 females: 6 un-sexed fawns) mouse-deer in seven breeding groups.

The average daily diet of each adult mouse-deer consists of apple-50gm, banana-100gm., carrot-50gm, sweet potato-50gm, mixed grains (black gram, horse gram and moong)- 50gm, lucern- 100gm, hay-500gm and *Acalhypha*/peepal-500gm.

Observations and discussion

Breeding season

The details of observation on breeding season are given in Table-1.

Table-1. Breeding season of mouse-deer (*Tragulus meminna*) in Nehru Zoological Park, Hyderabad

Month	Number of matings recorded	No. of births recorded
January	4	1
February	9	3
March	6	3
April	4	1
May	2	1
June	3	1

Conclusions

- Mouse-deer mates throughout the year and fawns are produced throughout the year in captivity and mating takes place immediately after parturition.
- The female mouse-deer matures sexually at the age of 5-8 months.
- The range of gestation period of mouse-deer recorded in 28 births varies from 152 to 199 days with an average of 162 days.

Table-3. Observation on gestation period recorded among mouse-deer (*Tragulus meminna*) in Nehru Zoological Park, Hyderabad

Name of the mating pairs (Male X Female)	Oestrus	Date of mating	Date birth of fawn	Gestation period (in days)
"Rajesh" X "Rosy"	1st 2nd 3rd 4th 5th 6th	14.05.2010 19.10.2010 23.03.2011 25.08.2011 27.01.2012 27.06.2012	19.10.2010 23.03.2011 24.08.2011 27.01.2012 27.06.2012 08.12.2012	158 155 154 155 152 164
"Rakesh" X "Radha"	1st	10.06.2010	No birth	–
"Rajesh" X "Razia"	1st 2nd 3rd 4th	15.05.2010 29.04.2011 01.10.2011 05.03.2012	25.11.2010 01.10.2011 05.03.2012 06.08.2012	194 155 156 154
"Rajesh" X "Rinky"	1st 2nd 3rd 4th	29.10.2010 06.04.2011 19.09.2011 19.02.2012	06.04.2011 19.09.2011 19.02.2012 23.07.2012	160 166 153 156
"Rakesh" X "Ramya"	1st 2nd	26.02.2011 30.07.2011	30.07.2011 07.02.2012	155 192
"Rajesh" X "Kartika"	1st 2nd	19.04.2011 25.09.2011	25.09.2011 29.02.2012	159 157
"Rajesh" X "Rajitha"	1st 2nd 3rd	26.04.2011 01.10.2011 12.04.2012	01.10.2011 12.04.2012 13.09.2012	158 194 154
"Arjun" X"Shravani"	1st 2nd	20.12.2011 06.07.2012	06.07.2012 09.12.2012	199 156

"Venkat" X "Kartika"	1st 2nd	29.02.2012 30.07.2012	30.07.2012 31.12.2012	152 154
"Ganesh" X"Rajini"	1st	22.05.2012	30.10.2012	161
"Venkat" X"Hasini"	1st	18.06.2012	20.11.2012	155
"Vishal" X"Ashiwini"	1st	27.06.2012	04.12.2012	160

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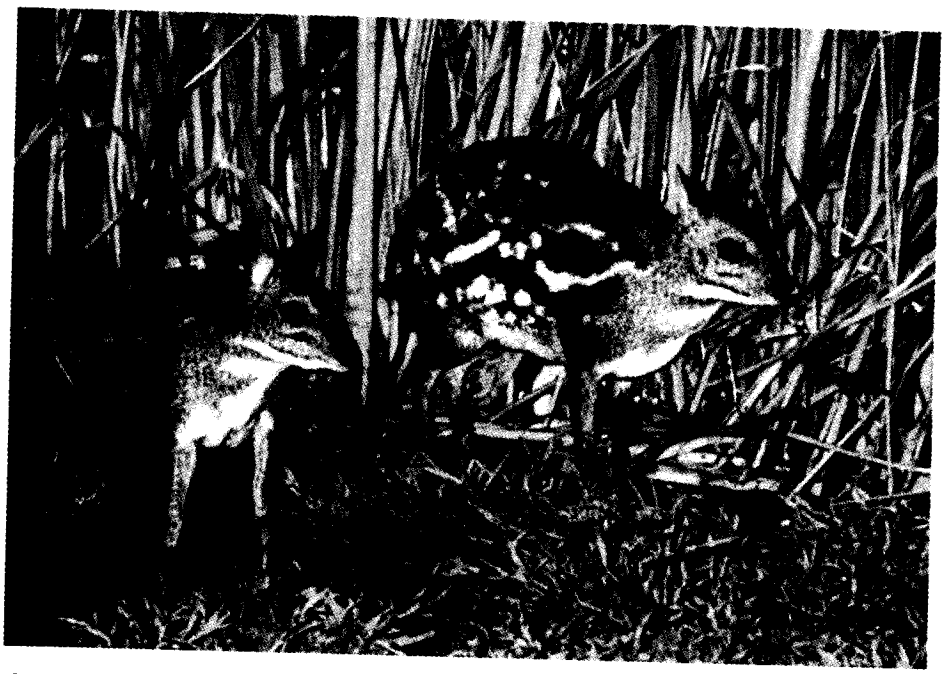

Mouse-deer (*Tragulus meminna*) with a fawn at Nehru Zoological Park, Hyderabad.

ZOO EDUCATION: BEYOND SHOWCASING THE ANIMALS IN ZOOS

Brij Kishor Gupta

It is of vital importance to make people realise the responsibility of preserving nature, and maintaining and restoring natural relations between man and the living world. In this context zoos or zoological gardens can play a big role.

For many of the visitors that visit India's zoos each year, zoos are the first introduction to India's wildlife which are charismatic, unique and truly Indian. From well-known mega fauna like Bengal tiger and Asian elephant, to lesser-known endangered Indian species like the pangolin, slow loris and vultures etc.; are zoos' showcases of India's faunal wealth. In Indian zoos at present over 88 species of mammals, 153 species of birds, 27 species of the reptiles and only one species of amphibian fauna are housed.

As we all know that to guide and monitor the functioning of the zoos in the country, the Central Zoo Authority (CZA) was set up in February 1992. One of CZA's most important mandates is to ensure that zoos go beyond just showcasing, monitoring zoos and stopping their mushrooming, but must also ensure that zoo educates the public on wildlife conservation and a sustainable lifestyle, both inside and outside zoological gardens.

As per the National Zoo Policy, 1998; the zoos play very important role to educate the masses. The youths who visit most our zoos play a very important role in this endeavour. Children also enjoy watching and learning about animals in zoos and use the zoos in a wide variety of devices to explain behaviour of animals, species requirements, as well as what is needed for species conservation in the wild. This is done, firstly, through the animal exhibit itself in any zoo which should be as naturalistic as much as possible, so that the animal can behave the way it would behave in the wild. Secondly, a range of activities are planned for educating the public, so that lessons from zoos can be applied in everyday life. Through quizzes, signages, interpretations, programmes during wildlife week, interactive installations that make an animal sounds like a bark or a roar, to painting competitions, clay models, nature photography etc., zoos perform important conservation education functions. Perhaps the most popular among all these is the annual painting competitions, held in several zoos in India.

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As a child, most of us remember a trip to the zoo with special fondness. Whether it is a school picnic trip or a family outing, zoos evoke fond memories of fun and frolic, amazing antics of the caged animals and the excitement of learning about their behaviour from signboards. People appreciate the opportunity to see animals they would never otherwise get a chance to see. This may be the closest to wildlife that many urban people may get and so zoos provide a unique opportunity to create an interest and love for animals.

Over 620 million people visit zoos across the world every year. That is more than one tenth of the human race. More than 50 per cent of world zoo visitation takes place in Asia. In India alone, over 500,00,000 (5 crore) people visit zoos annually. During 10 months (1st April 2012 to 12th February 2013) the Nehru Zoological Park, Hyderabad had crossed the mark of 25 lakh visitors, its highest since the zoo was established.

We all know that the learning experience gained while interacting with live animals–seeing, hearing or touching them–cannot be replaced by other modes of education. Live animals create curiosity and interest. Zoos provide an opportunity to open up a whole new world and this could be used in sensitising visitors regarding the value and need for conservation of wildlife.

Zoos act as living institutions, living classrooms and living landscapes. Zoo education is a holistic discipline targeted at zoo visitors, staff and the wider community aiming to promote an understanding of concern and respect for biodiversity, animals and the natural world and encourage action for a sustainable future.

The World Zoo Conservation Strategy published in 1993 concluded that, given a professional approach, a knowledge of the zoo public and a clear cut education plan, zoo education programmes can be successful in increasing the public's awareness of the irreplaceable value of nature. Education is therefore, an essential conservation task of zoos.

However, despite the fact that zoos provide a good opportunity for teaching and learning about wildlife, often zoo visits are considered just as picnics and are undertaken without any specific purpose in mind. It is important not to treat the zoo visit as an isolated activity. Without taking away the fun, with a little creativity and innovativeness, teachers can make the outcome of a zoo visit memorable and long lasting.

Dr. Jorg Junhold, President, World Association for Zoos and Aquariums (WAZA) and Director, Leipzig Zoo, Leipzig, Germany during his visit to New Delhi on 1-2 December, 2012 stated in his speech during the ceremony while signing an MoU between CZA and Leipzig Zoo, Leipzig that *"more and more people live in big cities and especially the*

kids have no chance ever to see or hear and smell wild animals, but zoos offer this opportunity and we can really change the world for our visitors and touch and inspire them. I believe that the species we keep in zoos are ambassadors for their wild living relatives. Zoos can play a very unique role for conservation and especially to raise awareness about the importance of biodiversity".

Why zoos and what are the significantly important functions that zoos perform?

Zoos were initially started for the entertainment of people. Gradually over the years, they have come to play an important role in conservation, education, research and now conservation breeding. Zoos also play an important role in rescue and rehabilitation of wild animals and are institutions that can uniquely integrate the three major tasks of conservation, research and education.

Zoos are last home for animals whose numbers have reduced drastically in the wild. A zoo is an ideal place to breed such endangered animals in off exhibit areas. A zoo acts as a reservoir of rare animals which can be bred in captivity. This also provides stocks for other zoos and keeps the animals safe for possible rehabilitation (reintroduction, if required) in the wild. Such captive breeding has to be done in addition to preserving wild habitats. Zoos offer individual animals protection from poachers and other problems. In the wild, the animals face threats such as hunting, poaching, loss of habitat and pollution of air, water, etc. Inside zoos, the animals are safe from these threats. For example the three species of vultures (white- backed vulture, slender-billed vulture and long-billed vulture) population have declined more than 95% in the wild. Steps are being taken by the Government of India/Central Zoo Authority by setting up of a breeding centre for vultures and other such species at Pinjore and other places. The other species like Indian pangolin, lion-tailed macaque, pigmy hog, one horned rhinoceros, mouse-deer, red panda, snow leopard etc. are few of the examples of the species bred successfully in Indian zoos.

Zoos also offer the opportunity for scientific study of animals. They provide a living laboratory for basic scientific research on the behaviour and biology of animals which would be extremely difficult to undertake in the wild. For a field biologist, it is very difficult to study behaviour, feeding habits, etc. of animals in the wild. It is also difficult to transport and set up the equipment needed for scientific investigation in the wild. It is also not fair to disturb the animals for investigations. Many such investigations are mostly conducted in zoos. The little data collected in the wild is often compared with the data obtained from zoos. Many university students of zoology and veterinary science also use zoos as their "laboratory" or a place where they can carry out practical research or field studies.

Zoos for education

Zoos are the only place for the general public to encounter wildlife in "safe" situations and at reasonable cost. Zoos maintain a collection of living animals from different parts of the country, sometimes from other parts of the world as well. In a single day, one can see animals of different kinds and possibly get an idea about their habitats.

Zoos have tremendous potential for educating people of different ages and backgrounds about wildlife and conservation. They are excellent institutions to increase public awareness about the values of nature. Considering the number of visitors to zoos, the scope of zoo education becomes large and positive.

Living animals that attract visitors form the basis for zoo education. Therefore, the most important education zoos provide is the love and fascination for animals. This can serve as a starting point to stimulate the visitors to become aware of the wonders of nature, relationships and the balance of the living world.

The National Zoo Policy, 1998 in India has also clearly listed the role and components of zoo education to be followed by individual zoos across the country:

"Education, Outreach Activity and Extension Activities

3.8.1 Each zoo should have a well drawn-up plan for educating the visitors as well as others in the community. Zoos shall keep a close liaison with other ex-situ facilities in this regard.

3.8.2 The central theme of the zoo education programme being the linkage between the survival of various species and protection of their natural habitat, enclosures which allow the animals to display natural behaviour are crucial to zoo education. Zoo shall, therefore, display animals in such enclosures only where the animals do not suffer physiological and psychological restraint.

3.8.3 Attractive and effective signage methods and interactive displays to explain activities of various species to visitors, published education material and audio-visual devices are proven methods for driving home the conservation's message. A formal education programme should also be pursued for strengthening the education message.

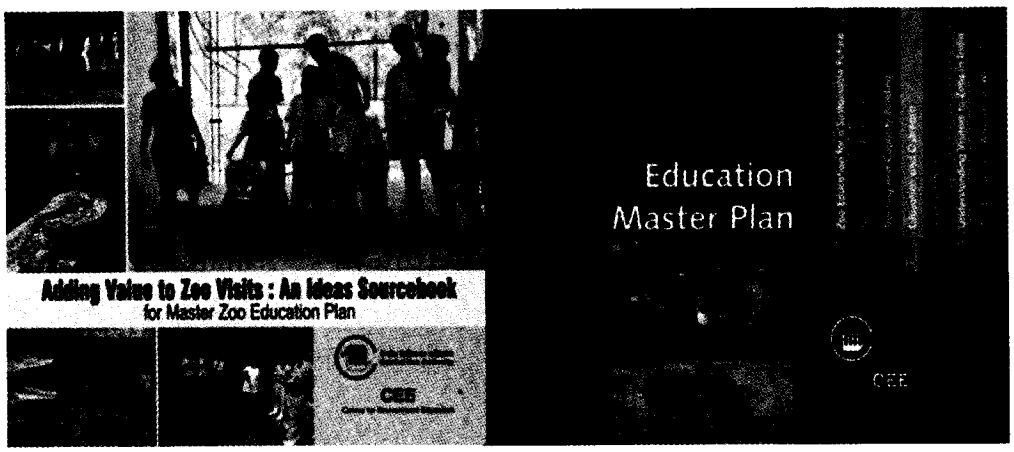
3.8.4 Besides signage, the zoos shall also use guided tours, talks by knowledgeable persons and audio-visual shows for effectively communicating the message for conservation to the visitors.

3.8.5 The help of universities, colleges and non-governmental organisation shall be taken to educate the students about the benefits of supporting nature conservation programmes.

3.9.1 To provide the urban population with a window to nature and to serve as green lungs for the polluting environment, zoos shall extend their expertise."

A large number of school children visit zoos each year and therefore, zoos have a tremendous potential to generate interest about wildlife among this important and impressionable group. This is a perfect place to teach concepts, change in attitudes, give information and create a love for the natural world. Anything from art and zoology to geography can be taught in zoos. Zoos offer a unique combination of resources that are not available in the classroom. The educational outcomes can be memorable and long lasting.

Many zoos also have full fledged interpretation where educational activity aiming to reveal meaning and relationship through the use of original objects by first-hand experience and by illustrative media has been carried out. Such centres also have visitors to understand the uniqueness of each animal and its relationship to its surroundings. Interpretation in zoos is done through a variety of means and media–exhibits, signages, publications like booklets, brochures and through guided tours.



Publications highlighting the various ways in which zoos can be used as a means of conservation and wildlife education

The zoos also use signboards outside each enclosure which give information about the animals and a learning tool for visitors.

Initiatives taken by zoos

Zoo education is far more than information, awareness and inspiration; it is a call to action. Zoos around the country have been taking several initiatives to use the zoos as a medium of education. For instance, the Arignar Anna Zoological Park, Vandalur, Chennai has initiated the "Teachers for Tigers (TFT)" programme in collaboration with the Zoo Outreach Organization (ZOO) to educate zoo biologists, teachers, NGOs and educators about different educational methods and activities using the tiger as an example. The importance of tigers and their conservation, the importance of suitable habitats and the need to preserve forests to protect tigers is highlighted. The programme also aims to train and develop creativity in teachers by making them prepare resource materials and mini dramas. A refresher course is also offered some time after the first workshop.

The Sri Chamarajendra Zoological Gardens, Mysore also initiated a zoo education programme called "Sustainable Future in the 21st century" for its visitors. The Mysore zoo has also pioneered the "Animal Adoption Programme" where any individual, trust, society, school, bank or organization can adopt an zoo animal. By adopting the animals he/she shall be paying one time amount incurred on the feed and upkeep of that particular animal or animals for a year or longer. In turn, a plaque containing his/her name is placed next to the animal exhibit. A citation and "Income Tax Exemption" certificate for the amount paid is also given. Such organizations are entitled to special visits to the zoo. Many zoos have taken up this programme now.

The Nandankanan Zoological Park, Bhubaneshwar has been also doing commendable work to convey the message on wildlife conservation to its visitors by organizing various programmes.

Similarly, the Madras Crocodile Bank Trust, Mammalapuram (MCBT) is involved in research and conservation and is also a centre to create public awareness regarding the most misunderstood group of animals – the reptiles. The Trust encourages all visitors to inquire and learn about different aspects related to reptiles. General reptile talks are held at scheduled times on weekends. Field trips to the Crocodile Bank are accompanied by educational programmes. The fun-based curriculum takes advantage of the Crocodile Bank's denizens and natural settings to engage students in a unique, exciting and supervised manner.

Special programmes for university students are designed based on fields of specialisation and interest ranging from animal sciences, conservation to photography and art. More recently, the MCBT included the Agumbe Rainforest Research Station and Andaman and Nicobar Environmental Team/Centre for Island Ecology as components of this programme,

allowing students the opportunity to experience a more diverse biological curriculum, whilst giving them the chance to get a taste of cutting edge environmental issues in the field.

Some of their long-standing and popular programmes at MCBT, Mammalapuram includes:

- *Young Explorers* for children between 5-7 years of age. The focus of the programme is on habitats and adaptations.
- *Young Discoverers* is for children between the ages of 8–11 years. Workshop activities are based on adaptations, identification and the behaviour of different species.
- *Amateur Naturalist* programme is for teenagers between the ages of 12-16. Topics include classifications, field research skills and conservation.
- *Behind the scenes* is a programme designed to provide a glimpse into what it takes to make Crocodile Bank work and the skills needed for reptile care and management.
- *Junior Zoo Keeper for a day* wherein the Crocodile Bank provides an opportunity to be a zoo keeper for a day and to do a zoo keeper's job under the keeper's supervision. This provides an eye opening experience of being a caretaker for over 2000 reptiles.
- *Docent Programme* is a formal and long-term means of engaging the local wildlife community. Docents at MCBT undergo a structured training programme during which they are taught basic skills required for conservation, research and education.
- Guided tours through which one can get to know the Crocodile Bank and its inhabitants better with a trained Crocodile Bank guide.
- Environment Education (EE) outreach programme for urban and rural areas as part of which mobile exhibitions and awareness programmes for schools and fishing villages along the East Coast Road are conducted. MCBT has also set up a mobile 'Puppet theatre'.

The Rajiv Gandhi Zoological Park and Wildlife Research Centre, Pune has initiated an SMS Alert System for the public to file complaints about injured birds or animals in trouble, or illegal tree felling. The Pune zoo also organises workshops to disseminate information on the importance of trees and forests and the need to save them. During "Rakshabandhan", *'Rakhis'* are made using seeds. Similarly, informative sessions are conducted on myths and facts about snakes. For instance, during *"Nagpanchami"* festival snake charmers take snakes from door to door and feed them the milk offered by people.

The milk may enter into the lungs of the snake leading to its death.

The National Zoological Park (NZP), New Delhi popularly known as Delhi Zoo has taken up the following activities:

1. International Vulture Awareness Day (1st September 2012)

1st September was celebrated as the international vulture awareness day in National Zoological Park. A group of school students from various schools were invited. The programme was aimed for introduction of the vultures-the nature cleaner and threats faced by them in nature to the students. The student participants were informed about how to save vultures which play an important role in nature and environments.

The students were provided with vulture shock kit. During the programme participants took "save vulture oath" and "Rakhi" on vultures were made. A poem competition with vulture as theme was also held. The teachers were also provided with orientation on the vulture species which are facing the threat of extinction (namely white-backed vulture, slender-billed vulture and long-billed vulture).

2. Celebrating "World Tourism Day" (27th September 2012)

In order to raise awareness on the role of "Ecotourism" for the conservation of wildlife, the zoo organized "Ecotourism" with an aim to develop an insight about the interdependence of wildlife conservation and ecotourism. By implementing eco-friendly or environmental friendly tourism both within and outside the protected areas, one can conserve biodiversity, support sustainable development, have limited environmental impact based activities, create environmental education, employment generation among local people or community participation etc. The basic principle behind ecotourism is to have a sensitive tourism for social, cultural and economical sustainability with the aim of managing the natural/ cultural resources in a sustainable manner. Application of strict rules and regulations in and around the protected areas should be followed in order to preserve the ecosystem, endangered wildlife species, natural resources and to control ecotourism activities etc. for saving the existing biodiversity for the present as well as for the future generation.

Implementing ecotourism is of utmost importance as for the very first time in the history of India the concept of ecotourism for the livelihoods of local communities is being proposed in the 12th Five Year Plan (2012- 2017). Several guidelines has also being given by Ministry of Environment and Forests, Government of India to state governments, protected area management authorities, tourist facilities/tour operators, temple/pilgrimage boards, local communities and public /visitors for ecotourism in and around the protected areas.

What not to do in a zoo

Zoos are special places for special animals. So, it is very important to know "what one should not do in a zoo?" Visitors should not disturb animals and feed animals knowingly or unknowingly. There are often signboards in zoos that tell the people about the things that should not be done. These instructions must be taken seriously.

The National Zoological Park at New Delhi has been declared a 'no polybag' zone. Other zoos namely Arignar Anna Zoological Park, Vandalur, Chennai; Sri Chamarajendra Zoological Gardens, Mysore; Nehru Zoological Park, Hyderabad; Padmaja Naidu Himalayan Zoological Park, Darjeeling, Nandankanan Zoological Park, Bhubaneswar have also declared themselves as polybag free zones. No visitor can bring a plastic bag with food material into the zoo. This has been done to protect the animals, as plastic bags (empty as well as with leftover snacks) which are dumped on the lawns or inside animal enclosures and these may be swallowed by the animals. Polythene bags are non-biodegradable and cannot be digested. They can clog the digestive tract of the animals leading to death.

There are two very important things that visitors to zoos must remember. First, there must be no teasing of animals by visitors. No person should tease, molest, injure or feed any animal or cause disturbance to the animals by noise or otherwise or litter the grounds in a zoo. Shouting, hissing, making faces, throwing things, running in front of the cage, waving sticks—such activities disturb and irritate animals. Animals will be a lot happier if the surroundings are quiet. Sounds that animals make can also be heard if silence is maintained.

Animals are very shy and sensitive and have their own routine. Some stay awake at night and sleep most of the day and if visitors disturb the animals just because they want to see the animals moving around, it disturbs their routine. Some animals need privacy and may be hiding. If the animal is hiding, one can come back later and see. People often expect animals to be active all the time, as though the animal wanted to meet and react to them at that precise moment!

Teasing is a major cause of suffering for zoo animals. Teasing causes mental stress. Even seemingly "harmless" teasing such as snapping fingers at the animals, calling, hissing, or running in front of the cage may be irritating to the animals. A visitor who is caught teasing or feeding animals in a zoo can be punished with a fine or even jailed [*The Wildlife (Protection) Amendment Act, 1991, No. 44 of 1991 Section 38.J Prohibition of teasing, etc. in a zoo.]*

Second, do not feed the animals. Each animal needs a different type of food. The food given at the zoo is special and similar to what the animals feed in the wild. If they are fed with biscuits, wafers, etc. by the visitors, animals lose their appetite for the type of food they are meant to eat. Animals may also get infected with human diseases when visitors give them food. This can make animals sick and even may lead to deaths.

Many people think that they are helping the animals by feeding them. This is where education to visitors in zoos becomes very essential. Instead of feeding animals, it would be a good idea to wait until their keepers feed them and have fun watching.

Other behaviours of visitors like spitting and smoking can prove dangerous to animals. Bringing pets to zoos is also not allowed—the fear is that the zoo animal might catch some infection. All these acts can adversely affect the health of the zoo animals.

It is to mention that since the inception of Central Zoo Authority, tremendous changes had happened in the functioning of zoos in India. The sub-standard zoos have been closed. The housing of animals in potential zoos has been upgraded tremendously. Today the zoos are more competent to carry out the conservation, education, research and conservation breeding programme (wherever required and assigned). Major Indian zoos are contributing towards *ex-situ* conservation of many of the endangered species.

INCIDENCE OF SARCOCYSTOSIS IN A BLACKBUCK (*Antilope cervicapra*) IN CAPTIVITY – A CASE STUDY

Power K. V., Tripathy S. A., Chaudhary P. R. and Anjankar A. M.

Introduction

Sarcocystis species of protozoa infect reptiles, birds and mammals. The name *Sarcocystis* is derived from Greek words viz., "sarx" means flesh and "kystis" means bladder. The protozoa *Sarcocystis* species has an obligatory two-hosts life cycle with the herbivores or omnivores usually acting as intermediate hosts and the carnivores as definitive host. The infection occurs usually through ingestion of feed contaminated with faeces of carnivores. Sarcocystic infection has been reported among captive antelopes in the United States of America, Africa and India. The present study deals with the sarcocystic infection in a captive blackbuck (*Antilope cervicapra*).

Case history

Veermata Jijabai Bhosale Udyan Zoo, Byculla, Mumbai has hoofed animals such as spotted deer, barking deer, four-horned antelope, blackbuck, nilgai and sambar deer. Out of these, there are 54 blackbucks (10 males and 44 females) in captivity. A 14-year-old blackbuck female with no previous history of illness was found dead in the enclosure. A routine postmortem examination was carried out and samples of liver, lungs, heart, kidney and spleen were sent to Haffkine Institute, Mumbai for histopathological examination.

Results and discussion

The examination reports revealed mutifocal glomerular atrophy and swelling of tubular epithelium in kidney along with the presence of diffused moderate degree of sarcocysts embedded in myocardium. Sarcocyst containing bradyzoites and merozoites were found in the heart muscle on histopathological examination (Fig.1, 2 & 3). The zoo receives water supply from the Municipal Corporation and the grass was received from Nashik. The ingestion of contaminated grass and water with faeces of carnivores containing oocysts of *Sarcocystis* species might have been responsible for this infection in the blackbuck.

The life cycle of *Sarcocystis* species is indirect. The sexual cycle begins when adult male and female parasites reproduce in the intestinal epithelial cells of the carnivores who are the definitive hosts. The newly created oocysts are sporulated in the host and while

Veermata Jijabai Bhosale Udyan and Zoo, Byculla, Mumbai-400 027.

Fig 1. Bradyzoite (Banana shaped) in heart muscle of *Antilope cervicapra*

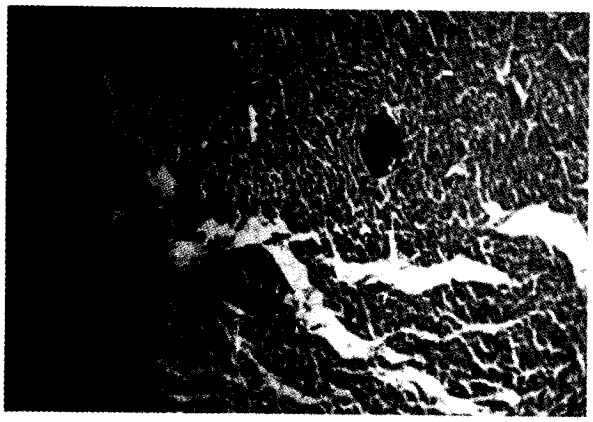


Fig. 2. Sarcocyst containing merozoites under 10x magnification in heart muscle of *Antilope cervicapra*

Fig. 3. Sarcocyst containing merozoites under 40x magnification in heart muscle of *Antilope cervicapra*

passing out of the body, the thin walled sporulated oocysts often rupture, releasing infective sporocysts. The host animal then sheds both sporocysts and sporulated oocysts in the faeces. The intermediate host ingests infective sporocysts through contaminated feed or water.

Sporozoites excyst from the sporocysts and invade the intestinal mucosa in the intermediate host i.e. a herbivore to reach endothelial cells. An asexual cycle begins, whereby initial reproduction forms schizonts. Merozoites present within the schizonts are released and eventually find their way to muscle tissue, where they form sarcocysts. The merozoites divide into pairs within the tissues of the cyst, forming metrocytes.

Metrocysts continue to undergo maturations, until finally forming mature, banana-shaped bradyzoites, which slowly divides, and infect the definitive hosts i.e. a carnivore. When the muscle tissue containing sarcocysts with infective bradyzoites is consumed by the definitive host, the bradyzoites penetrate the mucosa and transform into macrogametes and microgametocytes in the cells of the intestinal epithelium. The microgametocytes produce flagellated microgametes, which penetrate the macrogametes. The zygote lays down a resistant wall and sporulates endogenously. Diagnosis is possible by histopathological examination of infected muscle (Heart muscle, skeletal muscle and diaphragmatic tissue).

Infection is rarely symptomatic. This could be corroborated with the present study with the absence of any premonitory signs before death. Vaccine is not available for prophylaxis. Disinfecting the grass with Potassium paramagnet and/or shade drying is essential to destroy the oocysts. Provision of drinking water without being contaminated with the faecal sample of carnivores is another control measure.

Conclusion

Sarcocystic infection was recorded in a blackbuck in Veermata Jijabai Bhosale Udyan Zoo, Byculla, Mumbai through histopathological examination. Based on the prevailing management practices of the zoo, the grass was attributed to be the source of infection. Interdependence of various hosts in the life cycle, complexicity in the transmission and asymptomatic nature of the disease were taken into consideration while formulating control measures.

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HAEMOCYTOLOGICAL ANALYSIS OF TWO CARNIVORES OF NANDANKANAN ZOOLOGICAL PARK, ODISHA

G. N. Bhujabal[1], P. K. Mohanty[2] and S. Panda[3]

Abstract

The present study aims at haemocytological analysis of two species of captive carnivores namely tiger and hyena of Nandankanan Zoological Park, Bhubaneswar, Odisha (NKZP). Blood samples of tiger and hyena were collected, processed and analyzed for various blood parameters like haemoglobin concentration (Hb), packed cell volume (PCV), total erythrocyte count (TEC), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), total leucocyte count (TLC), differential leucocyte count (DLC) as per the standard protocol. The blood smears were also analyzed for morphological and morphometrical studies (cytomorphometry) of the various blood corpuscles. The detailed values of the above stated parameters are recorded and discussed.

Key words *: Tiger, hyena, haematology, carnivore, cytomorphometry.*

Introduction

The animals taken for this study are 5 Bengal tigers and 3 striped hyenas which belong to the Order- Carnivora, Class-Mammalia of Phylum-Chordata. Bengal tiger (*Panthera tigris tigris*) belongs to the Family- Felidae whereas striped hyena (*Hyaena hyaena*) belongs to the Faimly- Hyaenidae. Both the species of animals occupy the apex of a forest food chain. Tiger is the apex predator whereas hyena lives both as a predator as well as a scavenger. Both the animals are found in Indian forests in the wild as well as in captivity in various zoos of India including NKZP.

A few reports on haematological studies on wild carnivorous mammals are on record. Solfer and Bernstein (1974) reported haematological values of some zoo carnivores like tiger, lion, leopard, jaguar, cougar and cheetah. Hawkey (1975) gave an illustrative account on comparative haematology of striped, brown and spotted hyenas. Fowler (1986)

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published the references on basic haematological values of various groups of wild reptiles, birds and mammals. The normal haemtological values of 66 animals of 12 species of Family Felidae, Hyaenidae, Canidae and Ursidae were reported by Pospsil *et al.* (1987 a and b). Canine and feline reference values for various haematological parameters were given by Jacobs et al. (1995). Normal haematological values of cat were reported by Kenneth et al. (2000). Chandranaik et al. (2006) reviewed the haematological values of tigers of Bannerghata Biological Park, India. Sabapara et al. (2008) reported the haematological reference intervals for Indian leopards found under captive conditions in different zoos of Gujarat, India. Haematological and biochemical values of 12 Bengal tigers of central India were studied by Srivastav et al. (2012). Since references of haematological parameters of wild carnivores are inadequate and almost very little work has been done on the cytomorphometry of blood cells of wild animals, the present study is aimed at the cytomorphometrical analysis of the blood cells of tiger and striped hyena along with the haematological values. A comparative analysis of various blood parameters is also attempted between the two species.

Materials and Methods

Blood samples of five tigers, and three hyenas of NKZP were collected in EDTA vacuitainers by physical restraint of the animals during their routine health check up and other related routine programme. Blood samples were mostly collected during 0900 to 1000 hours in the morning from the coccygeal vein with the help of the zoo veterinarians while the animals were in squeeze cages. The collected blood samples were processed and analyzed for the following few haematological parameters.

Haemoglobin concentration (Hb) of the animals was measured by Sahli's haemoglobinometer by the acid haematin method. Total erythrocyte count and total leucocyte count were counted manually by the haemocytometric method using the Neubauer's chamber and the appropriate diluting fluid. Anticoagulated blood filled with Wintrobe's tube was centrifuged at 3500 rpm for 30 minutes for the analysis of Haematocrit or packed cell volume (PCV). Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpusclar haemoglobin concentration (MCHC) were calculated by the following formulae.

MCV = (PCV % ÷ TEC in million) x 10 fl[4]

MCH =(Haemoglobin in gm % ÷ TEC in million) x 10 pg[5]

MCHC = (Haemoglobin in gm % ÷ PCV) x 100 %.

[4] fl- Femtolitre

[5] pg- Picogram

The population of differential leucocytes in percentage was counted from Giemsa stained thin blood smears. The same smear was also used for the morphological and morphometrical study of the various blood cells. The morphological studies include shape and staining properties of various blood cells whereas the diameters of blood cells were measured by using the micrometer in morphometrical studies.

Results and Discussion

The normal shape and size of erythrocytes, leucocytes and blood platelets were observed along with the staining properties of their cytoplasm and nucleus.

The erythrocytes of tigers are circular and biconcave with inconspicuous pallor rings at the centre. A moderate degree of poikilocytosis (variation in shape) is also observed. Along with the normocytes, the other abnormal cells like tear drop cells, elliptocytes and echinocytes were commonly observed (Fig.1). Negligible numbers of erythrocytes are found with Howel Jolly bodies. The erythrocytes of hyena are slightly larger than that of tiger and typical mammalian type. The pallor rings are prominent and large. In some erythrocytes, the pallor rings are modified into a mouth like structure. Such cells are called stomocytes (Figs. 2 and 3). Nucleocytes, the immature nucleated erythrocytes, are also found in 0.1% of total population of cells (Fig. 3).

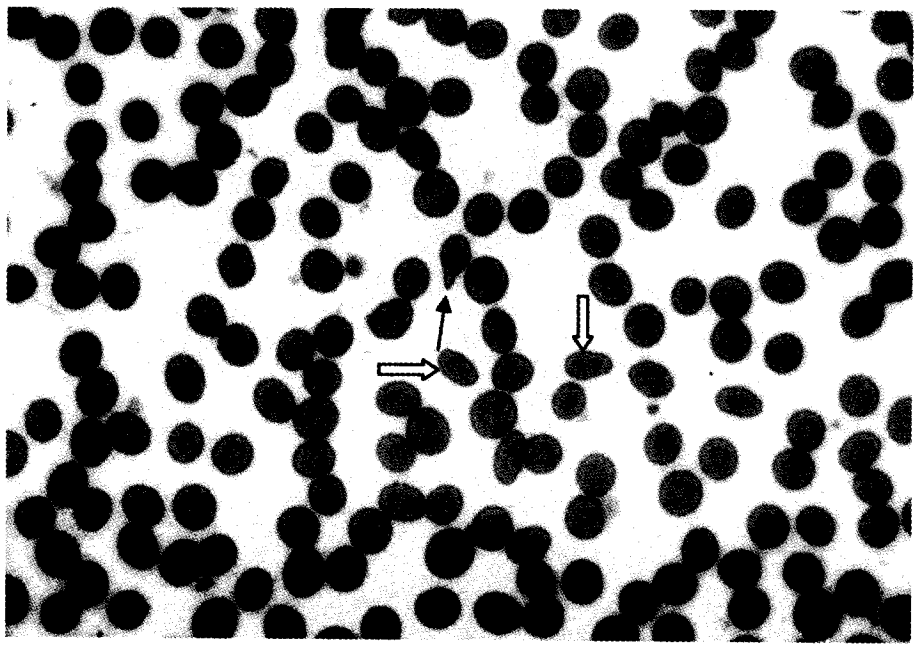

Fig.1 Poikilocytosis of erythrocytes showing normocytes, eliptocytes (thick arrow) and tear drop (thin arrow) cell of tiger

The neutrophils are typically spherical but found amoeboid in some cases in tigers. The cytoplasmic granules are very fine and stain colourless to slightly pink. Neutrophils are larger in hyena and the cytoplasm looks clear with a well defined plama membrane. Both banded and lobed forms are found in both the animals. Eosinophils are of typical feline type in tiger which bear numerous coarse granules, comparatively smaller than that of other non-felid animals with an orangey stain which is a taxonomical characteristic of family Felidae (Fig.4).

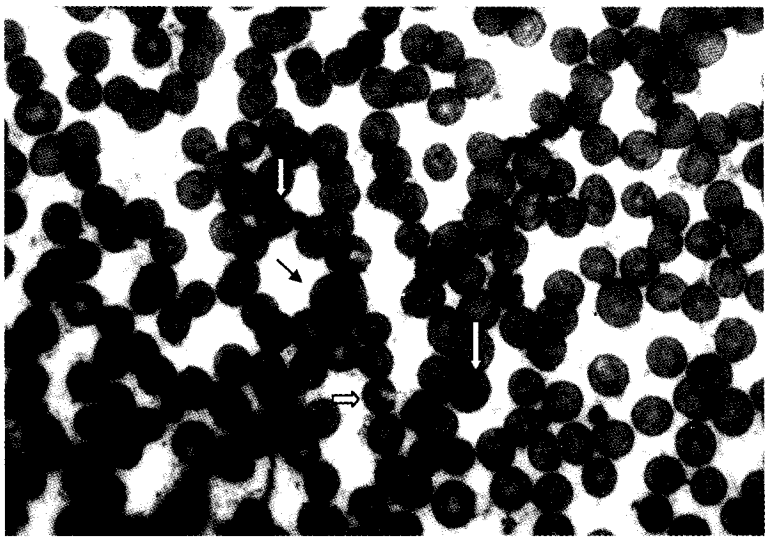

Fig. 2. Nucleocytic erythrocyte (thin arrow) and stomocytes (thick arrows) of striped hyena

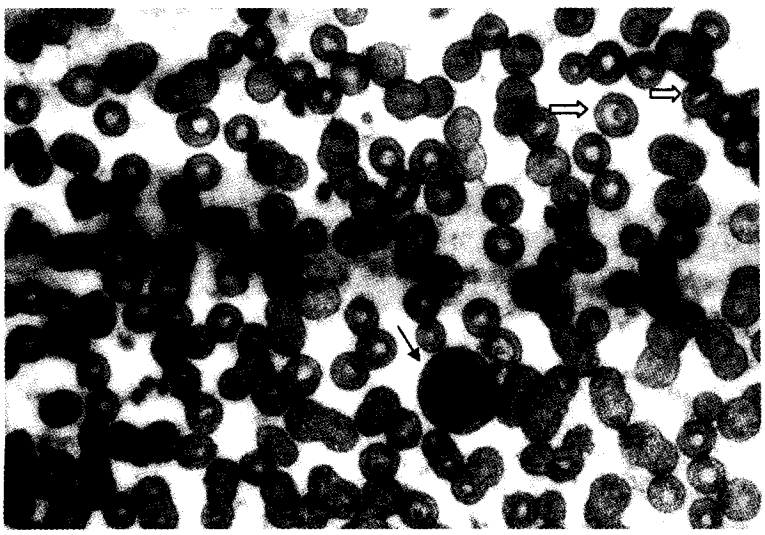

Fig. 3. Eosinophil (thin arrow) and stomocytes (thick arrows) of striped hyena

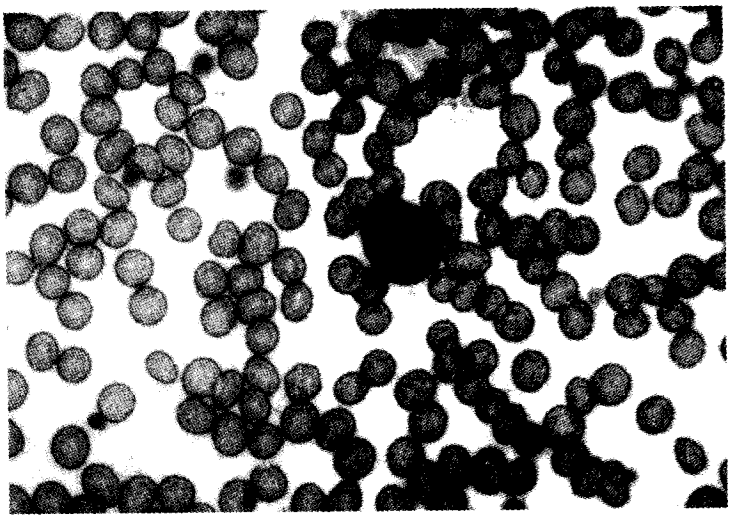

Fig. 4 Eosinophil of tiger

The most peculiar blood cell of hyena is the eosinophil (Fig.3) which is characterized by pinkish gray cytoplasm. The granules are inconspicuous and the cytoplasm contains vacuoles. Small lymphocytes, large lymphocytes and monocytes are of typical mammalian type. The platelets are small and circular or irregular, found scattered in the blood smears in both the species. Platelets in hyena are smaller and more numerous than tiger.

Morphometry and haematological analysis of blood

The details of the morphometrical and haematological values of the blood cells of tiger and hyena are given (Tables 1 and 2).

Table-1: Comparative morphometrical analysis of blood cells of tiger and hyena

Sl No	Types of cell	Diameter (µm)	
		Tiger	Hyena
1	Erythrocyte	6.41 ± 0.87	6.56± 1.62
2	Neutrophil	10.74 ± 1.23	10.63 ± 1.43
3	Eosinophil	12.00 ± 1.41	12.8 ± 1.75
4	Basophil		
5	Small lymphocyte	7.53 ± 1.25	8.60 ± 1.58
6	Large lymphocyte	10.00 ± 0.66	11.83 ± 1.43
7	Monocyte	13.70 ± 1.90	13.61 ± 1.30
8	Platelet	3.66 ± 1.05	2.64 ± 0.35

Table-2: Comparative haematological analysis of tiger and hyena

Sl No	Parameters	Units	Tiger	Hyena
1	Haemoglobin	gm/dl	12.33 ± 1.43	12.60 ± 0.71
2	PCV	%	38.50 ± 2.88	49.75 ± 1.50
3	TEC	$10^6/mm^3$	5.96 ± 0.67	6.47 ± 0.53
4	MCV	Fl	64.28 ± 3.76	77.09 ± 4.27
5	MCH	Pg	20.57 ± 3.08	22.88 ± 4.03
6	MCHC	gm/dl	31.96 ± 1.71	27.41 ± 1.52
7	TLC	$10^3/mm^3$	12.66 ± 2.47	12.97 ± 3.12
8	Neutrophils	%	66.66 ± 4.45	71.25 ± 6.94
9	Eosinophils	%	7.66 ± 4.27	10.75 ± 4.30
10	Basophils	%	0	0
11	Lymphocytes	%	22.66 ± 7.71	13.75 ± 5.73
12	Monocytes	%	3 ± 1.41	4.25 ± 1.5

No significant difference is found in haemoglobin content of both the species. The haematocrit value is higher in hyena than in tiger. The total number of erythrocytes per cubic millimeter of blood is slightly higher in hyena than tiger. Mean corpuscular haemoglobin is more in hyena than tiger but the percentage of saturation of erythrocyte by haemoglobin is higher in tiger than hyena. Neutrophils are the dominant cells among the leucocytes followed by lymphocytes, eosinophils and monocytes in decreasing order in both the species. Basophils could not be observed in both the species (Table 2).

Conclusion

Haematology is one of the major branches of veterinary science that helps in maintaining health status of the wild animals both in wild and captivity. A good baseline of haematological value depends upon a good number of specimens, but it is difficult to collect blood samples from wild animals. Therefore, very little work could be done yet in this field. Almost no work has been done on the cytomorphometry of various leucocytes of wild animals. The present study reveals the haemocytological analysis of tigers and hyenas of NKZP which may provide a baseline value for the haematological studies in these two species for their better health maintenance.

Acknowledgements

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BREEDING EXPERIENCE OF AFRICAN HUNTING CHEETAH (*Acinonyx jubatus*) IN CAPTIVITY AND LESSONS LEARNT FOR IMPORT OF EXOTICS

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Abstract

Zoo management all over the country has a desire to acquire exotic species and exhibit them in zoos. Sometimes acquiring animals of unknown pedigree of the species that have limited genetic variation and their breeding in zoos have resulted in undesired consequences. The details of how a breeding of African hunting cheetah (*Acinonyx jubatus*) in Mysore Zoo had resulted in death of all five cubs due to genetic disorder and unexpected consequences on captive management has been discussed.

Key Words: *Exotic, cheetah, breeding, pancreatic carcinoma, myelopathy, genetic disorder, captive management.*

Introduction

Sri Chamarajendra Zoological Gardens, popularly known as 'Mysore zoo', is one of the oldest zoos of the country established in 1892. Mysore zoo has a tradition of exhibiting and breeding exotics for a very long time. In 1977 a pair of gorillas, a pair of orangutans and some chimpanzees were acquired and for the first time in Indian zoo history, all these three species of large apes were housed together. Mysore zoo has the record of exhibiting a white elephant considered sacred by many as well as penguins during 1980s. A pair of red kangaroos was received from National Zoological Park, Washington DC and two lemurs have been received from Duke University and one pair of giraffes was received from Germany during 1986. This zoo currently displays more than1400 individuals belonging to 168 different species, out of which 74 species are exotics. Some important exotics like gorilla, chimpanzee, zebra, hippopotamus, giraffe, African white rhino, African elephant, ring-tailed lemur, hamadryas baboon, capuchin monkey, ostrich, macaws etc. are star attractions for the visitors.

Mysore zoo had succeeded in breeding of several exotic species such as chimpanzee, hippo, giraffe, African black rhino, marmoset, capuchin and many bird species. Two pairs

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of African hunting cheetah were acquired during 2011 as part of the exchange deal and taken up for breeding purpose.

History of cheetahs in Mysore Zoo

Four (2:2) adult cheetahs were received from Rhino Lion Nature Reserves, Muldersdrift, Brodedtrstroom, South Africa on behalf of Leipzig zoo, Germany by animal exchange programme in the month of March, 2011.

Preparation for quarantine and temporary housing facility was made in leopard and jaguar enclosures having holding room and out-door enclosure. Existing leopards and jaguars were shifted to holding room facility at zoo hospital and Bannerghatta Biological Park, Bangalore. Complete renovation was done for individual housing of all four cheetahs and thorough disinfection was done by top soil removal, gas flame burning, disinfectant spray and lime wash. Foot dips with disinfectant were provided at the entrance to all enclosures.

Animals arrived by flight from Johannesburg at Chennai air port on 25th March 2011 at 10.30pm and then reached Mysore zoo by road on 26th March 2011 at 3:30pm. Animals were unloaded and slowly released to the holding rooms. Large numbers of dead ticks were found on the floor of the transportation cage, indicating use of ecto-parasiticide just before the shipment. One of the females was debilitated with poor skin condition and lameness of right forelimb requiring special care. Transponder identification was not matching with the information given earlier and efforts to get animal history records and parentage details did not yield any results.

Care and management was initiated based on observations of management practices of Junagadh zoo, Gujarat and their valuable suggestions on keeping of this species and also by referring Cheetah Husbandry Manual.

Holding rooms and enclosures were always kept clean, disinfected and kept dry by gas flame burning to prevent dampness and contamination. Potable clean water was always made available both in indoor and outdoor in stainless steel bowls. Adult cheetahs drink about 1.5 to 2 litres of water per day. Cheetahs prefer easily digestible lean tender meat to fatty meat; hence, they were given 1.5kg of fresh dressed chicken twice daily, 0.5 kg in the morning and 1kg in the evening. Large pieces of meat with bone was given to have some exercise and to avoid choke as cheetahs readily swallow small and medium size pieces and also eat very fast, within 8-10 minutes and do not like to eat the left over. It was noticed that they always eat in the feeding bowl without spilling or taking the meat outside the bowl. Routine oral nutritional supplements of vitamins and minerals like calcium,

On 29th March 2012, Cheetah Maya delivered five healthy cubs. It took 12hours to deliver all five cubs. Nutritional supplementation with twice a day feeding is given to the dam for better milk production to take care of 5cubs. Maternal care and neonatal behaviour was being monitored through CCTV and only one animal keeper was entrusted to enter the adjacent room for providing food and water to dam. All cubs were nursed very well and were growing healthy till the age of two months. However, pancreatic carcinoma, a fatal disease condition was responsible for the death of dam. Subsequently all cubs (5:0) developed progressive demyelinating disease and died one after the other from the age of three months to five and a half months.

Death of cheetahs

The details of sequential death of seven out of 12 cheetahs over a period of four months due to fatal disease conditions are discussed hereunder.

I. Pancreatic carcinoma in adult breeding female "Maya"

Female cheetah "Maya" has successfully bred at Mysore zoo. It gave birth to five male cubs and was nursing very well. After 70 days of giving birth, on 9th June 2012 it developed acute symptoms of anorexia, weakness, dehydration, polydipsia, abdominal distension and laterally recumbent. Water intake increased to eight litres per day from an average of 1.5 litres per day. Cubs were separated from the dam to avoid spread of infection if any and to reduce the stress on the dam. Blood examination revealed increased white blood cells, creatinine, blood urea nitrogen and other biological parameters (Table-1), indicative of severe infection and toxemia. Initially, it was suspected for pyometra and treatment initiated accordingly.

By 10th June 2012, the cheetah was very week and was unable to get up. Problem was discussed with the Professors of Veterinary College and Director of Institute of Animal Health. Experts were invited for examination and diagnosis of the acute condition.

On 11th June 2012, ultrasonography examination ruled out the pyometra and revealed fluid in the abdomen indicative of peritonitis. Based on clinical findings it was concluded that cheetah "Maya" may be suffering from "Feline infectious peritonitis", a fatal viral disease. However, confirmation of disease was difficult due to lack of availability of diagnostic kits and there was no specific treatment protocol. There was no response to any treatment and regular blood sample analysis revealed failure of vital organs.

Condition deteriorated drastically. Severe blood vomiting noticed on 11th June 2012 and animal become severely anaemic. The cheetah succumbed to death on 12th June 2012. *Gross examination* at postmortem revealed severe enlargement and necrosis of pancreas,

Table-1. Haemato-biochemical analysis report of female cheetah "Maya"

Sl. No.	Parameters	Results 9/6/12	Results 10/6/12	Results 11/6/12	Results 12/6/12
Haematology					
1	White blood cell count (10^9/L)	58.5	53.2	77.5	117.7
2	Lymphocytes (10^9/L)	17.0	30.8	27.6	76.3
3	Mid cells (10^9/L)	4.5	6.0	6.7	11.9
4	Granulocytes (10^9/L)	37.0	16.4	43.2	29.5
5	Red blood cell count (10^{12}/L)	8.23	7.76	7.0	4.61
6	Haemoglobin (g/dL)	17.7	16.3	14.7	10.1
7	Haematocrit (%)	66.9	60.7	56.0	30.5
8	Platelet count (10^9/L)	95	78	38	52
Biochemical					
1	Blood urea nitrogen	70.2	-	160.8	250.8
2	Serum Creatinine	6.5		8.0	10.0
3	Blood Glucose	-	-	542.9	>600
4	Serum glutamic oxaloacetic transaminase	62.8		61.6	70.1
5	Serum glutamic pyruvic transaminase	71.0		97.7	94.6

accumulation of peritoneal fluid and peritonitis, large gastric ulcer invading into a gastro-epiploic artery with severe internal bleeding into the stomach and also severe inflammation in all vital organs was evident. Report of histopathological examination of autopsy samples was suggestive of adenocarcinoma of pancreas (cancer of pancreas or pancreatic carcinoma).

II. Progressive neuro-muscular weakness, myelopathy, causing death in five male cheetah cubs of same litter

Five male cheetah cubs were born to cheetah "Maya" on 29th March 2012. All cubs were healthy under good maternal care. In second week, all cubs developed mild herpes like infection affecting eye and upper respiratory tract. Immediate treatment resolved the problem. They were left to open enclosure on 24th June 2012. Growth of all five cubs was good till the end of second month. Cubs were able to feed on dressed raw chicken meat

with bone given twice a day by the age of six weeks and no special diet modification was done for cubs. Routine deworming based on parasitic load and vaccination against feline rhinotracheitis virus, panleucopaenia virus and feline calici virus infections as per schedule at 8 weeks and 10 weeks were done and oral nutritional supplementation to the cubs were provided.

After two months of age, one of the cub sustained simple fracture of right tibia on 3rd June 2012. Except occasional lameness it was normal in all other activity and hence, veterinary intervention was not felt necessary. After a couple of days, another cub developed weakness of hindlimb and ataxia on excitement. Vitamine E and selenium supplementation was initiated to all the cubs.

Unfortunately the dam developed acute problem on 9th June 2012 requiring separation of cubs at the age of seventy days. Subsequent death of the mother, weaning stress, change of diet and human interference caused severe stress on the cubs. The cubs developed digestive problems resulting in loose motion, dehydration and discomfort. Two of the cubs having existing musculoskeletal problem suffered more severely than the other three cubs. All cubs shifted to zoo hospital for treatment and care.

Fluid therapy and broad spectrum antibiotics were initiated. The cubs were housed in warm and soft bedding. Feeding schedule changed to three times feeding, 4am, 10am and 6pm. Small quantity of minced raw and boiled chicken meat with bone and chicken bone soup was given for easy digestion. Rabbit meat was introduced along with chicken meat and found acceptable. Nutritional supplements of micro minerals and vitamins A, D3, E and B-complex were given along with meat. Injection of vitamin E and selenium was initiated to cubs having neuro-muscular weakness.

i. **First cub died at the age of 89 days**: The cub that had fracture of tibia was severely affected and developed acute signs of anaemia and died on 26th June 2012. Postmortem examination revealed multiple punctured ulcers of duodenum just adjacent to pyloric spincture with severe internal hemorrhage causing blood loss anaemia and hypovolumia leading to shock and death. Severe intestinal contraction had caused intussusception of colon into the rectum leading to hemorrhage and necrosis of rectal mucosa. Severe enlargement of both kidneys was also evident.

ii. **Death of second cub at the age of 110days**: The cub that had developed muscular weakness was severely affected with gastro-intestinal problem. By the time it recovered from the gastro-intestinal problem, neuromuscular weakness and ataxia was progressed

markedly. The cub was in lateral recumbent and appetite was normal. All blood parameters were normal. Muscular atrophy and stiffening of extremities progressed. Head tremors and convulsion were seen during excitement or handling for treatment. The cub died on 18th July 2012. Postmortem examination did not reveal significant changes, except pressure sores and muscular atrophy. Laboratory report of autopsy sample revealed *E. coli* infection.

By the age of three months, rest three cubs had developed progressive neuromuscular weakness of different degrees of incoordinated movement, wobbling gait of hind limbs, lethargic, occasional ataxia, stiffening of extremities, hyper-excitation and tremors of head on handling, decreased activity, pressure sores and abrasive wounds. All haemato-biochemical parameters were normal. Appetite and digestion were good. The cubs were growing well and aggressive to handle for examination and treatment.

Experts were invited for examination and cheetah specialists of National Zoological Park, Smithsonia, Washington, USA were contacted to diagnose the problem and it was opinioned that the condition is myelopathy which is unfortunately progressive and fatal. Confirmation can only be made at necropsy. Treatment continued with nutritional supplementation and corticosteroids. Nutritional supplements of micro minerals and vitamins were given with food. Corticosteroids along with antibiotics and probiotics were given orally to avoid repeated handling. Infrared light therapy was given twice daily and animals were given access to move in day-kraal having thick sand covering. Warm condition with soft bedding and wooden boxes were provided. CCTV cameras were placed for continuous undisturbed monitoring. The haemoto-biochemical reports of the rest three cheetah cubs are given (Table-2).

Table-2. Haemato-biochemical report of last three cubs

Sl.No.	Parameters	Cheetah cub 1	Cheetah cub 2	Cheetah cub 3
Haematology				
1	White blood cell count (10^9/L)	8.200	5.600	5.700
2	Red blood cell count (10^{12}/L)	10	9.62	7.80
3	Haemoglobin (g/dL)	16.0	16.2	12.8
Biochemical				
1	Blood urea nitrogen	*30.5*	*40.6*	*45.7*
2	Serum Creatinine	*1.3*	*1.1*	*1.0s*
3	Blood Glucose	*147.0*	*121.0*	*112*

4	Serum glutamic oxaloacetic transaminase	*15.4*	*17.7*	*30.1*
5	Serum glutamic pyruvic transaminase	*75.5*	*69.1*	*90.5*
6	Serum total protein	7.9	7.8	7.6
7	Serum Creatine phosphokinase	*437.4*	*244.6*	*276.9*
8	Serum calcium	10.4	10.1	10.2

iii. Death of third cub at the age of 121 days: The cub remained in lateral recumbent position for long time and able to lift the head for feeding. The cub died on 29th July 2012. Necropsy samples of brain and spinal cord were sent to laboratory for examination of Infectious feline panleukopenia if any and the results were negative.

iv. Death of fourth cub at the age of 129days: After the onset of symptoms, condition progressed drastically. Most of the time cub was drowsy and imbalance of neck was seen along with other symptoms. The cub died on 6th August 2012.

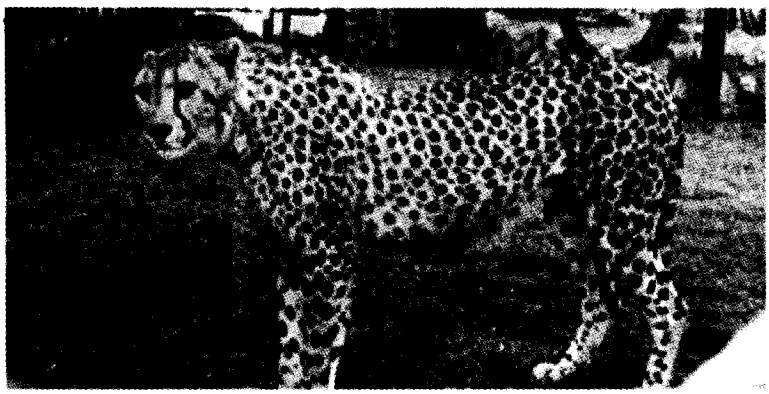
v. Death of fifth cub at the age of 166days: This cub was strongest of all with good growth. Symptoms started with wobbling and occasional incoordination of hind limbs. Trials were made to mix with year old cubs to provide amicable environment away from human interference. However, it sustained compound fracture of right calcaneal bone and condition started progressing fast. It died on 13th September 2012.

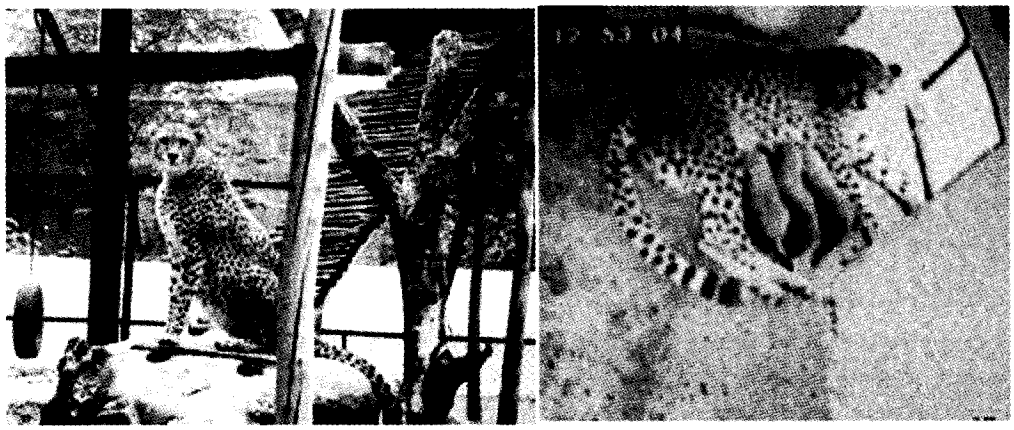
III. Death of 14 months old female cheetah cub

A healthy female cheetah cub was found dead on 10th July 2012. This cheetah cub was born to cheetah "Brunda" on 27th April 2011 and it was in healthy condition except a mild lameness two days before the death.

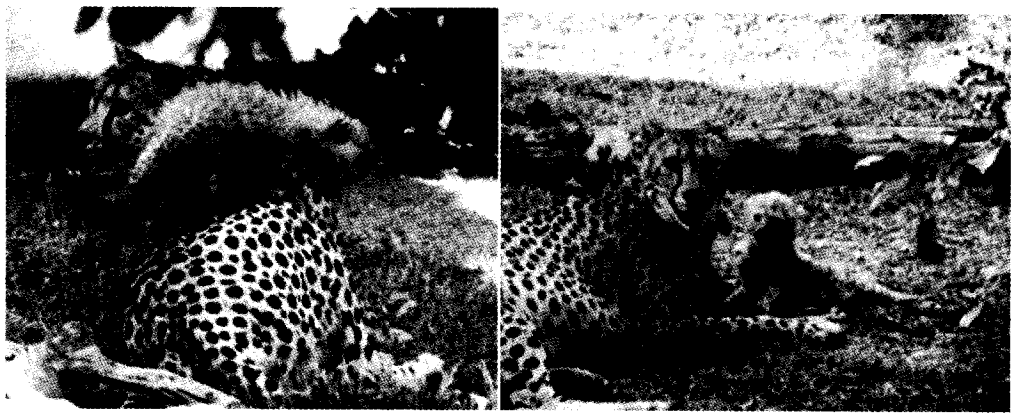
Postmortem examination revealed severe strain in right thigh muscles causing muscular damage and intramuscular haemorrhage. The inflammatory changes were seen extending from right chest region to base of the tail to right hock joint. Severe damage was seen in the inner aspect of right thigh region with severe inflammatory swelling. Laboratory examination for bacterial culture from affected muscles did not reveal any infection.

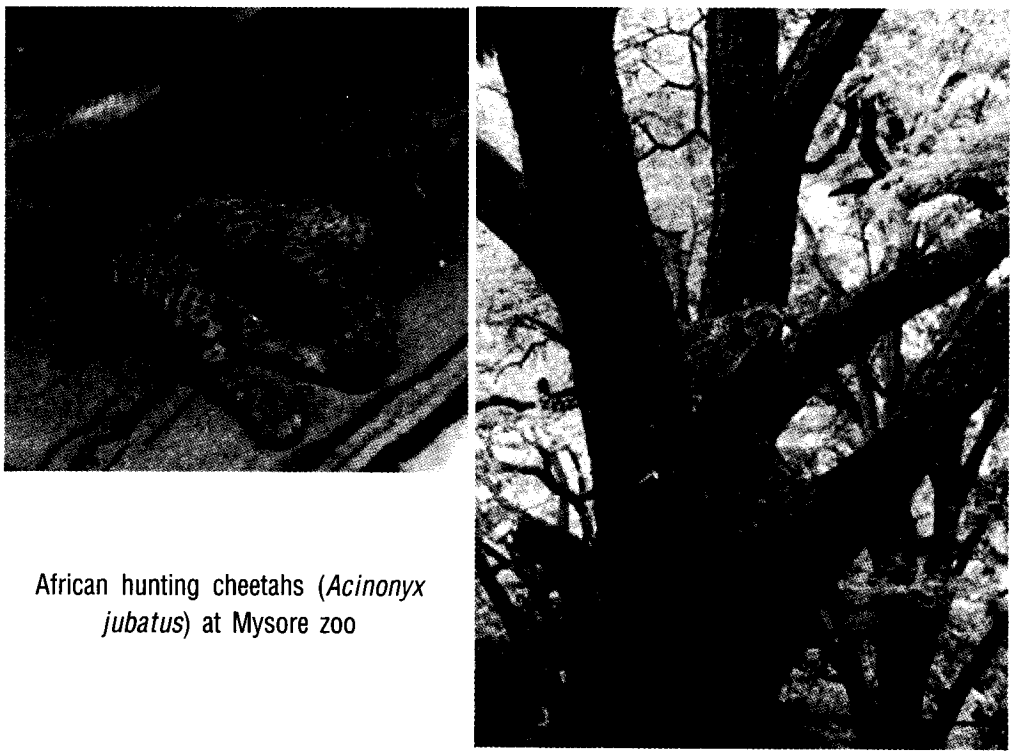
Deceased cheetah cub was very healthy and playful with litter mates and use to climb on trees. So, it was opinioned that the cub might have sustained severe muscular strain while climbing up or jumping down from tree. Muscular strain or damage happens when muscle contracts very strongly during fast stride or in response to strong painful stimuli.





African hunting cheetahs (*Acinonyx jubatus*) at Mysore zoo





African hunting cheetahs (*Acinonyx jubatus*) at Mysore zoo

Sudden death in muscular strain is unusual. However, severe pain and fear may cause shock and death in sensitive animals.

At present two males ("Arjun" and "Tejas") one female ("Brunda") received originally along with two cubs of "Brunda" are housed in four spacious enclosures built for cheetah.

Discussion

In captivity, breeding of cheetah is very difficult. Only 20%of captive females breed and neo-natal mortality is very high in both captive and wild conditions (Marker-Kraus 1997). The cheetah is polyoestrus and ovulation is almost always induced by mating or hormone administration (Brown *et al.* 1996). Care of pregnant female is very essential; hence, it is mandatory not to transport the pregnant female. Due to lack of animal history, the advanced stage of pregnancy of the female cheetah "Brunda" could not be ascertained. Sire could not be determined for future breeding of either cheetah "Brunda" or its cubs. In Mysore zoo, both females received from South Africa were bred successfully and both showed good maternal care. But, lack of animal history and pedigree chart may lead to indiscriminate breeding.

Progressive diseases seen in cubs started from the age of two months and death was seen within 4-6weeks after the onset of symptoms. Since, all cubs were males and shown similar progressive disorder and symptoms, it could be possibly due to sex linked genetic inheritance from mother. Exon deletion or mutation on 'X' linked gene as it was reported in human beings could be one of the reasons, as there is very limited genetic variability particularly in captive bred cheetahs. There are many conditions which can cause neurological signs in young kittens. Feline Distemper (panleukopenia) infection in utero, hypoglycemia, hypocalcemia, demyelination syndrome (congenital), aberrant migration of parasitic larvae in the central nervous system, toxoplasmosis (rare), rabies, genetic, nutritional-metabolic, toxic, and physical causes have been considered for progressive idiopathic myelopathy syndrome in cheetah cubs (Walzer and Kubber Heiss,1995; Walzer *et al.* 2003a&b). Studies shows that amino acid exchanges in the mitochondrial genome MTND5 gene were not associated with the occurrence of neurodegenerative disease in captive cheetah (Burger *et al.* 2004). However, previous history of earlier litter if any, from the same parentage or population would have helped in avoiding the breeding of such animals.

Conclusion

General public and media have always been watching any addition of exotic species with great interest. Acquiring African hunting cheetah and displaying it has aroused a lot of curiosity among the visitors, animal lovers and in media as Indian cheetah had already

become extinct. The story has been followed with great interest especially after the first litter of "Brunda" and subsequent release of her cubs into the enclosure, followed by birth of five cubs to "Maya", the interest and value of the success story of first birth and first breeding in any Indian zoo has brought loads of accolades to Mysore zoo. However, with subsequent death of cheetah infants along with their mother had brought intensive media scrutiny. The issue was discussed both in print and electronic media. It was a very difficult time for zoo management to clarify the incident to the general public and about all the possible steps taken to overcome the problem. All sorts of stories were doing the round and some vested interests gone to the extent of questioning the very necessity of captive management without understanding the complicated health issues involved. In the hindsight, it can be said that while acquiring exotics proper verification of history of past health record and parentage must be obtained. Otherwise importing exotics in tune with the popular demand may lead to undesired consequences. Therefore, it is imperative on part of the zoo management to verify the phylogenetic history of the animals before import.

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FLIGHT RESTRAINT TECHNIQUES FOR CONTROL OF BIRDS - A REVIEW

L.N. Acharjyo

Introduction

One of the major features of any Indian zoo is the exhibition of a great variety of bird life both flightless (e.g., Ostrich, Emu, etc.) and flying birds and therefore a great variety of problems are likely to be faced for their management. There are 9672 species of birds in the world out of which 1228 species occur in India.

One of the basic principles involved in keeping wild birds in captivity is the adaptation of the birds' locomotion capacity to the type of confinement (enclosure) available for them in the zoos. The modern trend in most zoological parks is to present the large number of birds in captivity in out-door enclosures and paddocks invariably provided with ponds / water bodies under natural surroundings. This is practised for presenting a better display of birds. Birds when kept in out-door enclosure needs to be curtailed of their flying ability to prevent escape. Proper understanding of the different flight restraint techniques for birds control is essential to prevent the escape of birds out of their display areas and it also helps in better management of the birds in captivity. Flight of flying birds can be restrained and escape of birds in zoos can be prevented by partially curtailing their capacity of locomotion / flying ability.

While planning for flight restraint in birds the age, size, weight, style of flight, behaviour, defensive and offensive structures like claws, beaks, legs and wings, purpose of restraint and species susceptibility to the proposed flight restraint technique if any etc. have to be taken into consideration. Some of the common flight restraint techniques adopted in zoos are discussed briefly as follows:

Wing / Flight feathers clipping:

Temporary flight restraint may be accomplished by wing / flight feathers clipping. There are a group of long primary flight feathers on the underside of each wing starting from tip of the wing towards the body. On the top of the wing there are a set of smaller and overlapping secondary feathers above the primary flight feathers. The primary feathers are chiefly used for locomotion whereas the secondary feathers are used for lift. The first

M-71, Housing Board Colony, Baramunda, Bhubaneswar - 751 003

ten primary flight feathers and the secondary feathers may be trimmed / clipped close to the wing with scissors.

One must be careful not to cut the blood feathers (newly formed feathers still in their sheaths) and if cut will bleed profusely for long period. These feathers can be easily detected as they look pinkish in colour and visible blood vessels can be noticed. Each feather needs to be examined before clipping to avoid such occurrence. If a blood feather is cut accidentally, the same can be removed from the follicle as otherwise it will continue to bleed(Anon.,2001). After removing the cut blood feather, it is easy to check the bleeding by direct pressure with fingers / application of suitable medicines to stop bleeding.

This operation is carried out in one wing only and clipping of wing must be carried out periodically at least once a year. If a wing clipping is carried out in young birds, the practice should be done more frequently.

The clipping of wings has its own limitations as it needs periodic check up and involves the usual disturbances with risk of injury to the bird each time. Besides, some birds may be able to fly even much earlier without being noticed as the flight feathers grow very fast and the period of growth of flight feathers varies from species to species.

Radial Neurectomy

This surgical operation involves cutting and removal of a portion of the nerve - nervus radialis supplying to the wings. This operation carried out under local anaesthesia is intended to prevent the bird from fully spreading its wings and thus preventing the birds from flying away. Success achieved by radial neuroectomy was reported to be of slightest value because of failure of this method tried in various species of birds like pheasants, ducks, gulls etc. at Basle Zoological Garden (Hediger, 1964). This neuroectomy operation in no way reduced the powers of flight among the operated birds.

Brailing

The brail is a narrow band of flexible plastic of 2 cm x 37.8 cm (0.75" x 15") size and about 1 mm thick. It is predrilled with holes about 1 cm apart (Ellis and Dein,1996). The application of this technique requires a brail and a riveting device.

This technique is a temporary fixation of one of the wings of a bird in the fixed position by means of a strap (brail) used for temporarily restraining fledglings, adults and birds during shipping / transportation. It is thought to be of limited value as the brail is used only for short periods and if left in the same position for more than three weeks may prevent satisfactory growth and functioning of the wings. Therefore, brails when in use are regularly changed from one wing to the other usually at an interval of two weeks to prevent

stiffening of the immobilized wing. While fixing the brail care should be taken not to restrict the circulation or cause damage to the skin. Birds regain their full flying capability within 1-2 weeks after the removal of the brail.

Tenectomy

This surgical procedure involves the cutting and removal of a portion of the tendon that runs parallel with blood vessels along the ventral surface of the wing. This operation is not in vogue as there are disadvantages like occasional drooping of the wing and at times there is reunion of severed tendon.

Netted pens

In this technique nylon woven net having smaller mesh size of not more than 5 cm (2") are used to cover the chain-link pens. If larger mesh size nets are used, at times birds are snared and held suspended(Ellis and Dein, 1996). This type of flight restraint is useful for full winged captive birds meant for breeding. Full winged birds are supposed to be able for better balance during copulation. Many zoos are having such netted pens for some species of birds.

In addition to the flight restraint techniques such as wing / flight feathers clipping, radial neurectomy, brailing, tenectomy and netted pens discussed earlier, there is one more method of flight restraint technique for birds control practiced widely in zoos i.e., **pinioning** which is discussed briefly here as follows:

Pinioning

Pinioning has been described as amputation of one of the wings at the level of metacarpals as close as possible below the carpal joint which is left intact (Moore, 1937) whereas **exarticualtion** is the amputation at the level of carpal joint in one of the wings only (Berge and Westhues, 1966) for preventing the flight in birds. Pinioning is performed in one of the wings only to make it asymmetrical so that whenever the bird makes any attempt to fly, it cannot keep up in the air but topples down at once. When both the wings are pinioned, they are usually capable of certain amount of flight (Moore, 1937).This practice is generally restricted to large and medium sized birds such as cranes, storks, flamingoes, geese, ducks, gulls, pelicans etc. Smaller birds in cages and aviaries are usually left alone. Radical amputation of the wing can also make the bird flightless but this is not carried out because the birds in zoos are kept for propagation and display purposes and these purposes cannot be served by radical amputation, The pinioned wing cannot easily be spotted out until it is fully stretched out by the bird.

Surgical Technique : The site of operation may be at the level of the **metacarpals** just below the carpal joint or at the **carpal joint** for exarticulation. The bird to be operated should be secured well by the attendant and the desired site can be selected by spreading the wing and feeling the carpal joint, radius and ulna and the metacarpals (Acharjyo and Ojha, 1972). A strong ligature may be placed with a bandage cloth a little above the carpal joint to control haemorrhage. The feathers (both primary and secondary) have to be plucked out from either of the selected sites of operation, cleaned and painted with tincture of iodine / betadine lotion / suitable antiseptic as an aseptic measure.

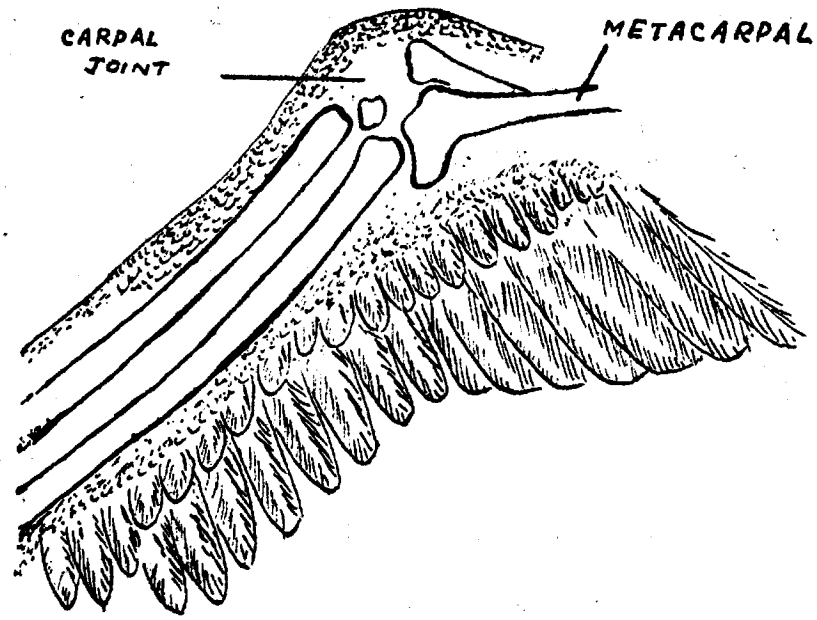
While pinioning at the level of metacarpals, the wing may be spread out on a clean wooden block. If required / desired a suitable local anaesthetic may be infiltrated into the wing around the site of operation. Then a bone chisel of appropriate size may be placed at right angle to the wing at the site of amputation and a hard blow with the help of a mallet may be given on the chisel. This completely severs the muscles and the skin along with the metacarpal bones. Bone pieces if any present may be removed and the wound may be sealed with a tincture benzoin pack and bandaged.

The pinioning operation can also be carried out as described by Amand (1986). "After the feathers are removed from the area and a tourniquet to control haemorrhage is applied, the skin is cleaned with alcohol or other suitable antiseptic. The skin approximately 1 inch distal to the proximal carpometacarpus is incised; the incision should encircle the wing and expose the underlying muscle and ligaments. These structures are incised and bluntly pushed proximal along with the skin to uncover the metacarpals. The third and fourth metacarpals are then cut with a bone cutter or chisel. Any bone chips are removed and the skin and muscle are pulled distal to provide a soft pad and covering for the remaining bone. A purse string or figure-of-eight suture is applied with chromic catgut to provide closure and haemostasis before removal of the tourniquet. A topical spray or powder antibiotic may be applied. If haemostatis is a problem, a pressure bandage may be applied for 24 to 36 hours".

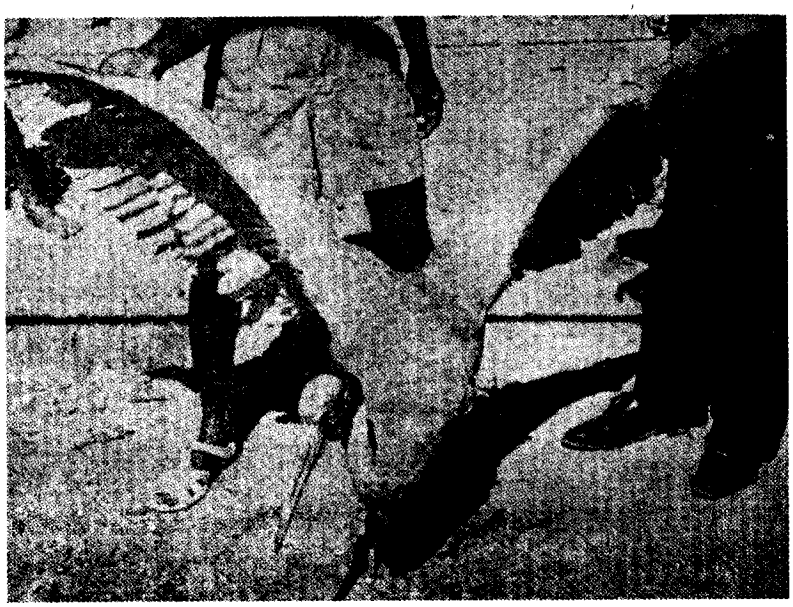
When pinioning is carried out at the level of carpal joint, a circular incision is made at the level of carpal joint after spreading the wing. The incision has to be extended to severe all the attachments so that the wing is completely disarticulated. Then the wound can be covered with tincture benjoin pack and bandaged (Acharjyo and Ojha, 1972). Alternatively the skin suture with chromic catgut may be given, a topical spray / antibiotic powder may be applied and bandaged.

Discussion

Pinioning both at the level of metacarpals and carpal joint was successfully carried



Site of pinioning through the metacarpals



Left wing pinioned at the carpal joint in a Sarus Crane

out on a number of species of captive wild birds such as Sarus Crane, Lilford Crane, Demoiselle Crane, Adjutant Stork, Whitenecked Stork, Blacknecked Stork, White Stork, Black Stork, Painted Stork, Rosy Pelican, Grey Heron, White Ibis, Greylag Goose, Barheaded Goose and a variety of wild ducks at Nandankanan zoo(Acharjyo and Ojha ,1972). In most cases no post operative complications like severe pain, depression or loss of appetite could be recorded. The birds moved about freely soon after the operation and accepted the feed when offered. Only the Rosy pelican remained off-feed for two consecutive days. Ligature was removed a day after the operation and the bandage was removed on the 7th or 8th day leaving the benzoin seal intact until complete healing was obtained. Some birds operated at the carpal joint reinjured the wound with mild disturbance and so rebandaging was necessary (Acharjyo and Ojha,1972). No anaesthesia or post-operative application of antibiotics was necessary. Hediger (1964) also did not observe any failure in a large number of operations performed at metacarpals in various birds.

Startup (1967) reported that local anaesthesia such as procaine may be infiltered around the carpometacarpal joint or general anaesthesia like halothane may be given for pinioning older birds and no anaesthesis was required for 4 to 10 days old chicks. Hediger (1964) observed that no anaesthesia was necessary for pinioning through the metacarpals as the pain felt of the operation is apparently negligible.

Lorenz (1940) observed a peculiar behaviour in a grey goose consequent to pinioning-severe pain, depression, complete loss of appetite and no breeding activity. On the contrary, Hediger (1964) reported pinioned grey geese bred repeatedly. According to Amand (1986) pinioning should not be done before or during breeding season. Startup (1967) reported that shock and haemorrhage are the two risks involved in pinioning but shock is most likely to develop in wild birds e.g., cranes.

Acharjyo and Ojha (1972) noted that fish eating birds like storks, herons and peilicans regurgitated out the fishes when they were subjected to pinioning soon after feeding but no such behaviour was seen when done before feeding.

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CAPTURE OF CAPTIVE SPOTTED DEER OR CHITAL (*Axis axis*) FOR TRANSPORTATION USING XYLAZINE AND KETAMINE

Mohan Lal Smith

Introduction

The spotted deer or chital (*Axis axis*) is one of the most common deer exhibited in almost all zoological/deer parks of India. There was a proposal to exchange captive animals between Nagaland Zoological Park, Rangapahar, Dimapur (NZP) and Assam State Zoo, Guwahati (ASZ) during the year 2011. Under this programme ASZ was to supply 18 zoo born captive spotted deer to NZP.

It was decided to tranquilize these animals and put them in suitable transportation wooden cages designed by Central Zoo Authority (CZA) for sending to NZP. This zoo in the past had the experience of chemical immobilization of three nilgais by using Katamine-Xylazine mixture and its reversal with yohimbine hydrochloride for transferring from one enclosure to another enclosure located about 200m away within the zoo (Sharma et al. 1997). This communication is intended to place on record briefly about the tranquilization of 18 zoo born captive spotted deer of ASZ using Katamine-Xylazine mixture and their transportation to NZP.

Planning for tranquilization and transportation

1. Fixing dates to send the animals in two separate days.
2. Taking animals to comparatively small enclosure where darting will be possible within a distance of 15-20 ft. (4.5-6.0m) by using Pneumatic Syringe Projector and selection of animals shall be done accordingly.
3. Only healthy animals are to be selected who can tolerate stress of drugs and transportation.
4. Adult males were to be selected with short antlers.
5. Hiring trucks from the market for transportation.
6. Truck is to move at a speed of 40 km/hour with animals.
7. Pregnant animals will not be selected.

Forest Veterinary Officer, Assam State Zoo, R. G. Baruah Road, Guwahati-781 005.

8. Selection of animals has to be done with the consent of receiving officials.

9. All Spotted deer of Assam State Zoo are zoo born and hence all trials are basically on zoo born animals but not of wild origin.

10. Truck with animals to be moved from the starting point during evening hours.

Name of drugs used and its concentration

- Xylazine[1] : 100 mg/ml
- Ketamine[2] : 100 mg/ml
- Yohimbin (Reversal)[3] : 10mg/ml

Procedures and strategies adopted for tranquilization of spotted deer

1. Five to six experienced animal handlers were made available to capture the sedated animals as fast as possible and take them out from the enclosure and then put into the wooden transportation cage designed by CZA.

2. Dosing of drug was done in such a way that animals were not completely sedated but can be captured by handlers and put them into cage.

3. Steroid (Prednisolone) were given to the animals before they were caged to avoid any shock.

4. Reversal administered just after animals are caged.

5. Darting was done by pneumatic syringe projector from a distance of not more than 15-20 ft. (4.5-6.0m).

6. Tranquilization started in the morning hours and completed within 10 am.

7. Less food to be served during transit.

8. Doses were administered individually to zoo born captive spotted deer on the basis of sex and age group (Table-1).

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[1] Manufactured by Troy laboratories Pty Limited,98 Long street Smithfield NSW 2164 Australia

[2] Manufactured by Troy laboratories Pty Limited,98 Long street Smithfield NSW 2164 Australia

[3] Manufactured by Bomac Pty limited, ABN 52 125427 241 15/36, Leighton place, Homsby, NSW 2077 Australia

Table-1

Sl. No.	Date of darting	Sex	Age	Quantity of drug administered	Remark
1	28/11/11	Male	Adult	Xylazine: 50 mg Ketamine: 100 mg Yohimbin: 5 mg	Did fine from starting point to destination.
2	28/11/11	Male	Adult	Xylazine: 50 mg Ketamine: 100 mg Yohimbin: 5 mg	Did fine from starting point to destination
3	28/11/11	Male	Adult	Xylazine: 50 mg Ketamine: 100 mg Yohimbin: 5 mg	Did fine from starting point to destination
4	28/11/11	Male	Sub-adult	Xylazine: 40 mg Ketamine: 100 mg Yohimbin: 10 mg	Did fine from starting point to destination
5	28/11/11	Female	Adult	Xylazine: 40 mg Ketamine: 100 mg Yohimbin:- 10 mg	Did fine from starting point to destination
6	28/11/11	Female	Adult	Xylazine: 40 mg Ketamine: 100 mg Yohimbin: 10 mg	Did fine from starting point to destination
7	28/11/11	Female	Adult	Xylazine: 40 mg Ketamine: 100 mg Yohimbin: 10 mg	Did fine from starting point to destination
8	28/11/11	Female	Sub-adult	Xylazine: 30 mg Ketamine: 100 mg Yohimbin: 10 mg	Did fine from starting point to destination
9	28/11/11	Female	Sub-adult	Xylazine: 30 mg Ketamine: 100 mg Yohimbin: 10 mg	Did fine from starting point to destination
10	16/12/11	Male	Adult	Xylazine: 50 mg Ketamine: 100 mg Yohimbin: 10 mg	Did fine from starting point to destination
11	16/12/11	Female	Adult	Xylazine: 40 mg Ketamine: 100 mg Yohimbin: 10 mg	Did fine from starting point to destination

12	16/12/11	Female	Adult	Xylazine: 40 mg Ketamine: 100 mg Yohimbin: 10 mg	Did fine from starting point to destination
13	16/12/11	Female	Adult	Xylazine: 40 mg Ketamine: 100 mg Yohimbin: 10 mg	Did fine from starting point to destination
14	16/12/11	Female	Adult	Xylazine: 40 mg Ketamine: 100 mg Yohimbin: 10 mg	Did fine from starting point to destination
15	16/12/11	Female	Adult	Xylazine: 40 mg Ketamine: 100 mg Yohimbin: 10 mg	Did fine from starting point to destination
16	16/12/11	Female	Adult	Xylazine: 40 mg Ketamine: 100 mg Yohimbin: 10 mg	Did fine from starting point to destination
17	16/12/11	Female	Adult	Xylazine: 40 mg Ketamine: 100 mg Yohimbin: 10 mg	Did fine from starting point to destination
18	16/12/11	Female	Adult	Xylazine: 40 mg Ketamine: 100 mg Yohimbin: 10 mg	Did fine from starting point to destination

Observations

1. The trial was limited to zoo born animals only.
2. Nineteen spotted deer were sedated but one individual died before transportation.
3. These animals covered a distance of 250 km from Guwahati to Dimapur without any casualty within 24 hours (journey time).
4. Doses of drugs administered were above 95% safe to animals.
5. .Adults required more drug than the sub-adult.
6. Males required more drug than females of same age group.
7. No infusion (Normal saline) required after tranquilization during these operations.
8. The above doses of Xylazine and Ketamine are not enough to cover any surgical intervention for a prolonged period.
9. The animals were tranquilized in the morning hours and rested for the whole day after they were caged and the journey started in the evening.

Conclusion

The following doses of drugs may be recommended purely on the basis of observation from field records with 95 % safety margin to capture captive spotted deer (zoo born) for transportation (Table-2).

Table-2

Sl No	Sex	Age	Quantity of drug administered
1	Male	Adult	Xylazine: 50 mg Ketamine: 100 mg Yohimbin: 5 mg
2	Female	Adult	Xylazine: 40 mg Ketamine: 100 mg Yohimbin: 10 mg
3	Male	Sub-adult	Xylazine: 40 mg Ketamine: 100 mg Yohimbin: 10 mg
4	Female	Sub-adult	Xylazine: 30 mg Ketamine: 100 mg Yohimbin: 10 mg

Reference

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MANAGEMENT AND BREEDING OF RATEL OR HONEY BADGER (*Mellivora capensis*) IN NANDANKANAN ZOOLOGICAL PARK, ODISHA

S. K. Sahu, S. Panda and P. K. Roy

Introduction

The ratel or honey badger (*Mellivora capensis)* is relatively a large mustelid (8-10 kg) that has an extensive distribution across the base of Himalayas to Cape Comorin, South-western Asia and Africa (Prater, 1998). There are ten subspecies of ratel in the world, out of which one subspecies namely *Mellivora capensis indica* is distributed in peninsular India. According to IUCN Red List status they are placed in 'Lower risk' (least concerned). The species is highly endangered and included in the Schedule-I of the Indian Wildlife (Protection) Act, 1972. There are only eleven ratels (8 males and 3 females) in captivity in six zoological parks (Wardha, Jaipur, Bilaspur, Nandankanan, Hyderabad and Sambalpur) in India (Anonymous, 2010-11).

Though Nandankanan Zoological Park (NKZP) has been maintaining the ratel or honey badger since August 1967(Acharjyo and Patnaik, 1990), success could not be achieved in breeding of this species in this park earlier. The present paper attempts to record some of the experiences on management and breeding of this endangered species i.e. ratel observed during the period from July to April 2012 in NKZP. This appears to be the first record of breeding of ratel in captivity in any Indian zoo.

Management practices

NKZP received one rescued ratel (male) on 16.09.1999 at an estimated age of about one year. Another adult rescued ratel (female) with an estimated age of about five years was received in the park on 16.01.2008. These two animals were housed together as a pair in a well ventilated covered enclosure having a floor space of approximately 40 sq.m. with 3 m. in height. This was connected to a retreating chamber having a floor space of 4 sq.m.. The enclosure was having a concrete floor reinforced with wire mesh underneath to prevent escape through digging. A layer of 0.50 m. thick soil was placed on the concrete floor to meet its biological needs of digging and burrowing. Further a few hollow wooden logs were kept inside the enclosure to serve as hiding space. One cave like den measuring 0.6m.x0.6m. with a height of 0.6 m. was constructed inside the enclosure. Besides two hollow hume

Nandankanan Zoological Park, Mayur Bhawan, Janpath, Saheed Nagar, Bhubaneswar- 751 007

pipes of 30cm diameter partially submerged in the soil were also provided as artificial burrows which were frequently used by the female to hide the cubs (Fig. 1). But the ratels were mostly seen using the burrows excavated by themselves on the floor of the enclosure (Fig. 2). Soil of the enclosure was kept moist by sprinkling water to facilitate digging by the animals. The male was separated from the female to minimise disturbances during pregnancy and the whole enclosure was closed for the visitors well before the expected date of parturition .

Each ratel was provided with 200g of goat meat, 400g of buffalo meat, 20g honey and 200g ripe banana per day, but buffalo meat was not given on Mondays. Multivitamins and minerals were provided as feed supplement periodically. An additional diet of 200g goat meat along with one tablet of galactogogue (Leptaden[1]) and 5ml of Ostocalcium B12[2] syrup were given to the female ratel daily during advanced stage of pregnancy and first month of nursing of the cub. As per Crandall (1965) the food of ratel consisted of a mixture of chopped raw meat, dog meal, bone meal and cord-liver oil with fruits, vegetables, and occasional rat or chicken neck and now and then a treat of honey.

Routine deworming of the ratels with broad spectrum deworming drugs was carried out at three months interval. Besides, faecal samples were examined at regular intervals to detect parasitic infestation if any followed by appropriate treatment.

A water trough was provided inside the enclosure which was cleaned daily and filled with fresh water. The enclosure and the retreating chamber were thoroughly cleaned and disinfected daily. Care was taken not to use any disinfectant containing phenol.

Observations and discussion

Mating behaviour

Frequent urination by the female and mutual licking of external genitalia by both the male and female were suggestive of estrous in the female. This type of behaviour followed by mating lasted for 2-3 days only. Mating behaviour of ratel in Nehru Zoological Park, Hyderabad was reported by Pillai (2000). According to him the actual mating activity lasted for two minutes and the genitals of both the male and female got locked as reported in dogs.

Crandall (1965) states that he is not aware of any record of breeding of the ratel in captivity. Prater (1998) writes that little definite is known about breeding habits of this species.

[1] Alarsin (Pharmaceuticals), Alarsin House, M.I.D.C. Andheri (East), Mumbai - 400 093.
[2] GlaxoSmithKline Pharmaceuticals Limited, Dr. Annie Besant Road, Mumbai - 400 030.

Ratels are non seasonal breeders (Begg *et al.*, 2003) and mating is mostly concealed within the burrow (Verwey *et al.*, 2004). The life history variables of free-living honey badgers was studied and documented by Begg *et al.* (2005) and Verwey *et al.* (2004) in the wild.

The pre-mating behaviour recorded by Begg *et al.* (2003) in southern Kalahari were token urination, defecation, scent marking, male's flehman behaviour and mutual inspection of genitalia.

Gestation period

The gestation period was calculated from the last day of mating to birth of cubs as per Desai (1975). The gestation period of ratel recorded in this park was 45-46 days (Table).

Table

Dates of mating behaviour	Date of parturition	Gestation period in days	Litter size	Inter parturition interval in days	Remarks
17.07.2011 to19.07.11	02.09.11	45 days	2 (1 male, sex of the other cub could notbe ascertained)	68 days	Still-birth
24.09.11 and 25.09.11	10.11.11	46 days	2 (1M,1F)	85 days	Still-birth
19.12.11 to 21.12.11	04.2.12	45 days	2 (1M,1F)	–	Mother rejected the female cub on 17.2.2012 after 13 days of birth but it died on 22.12.2012. The male cub is surviving and data are recorded on this male cub.

The gestation period reported in this species by Begg *et al.* (2005) was 50-70 days and by Yaniv and Golani (1987) was 6 weeks. However, Johnstone-Scott (1981) reported gestation period in two female African ratels in Howletts zoo, England to be 153 and 162 days due to delayed implantation.

Inter-parturition interval

The inter-parturition intervals recorded twice were 68 and 85 days (Table). The inter-birth interval was reported to be more than 12 months by Verwey *et al.* (2004) and Begg *et al.* (2005).

Litter size

In all the three cases of parturition, the number of off-springs was found to be two only. First two litters (four cubs) were still-born. Out of two cubs born in the third litter on 04.02.12, one female cub died on 22.12.2012 and the male cub survived (Table).

According to Hussain (1999) in India the ratel breeds during summer months and may produce two litters in a year. The gestation period is believed to be around 180 days and the litter size is two (Pocock, 1941).

Ratel cubs

The new born cubs were almost hairless and blind. The living male cub started showing the characteristic black and white pelage of adults at four weeks of age. At about 8 weeks of age the body coat changed completely to that of adult ratel. Opening of the eyes of the male cub was observed on 24.03.12 (50 days of age). The cub was first observed foraging on minced goat meat along with its mother on 22.04.12 i.e., at the age of 79 days. The ten month old surviving male cub is still foraging along with its mother. In case of ratel long period of dependence was reported in the wild by several authors. The long time to independence is likely to be the result of a gradual development of necessary hunting, digging and climbing skills (Begg *et al.* 2005).

Maternal behaviour

Maternal behaviour of the ratel could only be observed in the third litter as the cubs of the first two litters were still-born. The mother ratel came out for feeding leaving the cub in the burrow upto ten weeks. The mother was seen holding her hairless cubs with her mouth at the nape (Fig. 3) and shifting them from one place to another. Suckling mostly occurred inside the burrow but occasionally it was also seen outside the burrow. The suckling position was typical- the mother used to lie on one side or on her back placing the cub on her belly with its tail near her head and clasped her forearms around the cub (Fig 4a and 4b). At times the mother was seen rolling the cub on soil followed by dipping in the water.

Fig. 1. Artificial burrows (hume pipe) used by the mother to hide its cubs

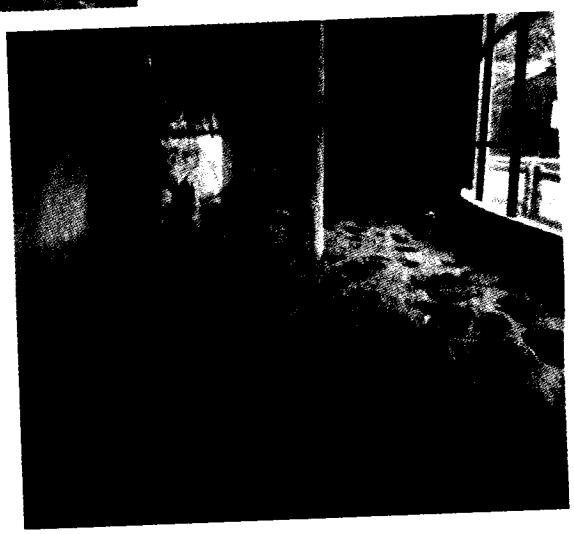

Fig. 2. Enclosure where the ratels were housed showing lots of burrows dug by themselves

Fig. 3. Mother holding the young one at the nape with its mouth

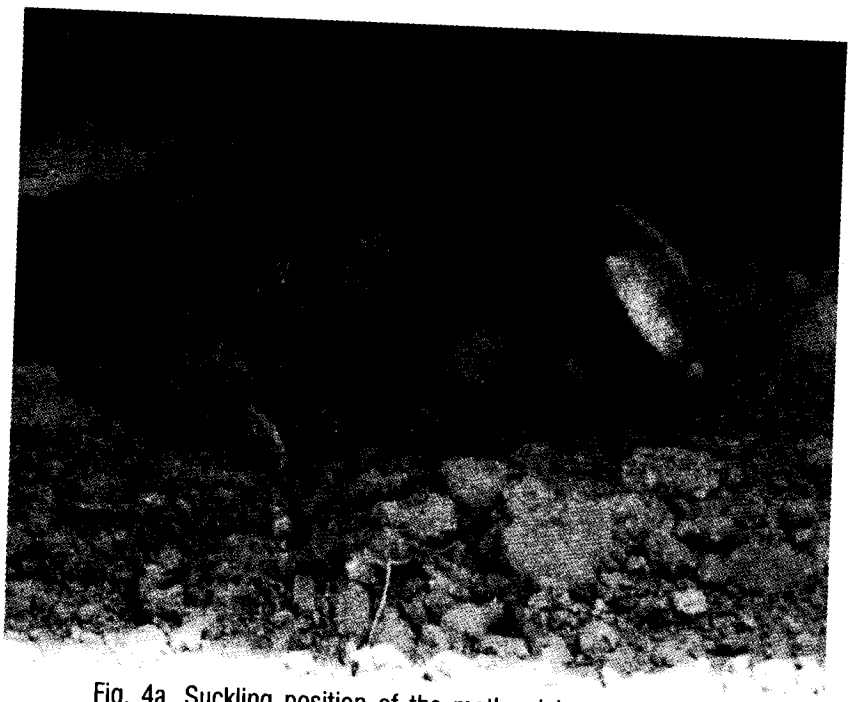

Fig. 4a. Suckling position of the mother lying on one side

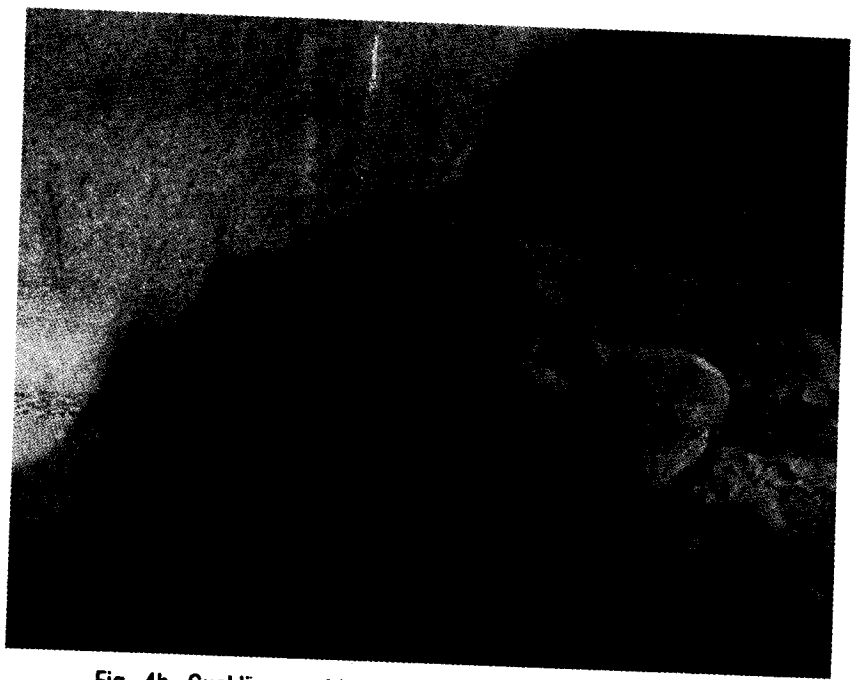

Fig. 4b. Suckling position of the mother lying on her back

Weaning age and lactation period

The weaning age and lactation period is defined as the "length of time from birth to independence from maternal milk, estimated as time from birth to when females were observed taking prey items back to the den" (Begg *et al.*, 2005). The ratel mother was seen carrying food items back to the burrow for the first time from 10 weeks (70days) onwards, probably for the baby ratel. On this basis the estimated duration of lactation period calculated in the present case was 10 weeks (70days) which agrees with the range of 60-90 days as reported by Begg *et al.* (2005) for the honey badgers in the Kgalagadi Transfrontier Park, Africa.

Acknowledgement

We sincerely acknowledge the services rendered by animal keepers of Nandankanan Zoological Park for the successful breeding of the ratel in this park.

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HERNIA OPERATION IN A BLACKBUCK (*Antilope cervicapra*) IN TATA STEEL ZOOLOGICAL PARK, JAMSHEDPUR

Manik Palit

Introduction

The Tata Steel Zoological Park, Jamshedpur (TSZP) which is situated in Jubilee park area of Jamshedpur town was opened to the public during March, 1994. The zoo is having 74 acres of land and is managing 400 specimens in its collection. There are seven common species of herbivores housed in the park *viz.* hippopotamus, nilgai, chital. sambar, blackbuck, hog-deer and barking deer. Presently TSZP is having a population of 38 blackbucks in its collection. The animals were brought from Satsang zoo, Deoghar, Jharkhand (2:2) and from Indian Veterinary Research Institute, Izatnager, U.P. (2:4) during the year1995 and 1996 respectivily. Out of 38 specimens, there are 9 albino specimens. TSZP is successfully maintaining these animals and their breeding records are also good.

Case history

On 16th March 2012 noon, one female blackbuck was found secluded from the herd and was having a tendency of frequent stretching of its body, restlessness and off feed. On close observation it was found that the affected 6-7 years old doe was having a localized swelling on the right side of abdomen at the level of para lumber fossa. The stretching of whole body was suggestive of abdominal pain and the animal appeared pregnant. Considering all the existing circumstances and condition of the animal, it was decided to a have close examination of the animal in a restricted area (cell) so that chances of further damage to the animal can be avoided during capture.

Clinical observations and diagnosis

The animal was restrained in a cell on 19th March 2012 afternoon and physically captured for examination of the swelling. The hernial mass (content) and the ring were felt. The case was diagnosed as a typical "hernia of abdomen" (Fig.1) caused probably due to traumatic injury. The animal was shifted to a separate cell having the facility of kraal for further surgical procedure and post-operative management.

Deputy Director cum Veterinary officer, Tata Steel Zoological Park, Jamshedpur, Jharkhand.

Anaesthesia / immobilization

The animal was kept fasting for 24 hours and without water for 12 hours before the anaesthesia (immobilization) process. The operation process was initiated on 21.03.2012 at 11:00 am through chemical immobilization using Xylzine HCl[1] + Ketamine HCl[2] mixture (30 mg each) as intra-muscular injection and local anaesthesia (Xylocain 20 %) was given at the operation site.

Surgical Procedure (Operation)

After preparing the site of operation, laparotomy was performed observing all the general surgical aseptic precautions. On incision of the skin and subcutaneous tissue layer the protruded portion of the intestine appeared coming out from the ruptured portion of the abdominal muscle layers (Fig.2).

Hernial mass (intestinal loop) was inserted manually into the abdominal cavity by gentle push, the two muscle layers were sutured (Fig.3) separately using chromic cat gut (Chromic NW 4242EP, Ethicon, Johnson & Johnson) by horizontal mattress fashion. The subcutaneous tissue layer was also sutured with cat gut. Finally the skin opening was closed (Fig.4) by silk suture (horizontal mattress fashion) keeping one small opening at the lowest position for drainage.

Cleaning and dressing of the surgical wound was done with Metricare I.U. solution (Povidone Iodine-5%, Metronidazole-1%[3]) and Nebasulf powder (Neomycine-Bacitracine and Sulfacetamide powder[4]). Himax ointment (Herbal fly replant)[5] was applied externally over the wound.

Long acting Antibiotic Fortivir[6] (Enrofloxacine 10%) 3 ml, Tetanus toxoid- 0.5 ml, Antispmodic, Inj. Pronac-3 ml (Piroxicam , Pitofenon HCl[7]) were given. During the process of operation the animal was given slow intravenous drip of Ringers lactate saline (400 ml).

The animal was revived using Reverzine- 2 ml I/V. (Yohimbine HCl[8] 10 mg / ml) and

[1] Manufactured by Troy laboratories Pty Limited,98 Long street Smithfield NSW 2164 Australia
[2] Manufactured by Troy laboratories Pty Limited,98 Long street Smithfield NSW 2164 Australia
[3] Zydus Animal Health Ltd., Block No. 10-13, Sarkhej-Bavia Road, Village-Changodar, Ahemedabad- 382213
[4] Pfizer Ltd., C4/13, MIDC, Bhosari, Pune-411 026
[5] Indian Herbs Research and Supply Co. Ltd., Darra Shivpuri, Saharanpur- 247 001 (Uttar Pradesh)
[6] Virbac Animal Health India Pvt. Ltd., 604, 6th floor, Western Edge-1, Magathane, Western Express Highway, Borivili (East), Mumbai-400 066.
[7] Rodec Pharmaceuticals Pvt. Ltd., 99, 1st and 2nd floor, Kalka Garhi Chowk, Ghaziabad (Uttar Pradesh)
[8] Manufactured by Bomac Pty limited, ABN 52 125427 241 15/36, Leighton place, Homsby, NSW 2077 Australia

released in (6.0m X 3.0m) hall. Recovery was smooth (Fig.5) and the animal started walking after half an hour.

Post-operative treatment and care

Post-operative treatment and care included the use of injection Fortivir on every third day, use of Ivermectine injection-1 ml S/C once, oral pain killer Maxxtol bolus (Tolfenamic acid[9]-500 mg) half a bolus daily for five days. Examination and dressing of surgical wound and application of fly repellent (Himax ointment or lotion) was carried out every day for 10 days after operation.

The animal has given birth to a live male fawn on 29th March 2012 morning, which has not survived due to maternal rejection and found dead on the next day. On 18th day, the animal was appearing normal except for the scar mark of skin suture and the animal was found taking its full diet. On 20th day the animal was finally released back into its original enclosure.

Summary

A case of surgical repair of hernia in a female blackbuck was carried out in TSZP, Jamshedpur successfully. Probable cause, diagnosis and surgical management have been described.

Acknowledgement

The author is thankful to Sri Bipul Chakrabarty, Director, Tata Steel Zoological Park, Jamshedpur for his encouragement and providing necessary facilities to conduct this operation. The author also expresses his sincere thanks to veterinary staff and animal keepers for taking utmost care of the blackbuck from the day one till its full recovery from illness.

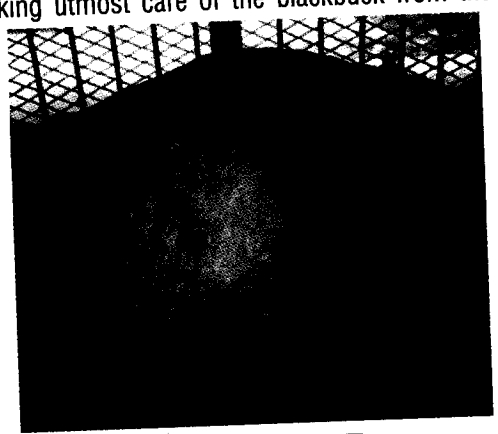

Fig. 1. Swelling at the site of harnia-right side of abdomen

[9] Intas Pharmaceuticals Ltd., Matoda 382 210, District- Ahmedabad

Fig. 2. Surgical skin incision and ruptured muscle layers

Fig. 3. Repair of ruptured muscle layers

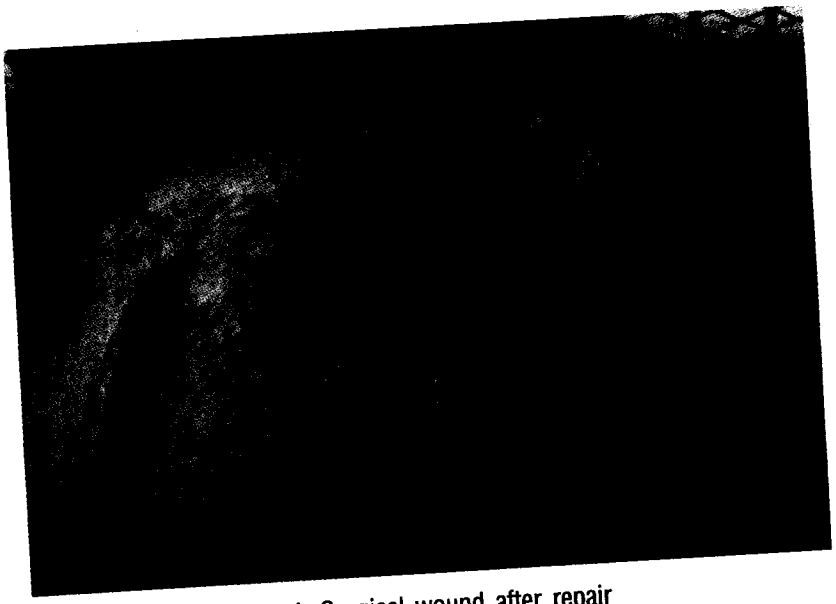

Fig.4. Surgical wound after repair

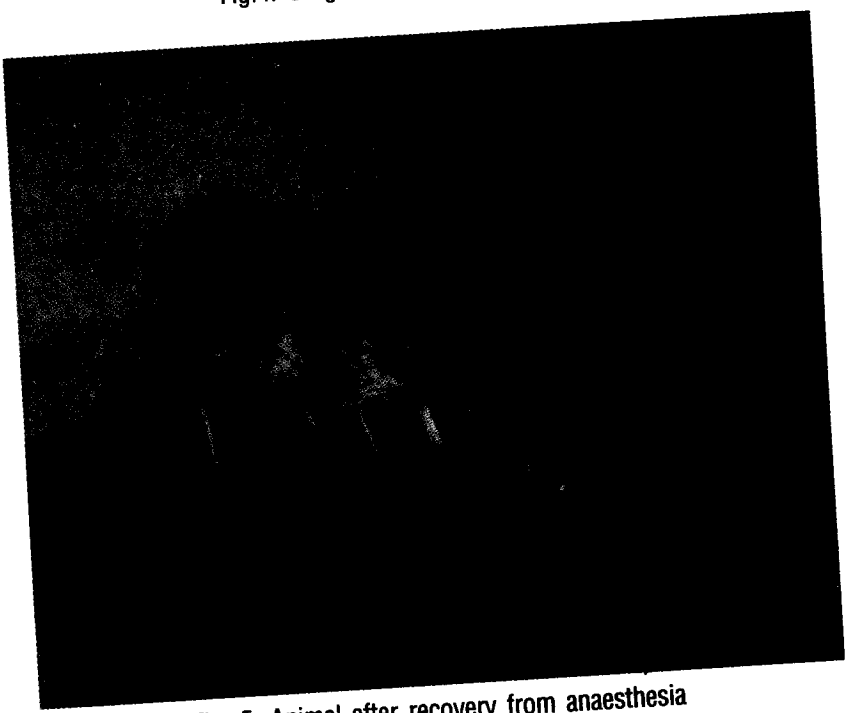

Fig. 5. Animal after recovery from anaesthesia

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2. Forceps were used with gloved hands to take out approximately 2gm from the freshly dropped faeces and placed into the collection tubes. Care was taken to avoid soil contamination.

3. The tubes were closed and labeled with identification number, date, time and site (ideally Global Positioning System- GPS coordinates) of collection, age, sex and species of the animal and signature of the faecal sample collector.

4. The preserved faecal samples/adult parasites were taken to the laboratory for microscopical examination.

5. The available three standard techniques namely-direct faecal smear method, sedimentation method and floatation method were used for microscopical examination (under 10x and 40x magnification) of faecal samples/adult parasites collected from SNP and NVNP in the laboratory. The standard procedures of these methods were followed while examining the faecal samples.

Results and discussion

The results obtained during microscopical examination of faecal samples are given species wise in Table-1 and 2.

The result of the host wise examination of the faecal samples is incorporated in Table 1 and Table 2 for SNP and NVNP respectively. Out of 106 samples 36 (34%) were found to be positive for parasitic infection from SNP and out of 16 samples, 3 (18%) were found positive for parasitic infection from NVNP. Three samples out of 40 were found positive for *Toxocara sp* in Singalila South Range, Gairibans, Rithu 1.

Herbivores showed multiple infection with more than one helminth parasite especially *Ascaris sp.* Other infections observed in herbivores were *Toxocara sp*, *Strongloides sp* and *Trichuris sp.* Among carnivores *Toxocara sp* was the significant infection specifically present.

The faecal samples with no parasitic infection were recorded from that of Himalayan goral, barking deer, wild boar, common leopard and kalij pheasant in areas like Sabarkum 10, 8,4 & 3, Sandakphu 9 and kankibong 2. The above findings clearly indicate that parasitic infection at SNP is more prevalent in the lower areas of the park like Maneybhanjang, Kankibong, Rilling, South Rimbick and North Rimbick. In NVNP parasitic infection was found in Upper Neora Valley National Park.

A preliminary study of this kind provides an insight on the gastro-intestinal parasitic infection occurrence in the wild animals which can have a negative impact in the host

population size. Parasites can also play a central role in ecosystem affecting the ecology and evolution of specific interactions (Esch and Fernandez, 1993), host population, growth and regulation (Hochachka and Dhondt, 2000; Hudson *et .al.* 1998) and community biodiversity (Hudson *et. al.* 2002).

The study is still going on and is only indicative and not conclusive. The gastro-intestinal parasitic infection may have considerable bearing on wildlife health within our sanctuaries and national parks.

Acknowledgement

We would like to acknowledge the following persons of Wildlife Division I, Forest Department, Govt. of West Bengal, Dr. Raju Roy, Mr Pradeep Singh, Miss Deewa Basnett and Miss Shradhanjali Rai.

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Table-1

Sl No.	Species	Date of collection	Block	Compartment	Microscopic Field	Eggs/adult worm/Oocyst	GPS Reading
1.	Barking deer	05.03.2012	South Rimbick	7	2-4/L.P.F	*Ascaris sp.*/ Adult Round Worm (++)	N27°05'17.3" E088°06'417"
2.	Barking deer	05.03.2012	Sandakphu	6	2-4/L.P.F	*Ascaris sp.*/Adult Round Worm (++)	N27°06'17.3" E088°03'05.3"
3	Himalayan goral	3/3/2012	Sabarkrum	4	1-2/L.P.F	*Ascaris sp.*/Adult Round Worm (++)	N27°06'12.3" E088°03'0.7"
4	Wild boar	3/3/2012	Relling	RL -4	1-2/L.P.F	*Ascaris. sp.*/ Oocyst(+)	N27°02'504" E088°05'823"
5	Himalayan monal	3/3/2012	Maneybhanjang	LR 2	2-4/L.P.F	*Ascaris sp.*/Adult worm(++)	N26°59'852"E 088°06'417"
6.	Himalayan goral	5/3/2012	Maneybhanjyang	LR 2	1-2/L.P.F	*Ascaris. sp.*/ Oocyst(+)	N26°59'911"E 088°06'23.305"
7	Himalayan goral	6/03/2012	Maneybhanjang	LR 9	3-4/L.P.F	*Ascaris sp.*/ Adult worm(+++)	N27°0'8.059"E 088°06'05.3"
8	Himalayan serow	4/3/2012	Sandakphu	9	1-2/L.P.F	*Ascaris sp.*/ Adult worm(+)	N27° 06'17.3"E 088°03' 05.3"
9	Barking deer	7/3/2012	Siri	5	1-2/L.P.F	*Ascaris sp.*/ Adult Worm (+).	N27°06'401"E 088°04°483"
10	Barking deer	4/3/2012	Sandakphu	9	1-2/L.P.F	*Ascaris sp.* / Adult Worm. (+).	N27°06'17.3"E 088°01'16.9"
11	Himalayan serow	Ghorkey	Phalut	2	1-2/L.P.F	*Ascaris sp.* / Adult Worm. (+).	N27°12'62.2"E 088°03' 05.3"
12	Common leopard	6/3/2012	Maneybhanjang	LR 2	2-3/L.P.F	*Strongyloides sp.* (++)/Oocyst	N26°59'852"E 088°06'417"
13	Wild boar	5/3/2012	Maneybhanjang	LR 9	1-2/L.P.F	*Trichuris sp.* (+)/ Oocyst	

14	Barking deer	7/3/2012	Gairibans	South Rimbick-7	2-3/L.P.F	*Ascaris sp.*/ Adult Worm (++).	N27°05'817.3"E 088°01'17.0"
15	Barking deer	3/3/2012	Kankibong	KB 2	2-3/L.P.F	*Ascaris sp.*/ Adult Worm. (+).	N27°02'091"E 088°21'551"
16	Leopard cat	4/3/2012	Kankibong	KB 2	1-2/L.P.F	*Toxocara sp.*(++)	N26°59'52.702"E 088°6'53998"
17	Himalayan serow	7/3/2012	Dilpa	KB 6-8	3-4/L.P.F	*Ascaris sp.*/ Adult Worm. (+++).	N27°02'091"E 088°21'551"
18	Barking deer	3/3/2012	Kankibong	KB-2	1-2/L.P.F	*Ascaris. sp.*/ ocyst(+)	N26°5956.652"E 088°6'53.998"
19	Barking deer	4/3/12	Kankibong	KB-1	2-3/L.P.F	*Ascaris sp./.* Adult Worm. (++)	N26°5950.119"E 088°6'45.353"
20	Barking deer	7/3/2012	Maneybhanjang	LR 2	1-2/L.P.F	*Ascaris sp.*/ Adult Worm. (+).	N26°59'804" E088°06'508"
21	Himalayan Serow	7/3/2012	North Rimbick	NR 3	2-3/L.P.F	*Ascaris sp./* Adult Worm. (++).	N27°06'847"E 088°04'079"
22	Leopard cat	4/3/2012	Maneybhanjang	LR 2	2-3/L.P.F	*Toxocara Sp.* Adult worm.(++)	N26°59'832" E088°06'419"
23	Barking deer	4/3/2012	Maneybhanjang	LR 9	2-3/L.P.F	*Ascaris sp./* Adult Worm. (+).	N27°00'761" E088°05'397"
24	Barking deer	7/3/2012	Maneybhanjang	LR 9	2-3/L.P.F	*Ascaris sp./* Adult Worm. (+).	N27°00'766" E088°05'408"
25	Barking deer	6/3/2012	Maneybhanjang	LR 9	2-3/L.P.F	*Ascaris sp./* Adult Worm. (+).	N27°00.595" E088°05'364"
26	Barking deer	3/3/2012	Maneybhanjang	LR 9	2-3/L.P.F	*Ascaris sp./* Adult Worm. (+).	N27°00.559" E088°05'381"
27	Barking deer	5/3/2012	Relling	RL-6	2-3/L.P.F	*Toxocara sp.*(++)/ Oocyst	N27°02'393" E088°05'813"
28	Barking deer	5/3/2012	Kankibong	KB-1	2-3/L.P.F	*Ascaris sp./* Adult Worm. (++).	N27°02'724" E088°07'839"

29	Leopard cat	5/3/2012	Kankibong	KB-1	2-3/L.P.F	*Toxocara sp.*(++)/ Oocyst	N27°02'757" E088°07'873"
30	Barking deer	4/3/2012	Kankibong	KB-2	2-3/L.P.F	*Ascaris sp.*/ Adult Worm. (++).	N27°02'757" E088°07'873"
31	Himalayan serow		Kankibong	KB-1	2-3/L.P.F.	*Ascaris sp.*/Adult Worm. (+)./Oocyst	N27°03'17.679" E088°06'43.335"
32	Wild boar	7/3/2012	Maneybhanjang	LR 2	2-3/L.P.F.	*Ascaris sp.* (++)./ Oocyst	N26°59'51.332" E088°06'40.748"
33	Himalayan Monal	3/3/2012	Maneybhanjang	LR 2	2-3/L.P.F.	*Ascaris sp.* (+)./ Oocyst	N26°59'50.982" E088°06'48.49"
34	Wild boar	3/3/2012	Maneybhanjang	LR 9	1-2/L/P/F	*Trichuris sp.* (+)/ Oocyst	N27°0'13'.217" E088°06'48.49"
35	Barking Deer	7/3/2012	Maneybhanjang	LR 9	2-3/L.P.F.	*Ascaris sp.* (++)./ Oocyst	N27°0'10'.944" E088°06'27.224"
36	Barking Deer	6/3/2012	Maneybhanjang	LR 9	2-3/L.P.F.	*Ascaris sp.* (++)./ Oocyst	N27°0'10'.3.516" E088°06'27.908"

Table-2

Sl No.	Species	Date of collection	Block	Compartment	Microscopic Field	Eggs/adult worm/Oocyst	GPS Reading
1.	Common leopard	7/3/2012	Kolbong & Pankashari	Resit	1-2/L.P..F	*Toxocara sp.* (+)	N27°06'54.3" E088°45'43.8"
2	Barking deer	3/3/2012	Kolbong & Pankashari	Pankashari 2	3-4/L.P.F	Adult *Ascaris sp* (++)	N27°04'40.7" E088°41'40.0"
3	Barking deer	4/4.2012	Kolbong & Pankashari(Part)	Resit	3-4/L.P.F	Adult Ascaris *sp* (++)	N27°06'54.3" E088°45'43.8"

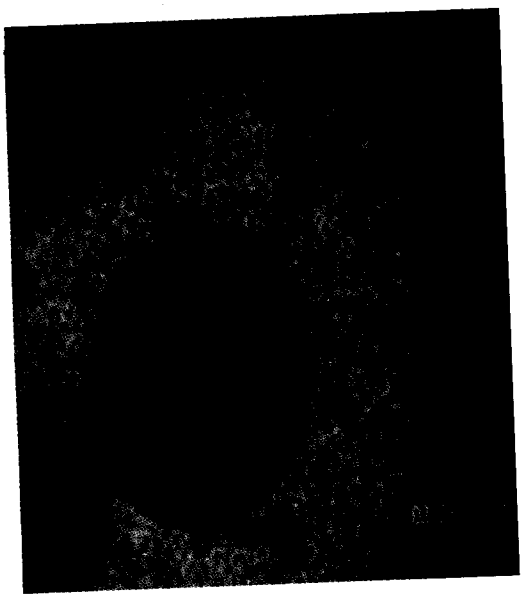

Fig. -1.Egg of *Toxocara sp.*

Fig.-2. Egg of *Strongyloide sp.*

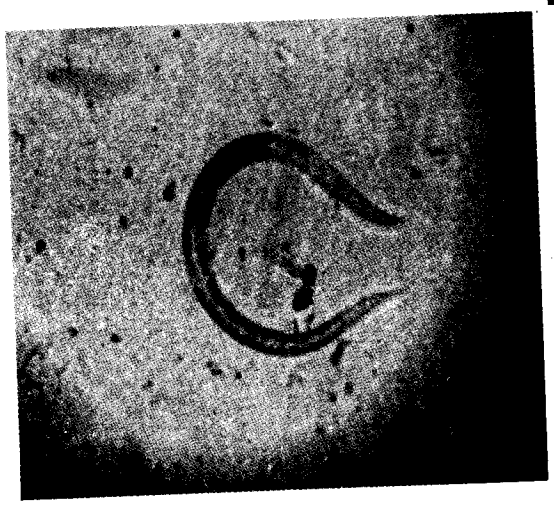

Fig.3. Ascaris sp. (adult)

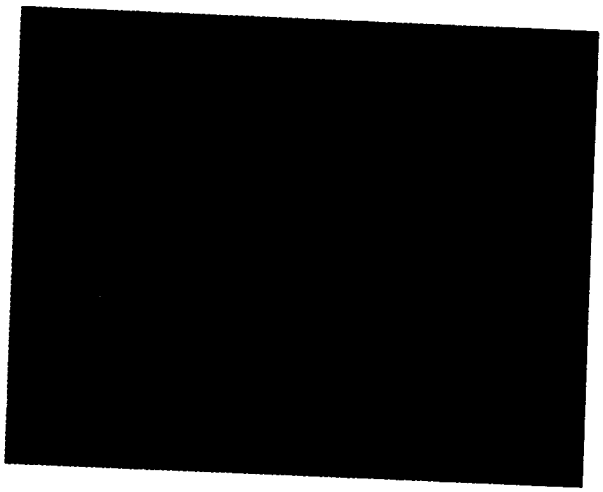

Fig.4. Egg of *Ascaris sp.*

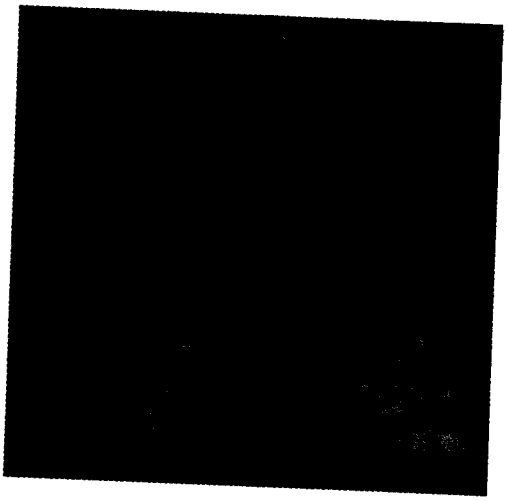

Fig.5. Egg of *Trichuris sp.*

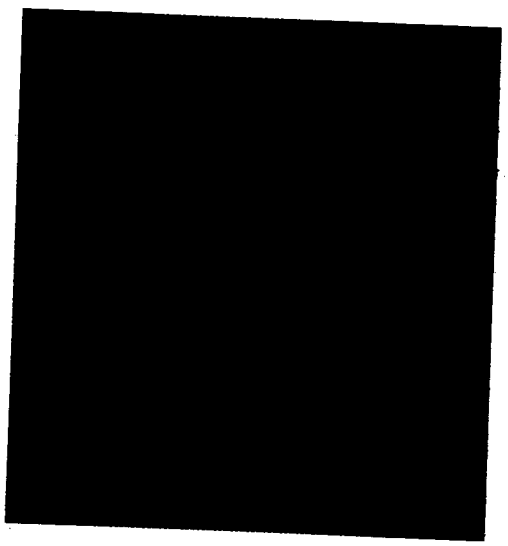

Fig.6. Egg of *Trichuris sp.*

ENRICHMENT IDEAS FOR AVES

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Abstract

Avian species are seldom the topic of discussion in areas concerning behavioural enrichment, despite the manifestation of abnormal behaviours and presumed boredom in captive birds. Birds in captivity are liable to suffer from a number of stress-related health and behavioural problems, unsuccessful breeding when placed in situations where social and environmental deprivations exist. This paper deals into the meaning of behavioural enrichment, the need for it in zoos today and highlights several examples of how best they can be maintained in zoos, rescue centres and conservation breeding centres.

We all know that the behavioural enrichment is important because it assists in reducing the possibilities of abnormal behaviour, increases the educational value of exhibits, helps to validate captive display and can stimulate greater interest in the physical environment leading to enriched social interactions between birds. Specifically, enrichment techniques optimize the levels of social and physical stimulation provided in captive environments to maximize reproductive potential, and ensure normal behavioural development.

In this communication the enrichment ideas for following group of birds are addressed-

1. Pheasant and birds belong to family Galliformes
2. Parrots and birds belonging to family Psittaciformes
3. Water birds and birds belonging to Pelicaniformes and Anseriformes
4. Storks and cranes
5. Birds of Prey (kites, falcons, vultures and owls)

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Introduction

Since the inception of the Central Zoo Authority in 1992, the attempts have been made at several zoos to exhibit the birds and the large aviaries, provided with large area and natural vegetation which meets the biological requirement of the birds. It is also mandatory under Recognition of Zoo Rules, 2009 for every zoo to provide naturalistic environment which meets the biological, physical and psychological needs of the birds. The Central Zoo Authority while issuing the guidelines for the scientific management of the zoos, had issued minimum prescribed sizes for outdoor enclosure for important birds in captivity. The details are given (Table-1).

Table -1. Minimum prescribed sizes for outdoor enclosure for important birds in captivity

Birds/Species	Minimum size of aviary (square meters)	Minimum height of the aviary (meters)	Minimum size of the water body within the aviary (square meters)
Birds of prey	300	8	10
Pheasant *	80	3	3
Water birds (mixed species enclosure)	300	8	60 (with a depth of 1.5 m)
Flying birds (mixed species enclosure)	300	8	20
Flying birds (single species)	80	6	2

* In case of peafowl the aviary size should be kept at 160 sq. m.

Further the Central Zoo Authority had issued guidelines on use of innovative exhibit design and barriers for holding and display of birds in zoos, which plays very important part while designing the enrichment guidelines for a species. The details are given (Table-2).

The birds housed in aviaries should induce a 'sense of freedom' in the mind of the visitor. The ability to visualize a bird cloaked in its natural surroundings would lead not only the visitor, but even zoo personnel to conclude and reasonably so, that every provision had been made to maximize its well-being in captivity.

It is important to remember, however, that even if a bird is placed in a large spacious aviary, complete with live plants, a naturally-occurring substrate, with a water body, the

Table-2. Aviary type, enclosure and barrier recommendations

Type	Front barrier/Rear barrier	Remarks
Pheasant	Covered type enclosure of wire mesh of 3 m high, 10-12 m depth, 6-7 m width	a. The double galvanized mesh of 12mm x 12mm x 4g should be placed 0.5m below the earthen surface to prevent rodents. b. The plinth should have 7 cm (over hang) to prevent rodents/ snakes approaching the chain-link mesh from the viewer side or either side.
Walk through aviary	i. The area for the walk through aviary should not be less than 2 hectares with at least 100 m wide withdrawal area for the birds. ii. The height of the aviary should be 12 m.	a. Adequate vegetation should be provided b. Provision of board walk shall be ideal for visitors.

basic idea is that meeting the birds' physical and behavioural requirement in captivity is to address animal welfare issues. This is where behavioural enrichment plays its part in the contemporary zoo by improving the physiology and mental well-being of the animal.

In the long run, however, behavioural enrichment does more than just provide welfare for the individual. As wild habitats continue to shrink and human pressures on wildlife continue to rise, zoos are increasingly concerned with the conservation and well-being of groups (populations and species) as well as individuals. These new and interrelated roles for enrichment have progressed from the predominantly individual-oriented approach to include goals like the conservation of culturally defined repertoires of behaviour for research and education and facilitating the reproduction of captive populations (especially endangered species). Furthermore, with the present emphasis on conserving entire ecosystems rather than individual species, zoos play an important role in the re-introduction of captive-bred animals into the wild. This has increased the need for the continued preservation of natural behaviours in captivity, a goal that is greatly aided by behavioural enrichment.

One of the most important misconceptions concerning birds in captivity, in our opinion, lies in the enclosure size in relation to body size. Now, for most carnivores, the enclosure size relative to body size is small, meaning to say that a lion is housed in an

enclosure of 1000 sq.m. area. A bird in the same enclosure, on the other hand, would have a much bigger enclosure size relative to body size, even for a large parrot like a macaw. In short, people tend to think that birds have 'plenty of space' because of their relatively smaller size. This however, is far from true. Some birds are migratory; others cover long distances in search of food. Still others have territories marked over hundreds of miles. The size of an animal does not necessarily determine the size of the required space. Rather, it should be dependent on their behavioural needs. Birds also need environments that closely resemble their native habitats to express their behavioural characteristics.

When this is lacking, birds can end up with a multitude of problems. The absence of certain key stimuli in the physical environment of captive animals can result in failure to express certain behavioural patterns. Based on the theory of natural selection, the rarity of certain essential behavioural patterns may cause these patterns to become gradually 'phased out' in a species over a period of time. Research has also shown that animals kept in socially and physically impoverished conditions tend to develop rigid, unvarying behaviour patterns (stereotypic behaviour), rather than remaining exploratory and alert to stimuli in the environment. Needless to say, stereotypic behaviour in confined birds is an indication of poor welfare.

How to design exhibit enrichment?

When designing an exhibit with enrichment for birds, one of the most important factors to consider is the species' natural history and its biological requirements. The zoos should also see that whether the bird is a predator or a prey animal. The same should be housed separately.

What are its feeding strategies?

Whether the birds live in large colonies or single?

Whether the species of bird housed will tolerate other species and if so, which species?

Is it capable of flight or has it lost the ability?

Does the birds spend time in or near water?

With the above few questions that one might ask while planning an exhibit. With this in mind one can begin to construct an exhibit best suited for a particular species.

When dealing with pre-existing exhibits, providing new enrichment may be more challenging than building it into a new exhibit. It is important to look at the birds as individuals and how they acclimatize to their environment in the wild. Providing flying birds

with perches at varying heights, widths and lengths is a good place to start. Potted plants and trees can be used for this purpose. They also can be used as screening from the sun, inclement weather and conspecifics. A variety of substrates such as sand, peat moss or dirt can be offered for birds that take dust baths. Water is also an important element to be considered. Pools or shallow pans can be provided for birds that bathe in water. Sprinklers can also be run periodically in the exhibit or the birds can be misted by hand. Providing enough space and areas to retreat is also essential, especially when dealing with mixed species exhibits.

Nest construction can be a time consuming project for birds during the breeding season. A variety of nesting sites and features such as nest boxes, logs, mud flats, platforms or burrows that can be built into the exhibit can promote natural nest building or excavating behaviour. The time spent and experience of building a nest or excavating a nest log may be essential for successful breeding. Nesting material like twigs of various sizes, green grass, dry grass, dry and green leaves, hollow wooden logs and nesting platforms should be provided before the onset of the breeding season to give the birds the opportunity to perform the natural behaviour of preparing the log for nesting.

Enhancing a bird's living quarters is only one aspect of a successful enrichment programme. Utilizing the components of a bird's daily diet offers a number of additional enrichment options.

A. Pheasants and allies – The galliformes

The order Galliformes includes all pheasants and partridges under one family Phasianidae, which is the largest family in Galliformes comprising of around 155 species from the Old World. The members of this order constitute a diverse group of small to large terrestrial birds, primarily ground-dwelling with squat bodies that are large in relation to the head, bill, short neck, wing and tail. In most the species, the males are usually larger than the females and possess brilliantly colored plumages in comparison to females which have drab plumages. Most of the species are fairly sedentary and use more or less the same habitat throughout the year and rarely disperse for different activities like nesting or feeding. The daily habits of phasianids generally follow a simple pattern involving a round of feeding after emergence from the roost, an afternoon latent period and a late afternoon feeding prior to retreating back to shelter. Although, substantial variations are observed in their feeding regimes, their diet primarily includes, seeds leaves, flowers, buds, roots and a variety of animals ranging from invertebrate larvae to small reptiles.

Most of the phasianids are quite adaptable and quickly acclimatize to captive conditions and also survive for reasonably longer periods of time, provided some of their basic

requirements are met. A few basic amenities that most the phasianids require in order to survive the captive conditions include:

1. The locations and orientation of the exhibits are chosen so that they face east and daylight is on the enclosures.

2. Pheasants being exclusively terrestrial birds need dry sandy areas to dust bath; an activity for feather maintenance which serves to soak up excess moisture and remove parasites that infest the feathers. The ground covering has to be soil or sand, with proper sloping to enable easy draining of water. Persistent dampness inside the enclosures has to be avoided under all circumstances.

3. The exhibits have to be designed so that they provide maximum ground space for the birds. Basic shapes like square and rectangular enclosures provide maximum surface area for the birds. The size of the enclosure depends on the number of the birds that have to be housed, however, while designing care has to be taken so that each pair gets at least 5-6 sq.m. enclosure space.

4. Having indoor pens attached to the outdoor exhibits, measuring around 2 x 2 x 2m high is also optional, in events of inclement weather or special situations when birds have to be separated for a while. Indoor pens have to well-ventilated and can have concrete flooring with proper sloping. Additional openings in the roof to allow sunlight can also be considered as an option with a provision to close it whenever required.

5. The enclosures can be constructed adjacent to each other with doors connecting the enclosures that permits keeper movement and at the same time allows shifting of birds from one pen to another, without having to handle the birds.

6. The enclosures have to be rodent proof which can be achieved by the use of appropriate fencing material. The recommended fencing to render the enclosure rodent-proof being galvanized chain-link mesh with an eye gap of not more than half an inch (1.25cm). Although, use of such mesh hinders the visibility to certain extent, in the long run it's a worthy trade-off in return for more healthier and breeding birds. The visibility of the enclosure can be accentuated by painting the fence with darker shades of colour like black.

7. The enclosures should have lot of vegetation which adds to the aesthetic look of the enclosure and at the same time offers areas for concealment to the birds. Roosting sites and perches have to be provided in the enclosures at various heights to encourage the birds to use them at dusk.

The above mentioned recommendations have to be considered and followed while dealing with any member of the phasianid group, however, there are certain variations with regard to the housing and other aspects like, nest sites, additional cage furniture that has been considered while dealing with certain species which will be explained in the following section. The following examples of this section present an account on the various aspects of the husbandry and environmental enrichment for phasianids housed at Sri Chamarajendra Zoological Gardens, Mysore.

All phasianids should be housed in outdoor aviaries constructed using chain-link mesh measuring 7.3 x 4.6 x 4.3m, with soil as ground cover. The use of chain-link mesh with a larger eye-gap had resulted in rodent infestation of the enclosures and further the rodents feeding on the diet of the birds and also defecation in the feeding trays which would increase the risk of potential health hazards. The rodents would even destroy the eggs and would also occasionally predate on the newly hatched chicks. The enclosures lacked shelters and hide-outs for the birds and also lacked vegetation. Wooden logs shall be used inside the enclosures as perches which conversely served as refuge for rodents in the enclosure (Figure 1). At Mysore zoo, abnormal and stereotypic behaviour of pecking was observed among adjacently housed pheasants. The enclosures also lacked appropriate nest sites and roosting sites for the birds (Figure 2).

In an attempt to increase the well-being of the pheasants and simultaneously to enrich their enclosures, following measures and modifications were implemented.

Exhibit enrichment

The exhibit should have been provided with wooden logs as perches. These may range in height from size of the aviary, preferably of 1.8m. to 2.5m. It should be ensured that multiple levels of perching grounds are available for the birds. These logs also serve as roosting grounds during night. Bamboo mats shall be used to tie as partitions between enclosures to a height of four feet (1.20m) or more. These mats serve as visual barriers and also serve to prevent the interaction between adjacently housed pheasants (Figure 3). Bamboo grasses and other foliages may be planted inside the enclosure along the side walls of the enclosure which shall also serve as hide-outs and at the same time offer areas for concealment for the pheasants in events of extreme public disturbances and mate aggressions.

Wooden platforms measuring 1.2m x 1m wide may be provided inside the enclosure at about 0.6m above the ground level. The platforms could be covered from the top and on the two sides and shall be positioned at the farther end of the enclosure, away from the viewing areas. These serve as nesting sites and also offer privacy to the pheasants (Figure 4). The platforms covered with hay which serve as nesting material. Multiple

platforms provided at various heights so that the birds get an opportunity to choose their preferred nesting site. Pheasants being exclusively terrestrial birds need dry sandy areas for dust bath; an activity for feather maintenance which serves to soak up excess moisture and remove parasites that infest the feathers. Areas with dry and loose soil mixed with small amounts of ash shall be provided for the pheasants for dust bath. The enclosure may be covered with half-way through using metal sheets at a height of 2m to prevent dampness inside the enclosure during the rains (Figure 5).

The tragopans are elevated nesters and they prefer nest sites that are located high up in the enclosure. A tree stump was added to the Satyr tragopan exhibit measuring around 4m high and was positioned away from the viewing area. A bamboo basket was placed on the top of the stump and was filled with hay and dried leaves as nesting material. It was covered from the top to prevent rainwater from entering the nest (Figure 6). An additional nest was also provided that was again a bamboo basket tied to one corner of the enclosure. The tragopans were found to be using the nest appreciably and further, during the breeding season, the eggs were laid in the elevated nest and not in the nest site provided down below.

Dietary enrichment

The feeding regime of the avian residents at the zoo follows a pattern which involves feeding the birds twice a day; once during the late morning and the second round during the late afternoon.

Considering the natural behavioural repertoires of most of the birds housed at the zoo, it can be noted that in the wild conditions the birds have access to a wide variety of dietary components. As already mentioned, phasianids' feeding cycles are in early mornings and late afternoon. Our primary intention prior to planning dietary enrichment was to mimic natural feeding cycles, increasing their foraging time and also to encourage the use of more enclosure space.

Leaf litter was scattered on the enclosure floor and food grains were dispersed among the litter. A portion inside the enclosure is also being used to cultivate grains and cereals. A mesh guard is being used to protect the seedling from the pheasants (Figure 7). This ensures that pheasants have access to seedlings only when they are sufficiently grown. Fish meal, liver function enhancers and vitamin supplements have been included in the diet. Live insects like termites have been included in their diet and these are being offered on a regular basis. This serves as a protein supplement and also mimics their natural environment where they forage for insects, thus arousing their interest in feeding and also increasing their activity.

B. Parrots and allies – The psittaciformes

Birds in captivity are predisposed to show deviations in their physical and psychological well-being when they are deprived of the basic amenities. Although being quite sensitive birds, psittacines can be successfully kept and bred under caged conditions provided the physiological and the psychological needs of the species in question are taken care of. Listed below are some of the basic requirements that have to be considered prior to housing parrots and allies.

1. Site selection and preparation for outdoor aviaries has to carefully planned taking into consideration the direction of the morning sun, primary direction of wind and rain in order to maximize protection for the birds.

2. The enclosure housing psittacines has to be considerably large with more emphasis on depth, rather than length or height and should provide enough space for the birds to exercise and to display their normal behaviour. In general, the larger the size of the enclosure, the better (Table 3).

Table 3. Recommended minimum sizes of the enclosure

Species	Enclosure dimensions (height x width x depth)
Large macaws	12'x8'x15'
Large cockatoos, medium macaws	10'x6'x12'
Amazons, African grey parrots	8'x6'x12'
Conures	6'x6'x8'
Cockatiels and small conures	4'x4'x6'
Lovebirds and budgerigars	2'x2'x2'

3. A typical enclosure is one that will have an outdoor area attached to an indoor facility which serves as a refuge to the birds during inclement weather. The enclosure should be properly drained, so that there is no water clogging during rain or following cleaning.

4. The mesh used for the construction of the enclosure should not allow the entry of rodents into the enclosure, the preferred fencing material being, 10-14 gauge galvanized chain-link mesh with an eye-gap of not more than half an inch (1.25cm).

5. The enclosure should have wooden perches which are rough textured, non-toxic, preferably unprocessed of variable diameters and positioned at varying heights inside the enclosure. They must be secured properly and should serve as an optimal site for copulation. The number of perches inside the enclosure should just be sufficient for the birds and should not interfere with the flight of the bird.

6. Multiple nest boxes have to be positioned inside the enclosures. The nest boxes have to be shielded from direct sunlight and rain and should contain comfortable bedding material.

7. The enclosures should have lot of vegetation that would add to the aesthetic looks of the enclosure and would also serve as hide-outs for the birds.

The aforesaid criterions are some of the preliminary necessities which all enclosures that house psittacines should possess. However, there are certain species-specific variations that have to be considered.

The given examples have been found suited with requirement of macaws, cockatoos, conures, African grey parrots, lories and lorikeets, toucans and turacos.

Exhibit enrichment

The first step towards enriching the enclosures was to reduce rodent infestation of the enclosures, which was achieved by revamping the enclosures using appropriate fencing material, following which other parameters were considered to be worked upon. New feeding platforms were constructed and were fixed in the indoor areas to protect the feeding trays from rain (Figure 8). Unprocessed coffee tree branches and *Casurina* poles were added as perches inside the enclosure. Perches of varying diameters were selected and were positioned at various heights in the indoor and outdoor areas of the enclosure (Figure 9).

The perches were so placed that they do not hinder the flight of the birds and away from the feeding platforms to prevent excrement contamination. Horizontal trapezes were added as additional cage furniture to increase the activity among the birds.

Species appropriate nest boxes were made and fixed in the indoor areas to shield the nest boxes from rain and sun. The nest boxes were made using hard wood and lined with metal sheets to protect it from chewing damage (Figure 10).

Positioning of the nest box is an important factor in that it should provide optimal level of stimulation to the birds to occupy the nest box; some birds like cockatoos and parakeets prefer nest boxes that are placed upright, while others like macaws and lorikeets prefer nest boxes fixed at an angle (Figure 11). Soft wood shavings was used as nesting

material, in addition to which wood chips were added to encourage the bird to chew and make their own nesting material.

Dietary enrichment

Feeding regime plays a very important role in the health of captive birds. In the wild, birds have access to a wide range of foods that vary from season to season. A captive diet that has been arbitrarily formulated, unbalanced and that is predictable can cause a major harm to the well-being of the birds.

For better understanding of the dietary requirements of the birds, a good knowledge regarding the feeding behaviour of free-ranging conspecifics is required. Prior to planning to dietary enrichment for psittacines, our main goals were to induce more activity among birds, increase foraging time, formulating a diet that meets the nutritional requirements of the birds and simultaneously offers the birds an opportunity to exercise their natural behavioural repertoires. It should also be noted that, in the wild psittacines forage on a varied diet including fruits, flowers, buds, seeds, grains, roots and even some insects and their availability is essentially seasonal. These variable diets across seasons also influence their reproductive cycles, hence provision of a diet that provides necessary psychological stimulation to the birds is necessary for healthier and breeding birds.

In order to encourage food processing abilities among the birds, whole food was offered instead of chopped food. Dry foods like groundnuts was scattered on the cage floor to simulate natural foraging conditions. Whole corn and cuttlefish bone was tied at various places in the enclosure, this encouraged the birds to exercise their manipulative skills and the latter one also served as supplemental source of calcium.

C. Water birds and allies – pelicaniformes, anseriformes and others

Anseriformes

At the Mysore zoo, birds belonging to the orders Anseriformes like ducks, swans and geese and Pelecaniformes were being housed in large aviaries and in mixed species exhibits. These enclosures were severely infested with rodents. The rodents would feed on the diet of the birds and would also defecate in the feeding trays and would also predate on the newly hatched chicks. It was observed that certain species of ducks like the Muscovy ducks (*Cairina moschata*) were prolifically breeding in these exhibits and hence were present in excess numbers, thus depriving other birds from space and also preferred nesting sites. Due to the lack of a separate feeding area, the greens and the vegetables offered to these birds were scattered in the pond, which would further disperse in the pond, thus causing accelerated algal growth.

As the mesh used in the construction of the exhibit was not in accordance with the desired specification, the enclosure was repaired to cover-up all possible entry points in the enclosure to render the enclosure rodent free. Regular trapping of rats inside the enclosure using rodent traps and flushing of rats from their burrows using high-pressure water have also been initiated to control rodent populations inside the enclosure. A feeding pond has been constructed with separate drain channel to enable easy feeding and cleaning of the feeding pond regularly. Species appropriate nest boxes (Figure 12) have also been installed for ducks that are tree-hole breeders like the Carolina wood duck (*Aix sponsa*) and Mandarin ducks (*Aix galericulata*).

Pelicaniformes, Ciconiiformes and allies

Pelicans, storks and other birds like herons, spoonbills, and ibises etc. have been housed in mixed species exhibits. Elevated nest platforms (Figure 13) have been provided for Grey pelicans (*Pelecanus philippensis*) and storks and, low-level nest platforms (Figure 14) for pink pelicans (*Pelecanus onocrotalus*) have also been provided. Small sticks, branches and hay are always scattered inside the enclosure to encourage the birds to select their preferred nesting material.

Future approaches

Revamping of the old enclosures using earlier mentioned fencing materials to render the enclosures rodent free. Usage of rodent proof feeding trays that prevents rodent access to the food items, thereby reducing the risk of infections and thus ensuring that the birds get their share of the diet. Increasing the number of nest sites and hide-outs inside pheasant enclosures and covering them with dried hay during all seasons is necessary so that the birds get habituated to using the nest sites. Facilities like small enclosures would be helpful to keep surplus birds that breed prolifically like budgerigars, Java sparrows etc. Installation of mist-makers in parrot and ratite enclosures would encourage them to play in water and would also serve to cool the heat during summer.

Ostriches and other ratites have been housed in large yards which do not have service routes. This presents a problem during the breeding season when these birds become extremely aggressive and territorial and any attempt to enter the enclosure during such seasons might prove to be dangerous. To avoid such encounters with the birds during such seasons, provision of service routes that offer safe access inside the enclosure is a need. Such service routes make cleaning and feeding easier and also provide safe means of collecting the eggs from the enclosure, if circumstances allow us to do so. And these enclosures need places that offer shelter and hide-outs to the birds during the rains and also suitable, secluded and sheltered places for egg laying and incubation. We are also

planning on installing nest box cameras and data loggers inside nest boxes so that the activity of the birds can be monitored in a less stressful manner and also some of the important and obscure behaviours of these birds, incubation patterns and maternal behaviours can be documented. Live screening of such feeds in front of the respective bird enclosures would also serve as a means of educating people, increase awareness and further contribute to the conservation of the species. Some futuristic designs planned for psittacine and ratite enclosures are described in Figure 15 and Figure 16&16.a.

Creation of more mixed species exhibits that serve to manage excess birds and is also aesthetically welcoming. Housing different species together can provide enrichment for many birds but may also create problems. It is important that each species has its own feeding station and areas to retreat from the other birds. Newly introduced birds should be closely monitored for any signs of aggression towards or from cage mates. It may become necessary to separate birds if serious harassment occurs. The following section in brief lists the various strategies employed to enrich the lives of birds in captivity.

Concise strategies towards environmental enrichment for birds

Exhibit enrichment

1. Areas that promote free flight
2. Variety of perching sizes and locations (re-perching periodically can stimulate activity) and sunbathing perches
3. Live plants
4. Plant trimmings for shade, screening and rain cover
5. Water features: pools, running water, sprinklers, etc.
6. Sand for dust baths
7. Nest boxes, logs, platforms, burrows, etc.
8. Multiple feeding stations
9. Areas for escape from aggressive cage-mates or other species in mixed exhibits

Dietary and social enrichment

1. Live insects like crickets, termites, mealworms etc.
2. Whole food instead of chopped food
3. Several feedings throughout day (unpredictable times)

4. Scattered feeding
5. Nesting material
6. Group exhibit for colonial animals
7. Mixed species exhibit
8. Recorded vocalizations of same or similar species

Safety considerations

1. Nesting material
2. Plants or parts of plants may be toxic to some animals
3. Dietary enrichment can lead to weight gain if not properly managed
4. Birds may become aggressive toward each other in mixed species exhibits
5. Birds can choke on large pieces of food
6. Live insects such as mealworms have been known to bite small birds that swallow them; whole worms should be killed before being offered to small birds
7. Foreign items, (pieces of toys, bedding material, etc.) if ingested, can cause impaction.

Conclusion

The American Zoo and Aquarium Association (AZA) define enrichment as:

"a process for improving or enhancing animal environments and care within the context of their inhabitants' behavioral biology and natural history. It is a dynamic process in which changes to structures and husbandry practices are made with the goal of increasing behavioral choices available to animals and drawing out their species-appropriate behaviors and abilities, thus enhancing animal welfare"

The enrichment plans at a zoo should be designed and executed so that higher standards of animal/bird welfare can be maintained and the animals/birds can remain healthy and live in near naturalistic conditions exhibiting a wide array of behaviours. Environmental enrichment instigates the animals to interact with their environment. This can be achieved by modifying animal exhibits, change in the feeding patterns, changing the way food is presented and ensuring proper housing of animals. Environmental enrichment also lessens boredom and reduces the display of abnormal behaviours. Initiatives should also be taken to extend the enrichment programme to all animal enclosures with an ultimate aim to provide the best possible home for animals/birds that are housed in *in situ* habitat.

Fig. 1: Pheasant enclosure pre-enrichment.

Fig. 2: Lack of visual barriers enabling the pheasants to interact with adjacently housed species.

Fig. 3: Visual barriers among adjacently housed pheasants.

Fig. 4: Multiple wooden platforms inside the enclosure to serve as nesting sites.

Fig. 5: Enclosure covered with half way through using metal sheets at a height of 2m to prevent dampness.

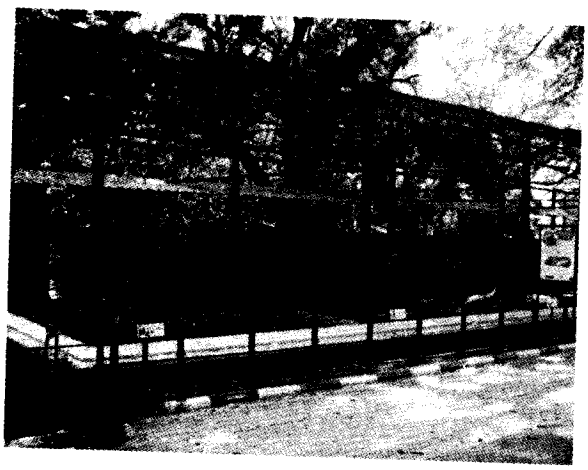


Fig. 6: Elevated nest sites for Satyr tragopan.

Fig. 7: Mesh guard to protect the seedlings form the pheasants inside the enclosure.

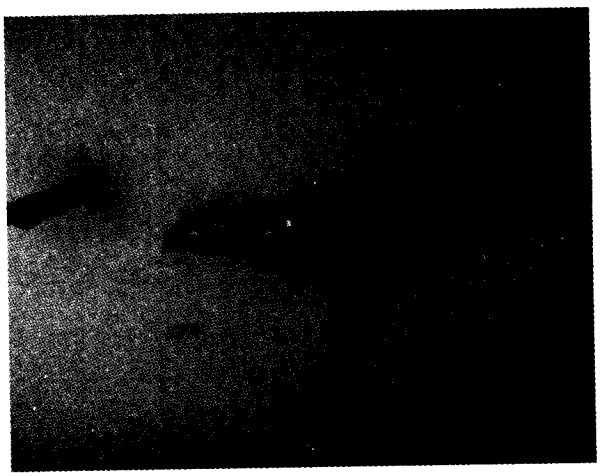


Fig. 8: Feeding platforms with trays in psittacine enclosure.

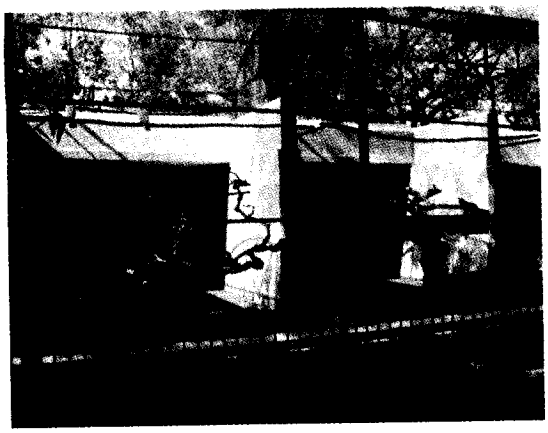


Fig. 9: Perches in psittacine enclosure at Mysore zoo.

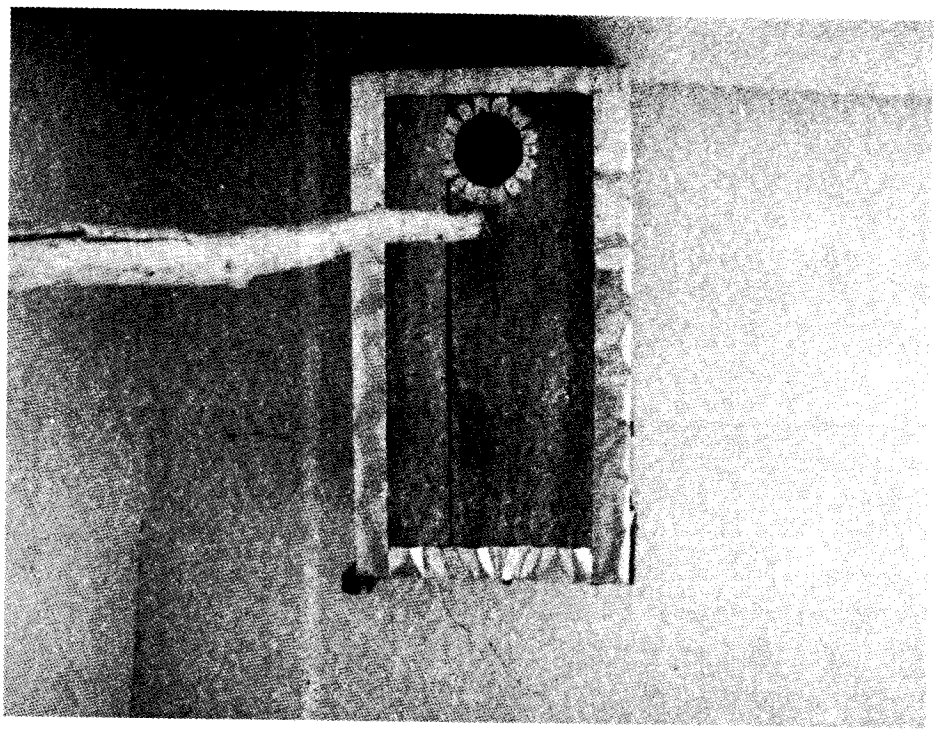


Fig. 10: Cockatoo nest box lined with metal sheet to prevent chewing damage.

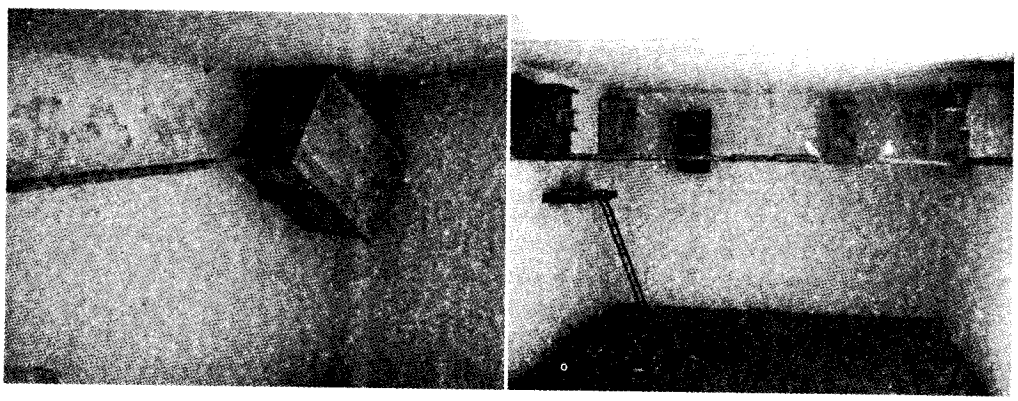


Fig. 11: Alignment of nest boxes in Psittacine enclosures:
left – macaw; right – ring-necked parakeet.

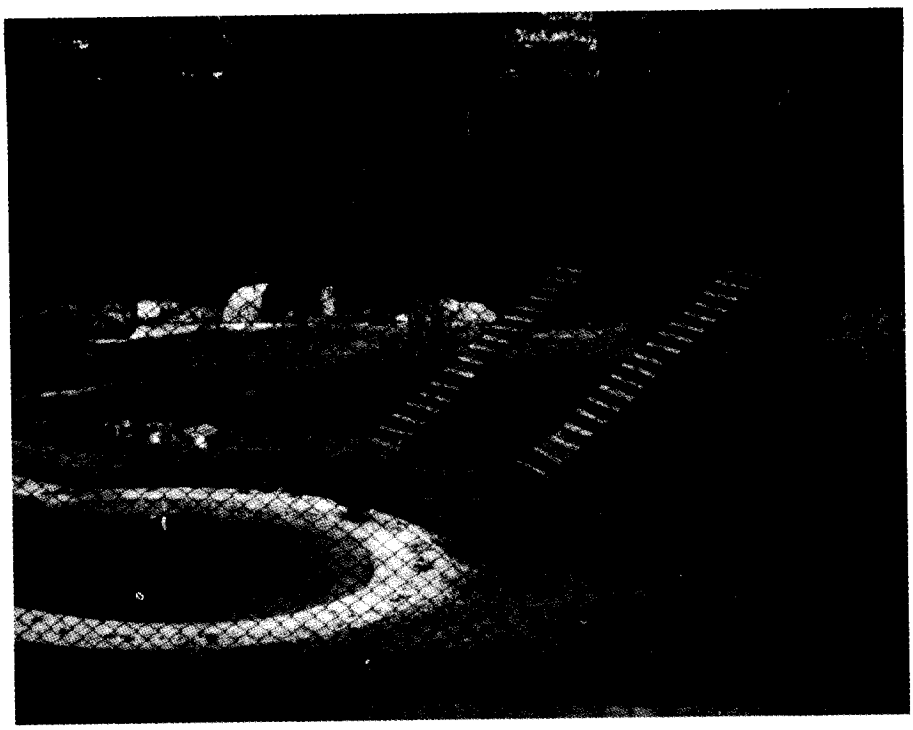


Fig. 12: Nest boxes for Wood ducks.

Fig. 13 & 14: Nesting platforms in free-flight aviaries for large water birds:
Left – elevated platforms for storks, pelicans etc.
Right – low-level platforms for pink pelicans.

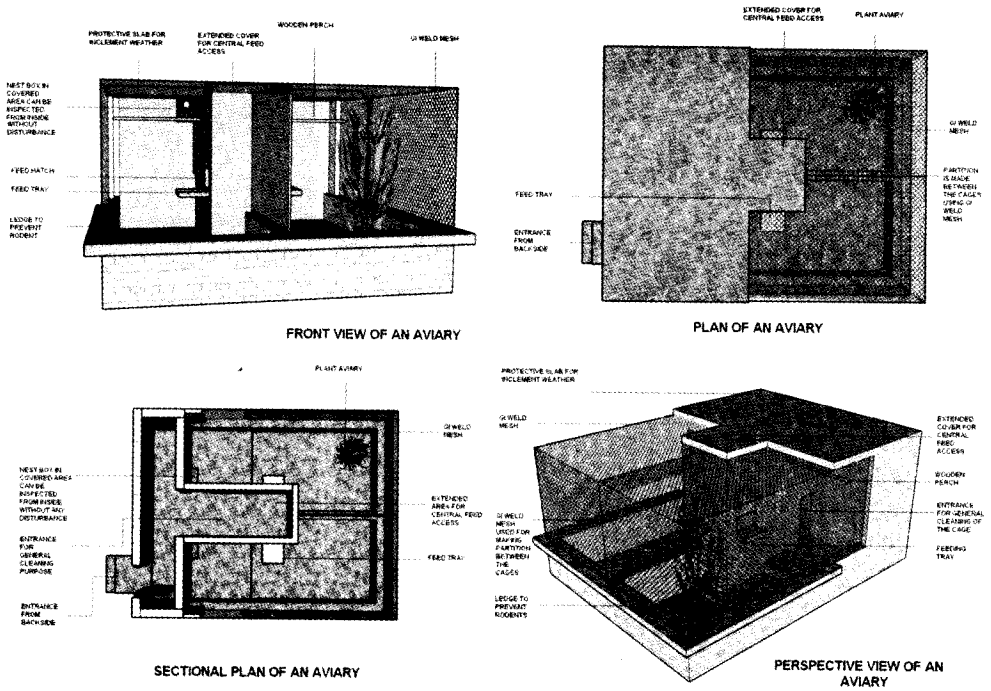


Fig. 15: Futuristic design of an aviary that can be used to house Psittacines, Ramphastids etc.

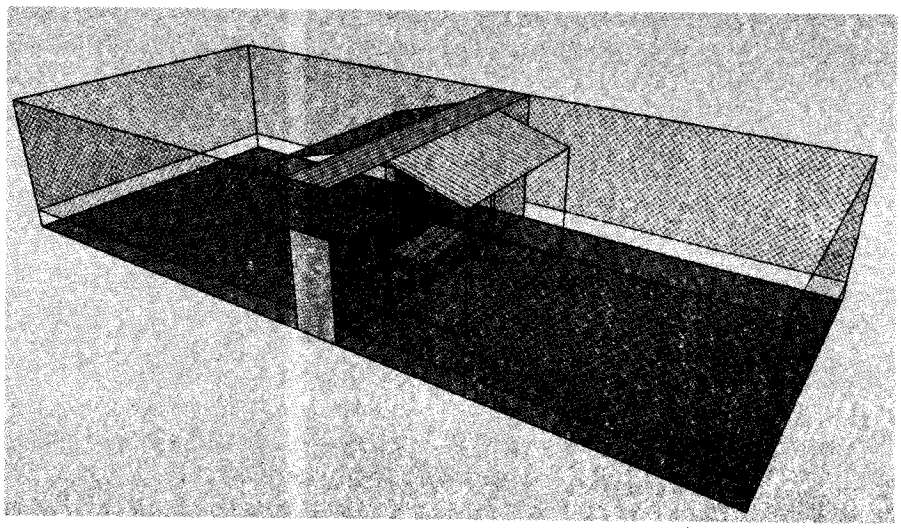
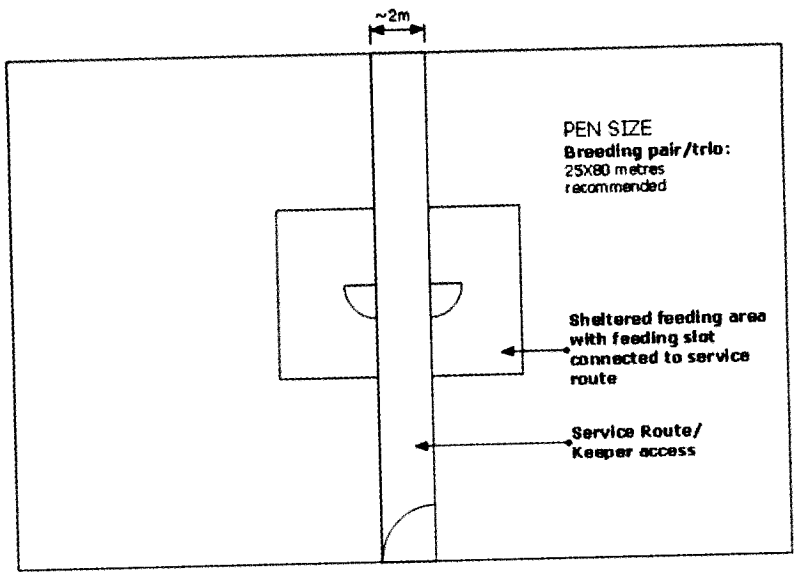
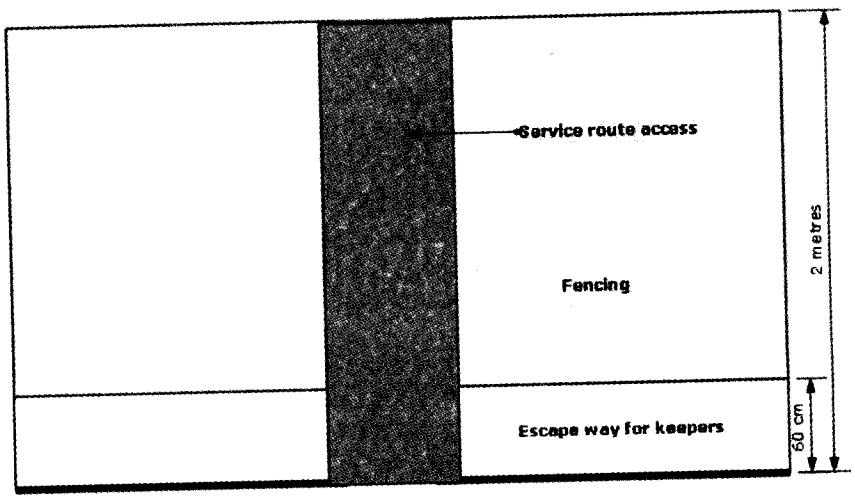


Fig. 16: Ostrich enclosure design.



LAYOUT FOR OSTRICH PENS



ELEVATION FOR OSTRICH PEN

Fig. 16.a: Plan for ostrich enclosure.

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EFFECT OF FEEDING ENRICHMENT ON BEHAVIOUR OF CAPTIVE TIGERS

Arun Kumar Mishra[1], Bhikari Charan Guru[2] and Ajit Kumar Patnaik[3]

Abstract

Environmental enrichment is any modification in the environment or husbandry of the captive animals that seek to enhance its physical and psychological well-being. The current study aimed to evaluate the effectiveness of feeding enrichment in promoting more natural behaviours in captive tigers. During the study, behavioural data were obtained by direct observations with instantaneous sampling in pre-enrichment, enrichment and post-enrichment periods for 20 tigers during the period from June, 2009 to April 2010 at Nandankanan Zoological Park, Odisha, India. The results indicate that deskinned chicken enrichment can be used to decrease stereotypic behaviour and increase explorative behaviour in captive tigers.

Introduction

In zoos, stereotypic behaviour patterns that are invariant in style, performed repetitively and appear to have no function (Mason, 1991a), are arguably the most problematic and poorly understood of behaviours. They are of concern primarily because they may indicate poor past or current welfare (Mason 1991b). They may be detrimental to an animal's health (Meyer-Holzapfel, 1968) and species conservation efforts. Environmental enrichments have been shown to reduce stereotypic behaviour (Young, 2003). Environmental enrichment can be defined as the provision of stimuli that provide the opportunity to express species-typical behaviour and mental activities, while addressing the animals' needs. Fundamental aims of enrichment frequently include that it should increase behavioural diversity, reduce abnormal behaviour and encourage wild-type activity patterns (Mellen and MacPhee, 2001). Enrichment studies not only contribute to animal well-being, but promote reproduction by reducing stress and improving behavioural competence (Carlstead and Shepherdson, 1994). It may be helpful for successful propagation of endangered species from captive-born offspring to normally breeding adults, which might at some point in the future be tapped as a source for reintroductions into the wild. Therefore, maintaining behavioural diversity of endangered genetic diversity in captivity is an important goal. The aim of this study was to examine

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whether food enrichment have effect on stereotypic behaviour. The period of the study was from June, 2009 to April 2010. We predicted that introduction of food enrichment would decrease the levels of stereotypic behaviour and elicit more explorative behaviour. In general we were expecting these experiences to be useful for those persons who are in charge of taking care and provide welfare to animals in captivity.

Material and methods

Subjects of this study were 20 captive tigers (*Panthera tigris tigris*), consisting of 14 female (11 adults, one sub-adult and two cubs) and 6 male (5 adults and one sub-adult) tigers. Except cubs or sub-adults which were housed together with their mother, the rest 16 adult tigers were housed individually. Six individual tigers and the group of two sub-adults and her mother were housed in their respective seven enclosures each having an area of approximately 1,500 sq. m. Other eight tigers and the group of mother and her two cubs were housed in nine enclosures each having an area of approximately 350 sq.m. Each of these enclosures contain one or two water holes, a feeding cubicle, and some trees and bushes. The ground was covered mainly with soil, small patches of grass, and the enclosure was surrounded by a 3m high chain-link fence except visitor viewing area of about 30m. During the course of the study, the adult tigers received 12 kg of buffalo meat according to conventional schedule of once-daily feeding (except a weekly fasting day i.e., Monday; data not shown in the study) in the afternoon. During enrichment days tigers were given with 2 kg of deskinned chicken hanged inside the enclosure at different heights of about one to two meters. Total daily feeding on enrichment days was maintained constant i.e., 10 kg of buffalo meat and 2kg deskinned chicken. Enrichment items were placed in the enclosures at the same time each day. The experimental schedule consisted of three observational periods; pre-enrichment observations (baseline/no enrichment), observations with enrichment treatment (provision of deskinned chicken) and post-enrichment observations. In each observational period nine days of behavioural observations were carried out by instantaneous behavioural sampling (Altmann, 1974) at 10 minute intervals from 08:00 to 18:00 for individual tiger, using data sheets and a stop watch. During the study, a total of 32400 observations (N=20 tigers) i.e., 540 observations in each observational period for individual tiger and 1620 observations for individual tiger in three observational periods, were obtained. Behaviours of interest were predetermined and divided into three major categories; explorative (aggressive, alert, biting, carry, clawing, climbing, cooling, dragging, drinking, feeding, grooming, jumping, playing, running, scent marking, walking, stalking, and smelling), resting (resting-awake, laying on back, roll-over, yawning, sitting and sleeping) and stereotypic (pacing). The frequencies of these behaviours were converted to proportion of time spent in that behaviour, which were compared to analyze the behavioural response of each tiger.

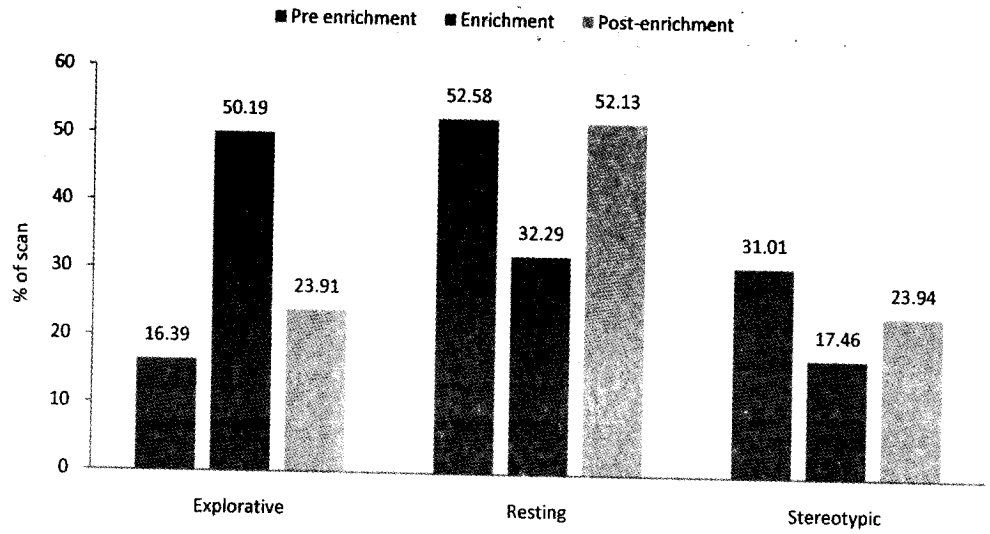

Fig.1. For captive tigers, mean time spent in three behavioural categories during pre-enrichment, enrichment and post-enrichment period.

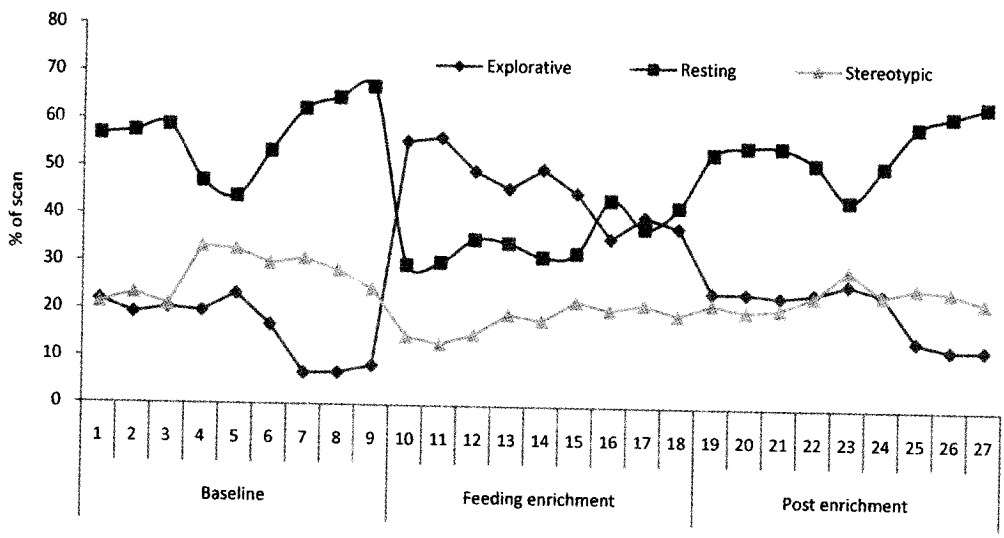

Fig.2. Pattern of time allocation in different behavioural categories during three different periods of experiment.

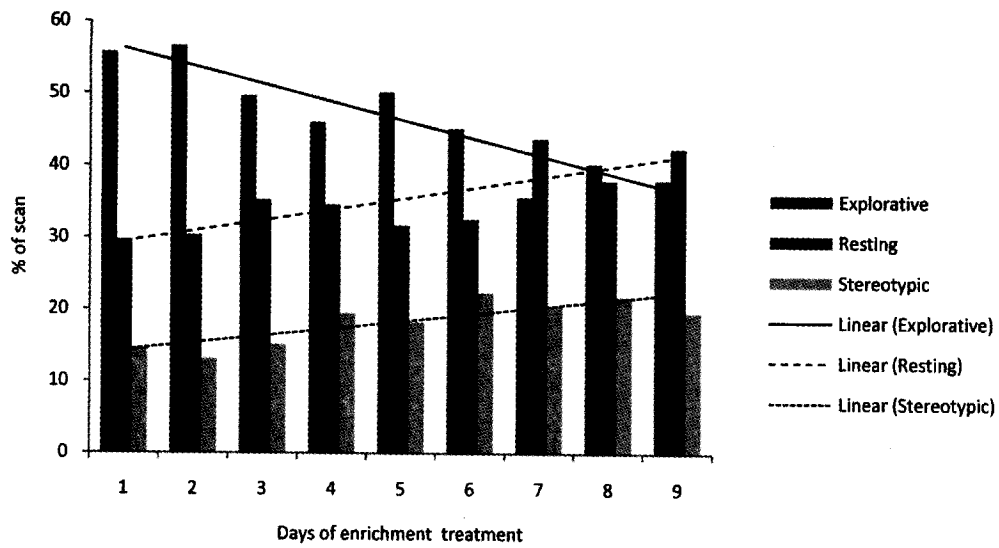

Fig.3. Time allocation in different behavioural categories with linear trend lines showing average increase or decrease with respect to successive days of enrichment treatments.

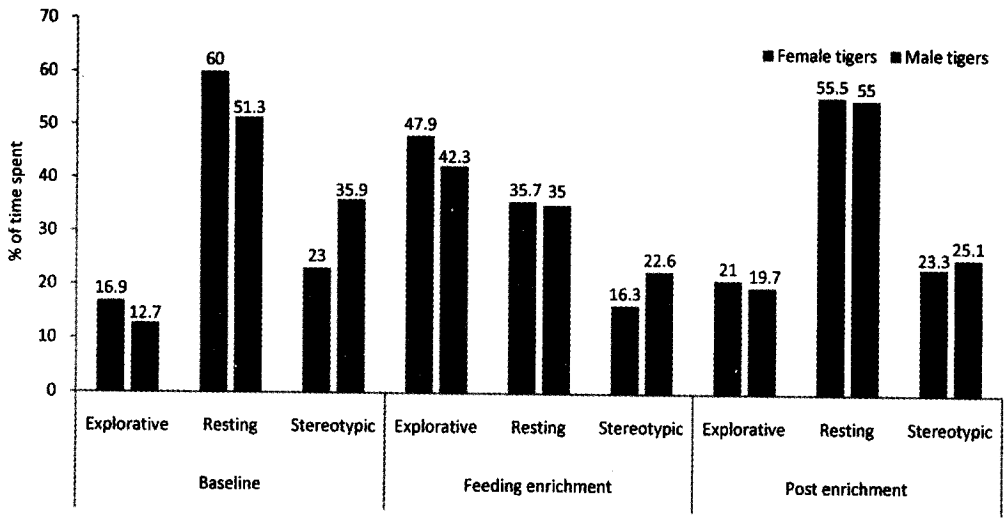

Fig.4. Comparison of behavioural response to feeding enrichment between female and male tigers in captivity.

2010). In this study, increased explorative behaviour and decreased resting and stereotypic behaviour were observed during enrichment days in comparison to the baseline observations. The increase in explorative behaviours constitutes a reaction to the physical addition of the enrichment, but the changes in stereotypic behaviour, used in part to monitor welfare (Bashaw *et al.* 2003). Besides, this study provides an example of the importance of evaluating the long-term effects of enrichment, leading to habituation to the enrichment item. In addition to studying the reaction of an animal to the enrichment procedure or device when it is present, evaluation of behavioural changes that occur in the animals' overall activity budgets is also important.

Appetitive behaviours make up a large portion of the behavioural repertoire of wild felids. The majority of the activity of wild cats revolves around obtaining food (Schaller, 1967 and 1972; Dierenfeld, 1987) and they seem to be strongly motivated to perform appetitive behaviours (Shepherdson *et al.* 1993). Even through large open air enclosures with wildish appearance are provided to the captive tigers at Nandankanan Zoological Park, they have no prey population to attack and kill unlike that natural forest ecosystem. Organisms in an ecosystem are linked together in food chain, but in zoo this definite and systematic food chain is lacking due to the dependent substituted food supply. Therefore, supplying food in a novel way in order to complicate the acquisition of nourishment and to increase the time that the animal must devote to its search or consumption can increase natural foraging behaviours. Part of the regular diet can be incorporated into these enrichments, or this can be in addition to the regular diet, which can be scattered, hanged or hidden in the enclosure.

The normal presence of the keeper does not affect the activity of tigers but animal keeper with food trolley significantly induces increase in the restlessness and aggression among tigers which continues until the food was given (Mohapatra *et al.* 2010). A holistic approach to enrichment needs to be integrated into the way a keeper approaches their daily routines. This approach requires caretaker of the animals to have a basic understanding of the animal's natural history, including social structures, feeding habits and activity budgets. Considering the animal's life as a whole, the caretaker can have a better understanding of how to make the animals life more enriched by integrating enrichment into their daily routines.

Conclusion

In order to motivate the development of natural behaviours and minimize or even avoid unwanted or stereotyped behaviours (e.g. pacing in zoos), it is of great importance to implement feeding enrichment for captive tigers. It can provide the opportunity to express species-typical behaviour and mental activities addressing the animals' behavioural

needs. A holistic approach to enrichment needs to be integrated into the daily routines of captive tigers. This approach requires the caretakers to have a basic understanding of the animal's natural history, including feeding habits, behavioural need and activity budget.

Acknowledgements

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If there is a need, volunteers may be sent to zoos/facilities in the same city or another city for orientation for the best exposure.

3.3. Time commitment

Volunteers must work based on their time commitment schedule, decided by the zoo volunteer programme co-ordinator in consultation with them.

4.0. BENEFITS TO VOLUNTEERS

4.1. Special awards and certificates of participation

A zoo volunteer who has rendered service at least 30 days during a period of one year will be granted a certificate of participation.

A zoo volunteer who has been active for two or more consecutive years and who has rendered exemplary and exceptional service to the zoo may be granted a special award. A committee shall be constituted to award certificates/recognition to eligible volunteers.

4.2. Payments to volunteers

Volunteering is an opportunity for people to give their time, energy and skills. Volunteers are entitled to out-of-pocket expenses for their volunteering activities. When someone incurs expenses as a direct result of his or her volunteering activities, he or she should be reimbursed. Outof-pocket expenses for volunteers may include:

- travelling expenses to and from where he or she is working as a volunteer
- other subsistence costs e.g., food and drink
- expenses related to any special clothing and/or tools
- expenses involved in training

Organizations should ensure that they do not pay volunteers expenses at a flat rate, regardless of the actual expenses incurred because such a practice greatly increases the chance that the relationship will fall within the scope of regular employment. Payment of out-of-pocket expenses to a reasonable level is legitimate. Organizations should:

- produce detailed guidelines on expenses;
- provide all volunteers with information about claiming out-of- pocket expenses; and
- budget for volunteers' expenses.

4.3. Volunteers' out-of-pocket expenses

The quantum of volunteer fees that a zoo should provide is limited to the prevailing schedule of rates for unskilled workers and travel costs involved in travelling from the place

of residence to the zoo by public transport. If food/meals are given to a volunteer, the actual cost may be deducted from the out-of-pocket expenses.

Zoos may also opt for some other suitable staff welfare scheme for volunteers to encourage them and to boost their confidence when they up assignments. A volunteer must sign the Statement of Confidentiality and Organizational Ethics (Annexure II).

5.0. SELECTION/RE-ENGAGEMENT CRITERIA

Recruiting or re- engagement of any applicant or existing volunteer should not be a matter of right if he or she is otherwise eligible. The zoo management shall reserve the right to accept anyone or reject any application without assigning any reason forthe same, considering the sensitive nature of a volunteer's work and the damage that can be caused by an undesirable applicant as he or she get access to all parts of the zoo and animals. Every effort should be made to see that the applicant possesses the right aptitude for the job.

6.0. ZOO VOLUNTEER ETHICS NORMS AND CODE OF CONDUCT

Details of volunteer ethics and the code of conduct have been elaborated in Annexure-III.

7.0. WARNING OF RISK

Despite being careful and proper preparation, instruction, medical advice, conditioning and equipment, there is still a risk of serious injury when providing volunteer services. Understandably, not all hazards and dangers can be foreseen. Volunteers must understand that, depending upon the volunteer services, certain risks, dangers and injuries due to accidents, inclement weather, slips and falls, inadequate or defective equipment, failure of supervision or instruction, zoo premises defects, horseplay, carelessness, lack of skills or techniques and the other circumstances inherent to the particular volunteer services exist. In this regard, it must be recognized that it is impossible for the zoo to guarantee absolute safety.

8.0. WAIVER AND RELEASE OF ALL CLAIMS AND ASSUMPTION OF RISK

Those providing volunteer services will be expressly assuming the risk and legal liability and waiving and releasing all claims for injuries, damages or loss which they may sustain as a result of participating in any and all activities connected with and associated with volunteer services (including transportation services/vehicle operations, when provided). The volunteer will sign a waiver form to relinquish all claims (Annexure IV).

VOLUNTEER APPLICATION FORM

Annexure-I

- Name:
- Father's Name:
- Date of Birth:
- Nationality:
- Address:
- City:
- Home phone and e-mail:
- Mobile phone and work phone:
- Areas of interest:
- Hours of service willing to render (indicate days and months):
- Languages spoken:
- Fluency in languages:
- Previous experience in voluntary service (NSS, NCC, NGO, etc.):

Background information

Have you ever been convicted of a crime other than minor traffic violations? Yes/No

- Offence date:
- Location and fine/sentence:
- Are you currently on probation or on parole or awaiting trial?

Your application is subject to a complete background review including any criminal convictions.

Emergency information (required)

- Name:
- Relationship:
- Home phone:
- Mobile phone:
- Allergic reactions if any:

The information in this application is true and complete, and I have not knowingly withheld any information. I understand that misrepresentation may be cause for dismissal. I authorize verification of all information contained in this application. I understand that as a volunteer at the zoo I will be expected to demonstrate a commitment to uphold the mission of the organization, to maintain an environment of integrity for people and for animals and to focus on customer service, with respect for all employees, volunteers and guests. As a volunteer at the zoo, I agree to follow all zoo guidelines and policies. In addition, I give consent to the zoo for emergency medical attention in the event that I am not able to give consent, and if my emergency contacts are not available. I am aware that the zoo has the right to release me from service at any time, just as I have the right to withdraw from volunteer service at any time.

Signature of volunteer

Date

Note: Please attach resume and certificate of voluntary service from any organization.

Annexure-II

STATEMENT OF CONFIDENTIALITY AND ORGANIZATIONAL ETHICS FORM

I understand that all volunteers must hold zoo information in strict confidence. This obligation of confidentiality must extend to the following areas of concern:

- Copyrighted materials and programs developed and used by the Zoo
- Personnel information
- Donation database
- Financial or operational data
- Any sensitive animal information including escape situations
- Research proj ect information

(Under no circumstances shall the volunteer discuss the above information with anyone, especially the media, unless authorized to do so.)

I agree that the above material is the property of the zoo. I understand that the Director and his/her representative shall be the official spokesperson for the organization. I will neither disclose any information or materials to any persons who are not employees of the zoo nor will I copy or remove the same from the premises of the zoo.

Volunteers shall follow a code of ethics that follows these guidelines:

- Volunteers shall conduct themselves at all times in a professional manner.
- Volunteers are not to capitalize on their relationship with the zoo to further their personal or professional goals or gains, including areas of conflict of interest. These situations include but are not limited to promoting personal business opportunities.

I further understand that violation of any matters listed above may be grounds for dismissal.

I also certify that the information provided on this application is true and complete. False statements on this application shall be considered as grounds for termination. I also understand that this is not a paid position.

Signed

Date

Annexure-III

ZOO VOLUNTEER ETHICS NORMS AND CODE OF CONDUCT

1. Dress code

Since a volunteer is representing the zoo, it is important that the volunteer dress appropriately for zoo activity. It is necessary to wear shoes and protective clothing whenever required and nonrevealing clothing at all times.

2. Identification

Volunteers must wear the photo ID provided to each of them.

3. Customer service standards

Being a volunteer at the zoo means working with the public. Customer service is vital to the success of the visitor's experience and should be considered as the number one priority. If a visitor approaches a volunteer, he/she should always greet the the visitor with a smile and offer assistance. If one cannot answer a particular question from a visitor, he/she should find someone who can or direct the visitor to the Reception Officer at the front entrance. A volunteer should never ignore or be disrespectful to zoo guests.

4. Conduct

The zoo's volunteer programme is highly regarded by staff and volunteers alike and has a reputation for excellence. As a volunteer staff member, a volunteer represents the Zoo and the volunteer programme as a whole. Use of inappropriate language, drugs or alcohol and fighting are grounds for dismissal from the programme. Any disputes or problems should be handled in a calm manner and should be reported to the service or staff supervisor and the Volunteer Coordinator immediately.

Volunteers are important role models and often the most visible representatives of the zoo. Guests learn a lot from their attitude, comments and behaviour. It is expected that a volunteer will behave in a manner that is appropriate to one's position as a volunteer at the zoo.

The zoo should be confident in the professional abilities of all staff, both paid staff and volunteers. Everyone is expected to follow the same basic commonsense rules of conduct that will protect the interests and safety of visitors, animals and the organization. Certain actions and forms of behaviour will not be tolerated and may result in disciplinary action, including dismissal. Determination of appropriate action will take into consideration the circumstances surrounding the incident and the volunteer's overall record.

Disciplinary Policy

Verbal warning

Any complaint from a service area supervisor or other zoo staff member will result in a meeting with the Volunteer Coordinator and a verbal warning being issued to the individual.

Written warning

A second infraction will result in suspension from the programme for a period of time to be determined by the Volunteer Coordinator and Education Curator. A written warning will be filed in the individual's programme file.

Dismissal

A third infraction will result in dismissal from the programme.

Dissatisfied Customers

Occasions arise when a visitor is harsh, discourteous or speaks with a raised voice and is abusive. Volunteers should remain calm and handle the situation without being disturbed or agitated.

- The volunteer should take a deep breath and remember that the visitor is upset and deserves his or her attention.
- He/she must listen to visitors patiently
- To the visitor, a problem is important even if it does not seem so to a volunteer.
- Problems with food products sold in the restaurant or kiosk can be directed to the restaurant staff.
- Problems with animal exhibits and visibility of animals should be explained.
- With problems with zoo infrastructure and facilities, a volunteer may direct visitors to the executing staff.

Lost Person Protocol

In the case of a child that is lost, please find the nearest staff member with a wireless to initiate search protocols. Please be aware that there is also a wireless at the entrance and office. It is important to stay in the area where the child/parent was last seen. Do NOT walk around the zoo with the child/parent looking for the lost person. The staff will look in the park and direct help to your location.

Unruly Guests

These persons could be rude to a volunteer or other visitors, feeding the animals or doing things in the zoo that are not allowed (climbing over exhibit fences, harassing animals, etc.).

- This may be reported to the supervisor or another zoo staff member.
- If the above persons are not available, the receptionist or ticket booth staff member should be informed. Zoo staff members are the best people to deal with this type of situation.
- Unless a person or animal is in immediate danger, such miscreants should not be "reprimanded".

Volunteering Around Children

When assisting with zoo classes or in any other areas of the zoo, the following standards must be maintained at all times:

When working with children in a classroom situation, a volunteer should always keep his/ her voice calm. One should never raise one's voice to a child.

- In a classroom situation, the zoo staff person is the only disciplinarian unless a parent is present. A volunteer should not attempt to discipline a child at any time, either verbally or physically.
- The role of a volunteer is to support zoo staff and to ensure a fun, safe atmosphere for the children.
- Do not touch a child under any circumstances for any reason.
- If a volunteer is on the zoo grounds and witnessing a child doing something which he or she is not allowed to do (climbing over exhibit fences, harassing animals, etc.), the volunteer should tell the parent that the child's actions are not permitted within the zoo. If the behaviour persists, a senior staff member should be informed.

Zoonoses

Volunteers that handle animals do run the risk of acquiring/ transmitting zoonotic diseases. Zoonotic diseases are those which are shared by man and animals. All volunteers who handle animals should adhere to the following procedures.

Volunteers that work in the animal care areas must produce a negative TB test annually.

TB test results should be kept on file in the Volunteer office. Frequent hand washing and disinfecting of the environment is recommended as a way to prevent the transmission of zoonotic diseases.

Media

The zoo management must approve all media communications including interviews and/or article requests. If a volunteer is contacted by local media for an interview regarding the zoo, he/she should notify the Volunteer Coordinator. If approached by a media representative while on zoo grounds, he/she should refrain from answering any questions or sharing his/her opinions on a zoo matter, unless it has been previously approved by a representative of the zoo management. Media requesting information from a volunteer should be directed to the reception at the entrance. Any unauthorized interview or attempt to contact a member of the media regarding any zoo business made by a volunteer will result in immediate disciplinary action, not limited to but including dismissal from the volunteer programme.

Daily Work Routine

Sign-in/-out Procedure

Volunteers will report before the Education/Volunteer Coordinator/ Reception Officer.

1. Upon arrival

The volunteer will enter his or her name, date, service area worked and total hours worked in the volunteer hours book/time sheets located in the Volunteer Co-ordinator's office/ Reception office. The volunteer should sign-in on arrival and sign-out when leaving. From these time sheets, the staff can compile monthly records of all volunteer service areas. Signing in when the volunteer arrives at the zoo enables the staff to locate him/her in the event of an emergency.

The volunteer should check the bulletin board for updates/new information and then go to the assigned work area.

2. Before departing

Volunteer should check the schedule for any changes.

3. Protocols in case of illness or inability to work

In the event when a volunteer cannot come to work scheduled for him/her, the Education/ Reception Officer should be informed.

Disclaimer on risk and injury to volunteer

The volunteer programmes and activities in a zoo are organized in a safe manner and the zoo holds the safety of volunteers as of extreme importance. The zoo should continually strive to reduce such risks and ensure all volunteers follow safety rules and instructions that are designed to protect the volunteer's safety. However, volunteers must recognize that there is an inherent risk of injury when choosing to volunteer for any activity or programme. Additionally, each volunteer is solely responsible for determining if he/she is physically fit and/or properly skilled for any volunteer activity. It is always advisable, especially if the volunteer is disabled in any way or has recently suffered an illness, injury or impairment, to consult a physician before undertaking any physical activity.

Annexure-III

FORM OF WAIVER AND RELEASE OF ALL CLAIMS AND ASSUMPTION OF RISK

I Mr/Ms _____ (Name) have on my own will agreed to work as a volunteer in the _____ (Name of Zoo) and recognize and acknowledge that there are certain risks of physical injury to volunteers in this programme/activity, and I voluntarily agree to assume the full risk of any and all injuries, damages or loss, regardless of severity, that I may sustain as a result of my volunteer services. I further agree to waive and relinquish all claims I may have (or accrue to me) as a result of my volunteer services against the zoo, including its officers, officials, agents, volunteers and employees.

I do hereby fully release and forever discharge the Parties ['zoo'?] from any and all claims for injuries, damages, or loss that I may have or which may accrue to me and arising out of, connected with or in any way associated with my volunteer services. I have read and fully understood the above important information, warning of risk, assumption of risk and waiver and release of all claims.

Signature, name and address of volunteer

Signature, name and address of witness 1

Signature, name and address of witness 2

ENDANGERED SPECIES HOUSED IN VARIOUS INDIAN ZOOS

(As on 31/3/2012)

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
AGRA BEAR RESCUE FACILITY	UTTAR PRADESH	Bear Sloth	139	129	0	268
AGRA BEAR RESCUE FACILITY Total			**139**	**129**	**0**	**268**
AAIZAWL ZOO (MIZORAM ZOO)	MIZORAM	Badger Hog	0	0	2	2
		Bear Himalayan Black	5	3	0	8
		Bear Sun - Malayan	0	1	0	1
		Binturong	2	1	0	3
		Cat Jungle	0	0	0	0
		Cat Leopard	1	2	0	3
		Civet Indian Large	1	1	0	2
		Cobra Monocellate/accellate	1	1	1	3
		Gibbon Hoolock	2	5	1	8
		Hornbill Indian Pied	1	1	0	2
		Jackal	2	2	0	4
		Langur Capped	0	1	0	1
		Leopard Clouded	0	1	0	1
		Loris Slow	2	2	0	4
		Macaque Assamese	3	2	0	5
		Macaque Pig Tailed	3	2	0	5
		Macaque Rhesus	9	14	2	25
		Macaque Stump Tailed	10	9	2	21
		Monitor Lizard / Common Indian	0	0	2	2
		Pheasant Humes Bar-backed	6	4	0	10
		Pheasant Kalij	1	2	0	3
		Porcupine Himalayan Crestless	2	2	0	4
		Python Indian - Rock	3	1	1	5
		Serow	1	1	0	2
AIZAWL ZOO (MIZORAM ZOO) Total			**55**	**58**	**11**	**124**
ALIPORE ZOOLOGICAL GARDEN	WEST BENGAL	Bear Sloth	1	2	0	3
		Bear Himalayan Black	1	2	0	3
		Black Buck (Krishna Mrig)	4	2	3	9
		Cat Fishing	1	2	0	3
		Cat Jungle	1	3	0	4
		Cobra Indian	0	0	5	5
		Crocodile Long Snouted (Gharial)	2	2	1	5
		Crocodile Marsh (Mugger)	1	9	0	10
		Crocodile Salt Water	3	3	0	6
		Deer Brow-antlered (Sangai)	2	2	5	9
		Deer Swamp (Barasingha)	2	2	0	4
		Elephant Indian	0	3	0	3
		Hornbill Indian Pied	0	1	0	1

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Jackal	1	0	0	1
		Langur Common	3	3	1	7
		Leopard (Panther)	2	4	0	6
		Lion Indian	1	1	0	2
		Macaque Assamese	4	4	1	9
		Myna Hill	0	0	6	6
		Peafowl	5	2	8	15
		Peafowl White	1	0	0	1
		Pheasant Grey Peacock	0	0	21	21
		Python Indian - Rock	1	1	5	7
		Rhinoceros Indian One Horned	1	0	0	1
		Snake Keelback Checkered	0	0	5	5
		Snake Rat / Dhaman	0	0	4	4
		Spoonbill White	0	0	38	38
		Squirrel Giant Malabar / Indian	0	2	0	2
		Tiger Bengal	2	3	0	5
		Tiger Bengal (White)	1	2	0	3
ALIPORE ZOOLOGICAL GARDEN Total			**40**	**55**	**103**	**198**
AMIRDHI ZOO	**TAMIL NADU**	Civet Common Palm - Cat Toddy	0	0	1	1
		Cobra Indian	0	0	2	2
		Crocodile Marsh (Mugger)	0	0	2	2
		Jackal	0	0	3	3
		Mongoose Common	0	0	1	1
		Peafowl	0	0	9	9
		Python Indian - Rock	0	0	2	2
		Viper Russells	0	0	2	2
AMIRDHI ZOO Total			**0**	**0**	**22**	**22**
AMTES ANIMAL ARK	**MAHARASHTRA**	Antelope Four Horned (Chowsingha)	0	4	0	4
		Bear Sloth	1	2	0	3
		Cat Jungle	2	1	0	3
		Civet Common Palm - Cat Toddy	1	2	0	3
		Crocodile Long Snouted (Gharial)	1	1	0	2
		Jackal	2	2	0	4
		Langur Common	1	0	0	1
		Leopard (Panther)	2	3	0	5
		Macaque Rhesus	6	4	0	10
		Monitor Lizard / Common Indian	0	1	0	1
		Peafowl	2	3	0	5
		Python Indian - Rock	1	0	0	1
		Ratel	1	0	0	1
		Snake Rat / Dhaman	1	0	0	1

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Squirrel Giant Malabar / Indian	2	2	0	4
AMTES ANIMAL ARK Total			**23**	**25**	**0**	**48**
ARIGNAR ANNA ZOOLOGICAL PARK	**TAMIL NADU**	Antelope Four Horned (Chowsingha)	0	0	0	0
		Ass Wild Indian	0	0	0	0
		Bear Sloth	4	4	0	8
		Bear Himalayan Black	2	0	0	2
		Binturong	1	0	0	1
		Black Buck (Krishna Mrig)	2	5	0	7
		Cat Jungle	0	1	0	1
		Civet Common Palm - Cat Toddy	4	4	4	12
		Cobra Indian	0	0	3	3
		Cobra King	1	0	0	1
		Crocodile Long Snouted (Gharial)	2	2	0	4
		Crocodile Marsh (Mugger)	0	0	115	115
		Crocodile Salt Water	1	0	1	2
		Deer Brow-antlered (Sangai)	3	1	0	4
		Deer Swamp (Barasingha)	1	2	0	3
		Dog Wild (Dhole)	3	4	0	7
		Eagle White Bellied Sea	1	0	1	2
		Elephant Indian	5	1	0	6
		Fowl Jungle Grey	1	1	0	2
		Gaur (Indian Bison)	2	7	0	9
		Hornbill Great Indian / Great Pied	0	0	1	1
		Jackal	3	2	1	6
		Langur Common	1	1	2	4
		Langur Nilgiri	4	8	6	18
		Leopard (Panther)	2	2	0	4
		Lion Indian	1	0	0	1
		Loris Slender	1	1	0	2
		Macaque Lion-tailed	9	8	6	23
		Macaque Rhesus	19	13	0	32
		Monitor Lizard / Common Indian	0	0	2	2
		Otter Common	2	0	0	2
		Peafowl	4	2	6	12
		Peafowl White	2	3	11	16
		Pheasant Kalij	1	1	0	2
		Porcupine Bengal	1	2	3	6
		Python Indian - Rock	0	0	41	41
		Python Regal / Reticulated	0	0	22	22
		Shikra	0	0	2	2
		Snake Keelback Checkered	0	0	7	7

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Snake Rat / Dhaman	0	0	10	10
		Spoonbill White	0	0	1	1
		Squirrel Giant Flying Common	0	0	1	1
		Squirrel Giant Grizzled	1	0	0	1
		Squirrel Giant Malabar / Indian	1	1	0	2
		Stork Eastern White	0	0	1	1
		Tiger Bengal	1	2	0	3
		Tiger Bengal (White)	3	6	0	9
		Turtle Fresh Water/Indian Soft-shelled	0	0	1	1
		Viper Russells	0	0	3	3
		Vulture White Backed - Bengal	0	0	1	1
		Chameleon Indian	1	1	0	2
ARIGNAR ANNA ZOOLOGICAL PARK Total			**90**	**85**	**252**	**427**
ASSAM STATE ZOO CUM BOTANICAL GARDEN	**ASSAM**	Bear Himalayan Black	6	4	2	12
		Binturong	1	0	0	1
		Black Buck (Krishna Mrig)	1	2	1	4
		Cat Jungle	1	2	6	9
		Cat Leopard	4	2	13	19
		Civet Common Palm - Cat Toddy	2	6	5	13
		Civet Himalayan Palm / Masked	0	0	0	0
		Civet Indian Large	0	0	1	1
		Civet Indian Small	1	1	3	5
		Cobra Black	0	0	2	2
		Cobra Monocellate/accellate	0	0	10	10
		Crocodile Long Snouted (Gharial)	1	0	1	2
		Crocodile Marsh (Mugger)	0	1	0	1
		Deer Brow-antlered (Sangai)	2	6	13	21
		Elephant Indian	1	4	0	5
		Gibbon Hoolock	2	2	0	4
		Hornbill Great Indian / Great Pied	0	0	0	0
		Hornbill Malabar Pied	0	0	2	2
		Jackal	2	1	0	3
		Langur Capped	2	0	0	2
		Langur Common	2	2	0	4
		Langur Golden	5	2	0	7
		Leopard (Panther)	10	6	0	16
		Leopard Black	1	1	0	2
		Loris Slow	11	0	4	15
		Macaque Assamese	2	0	0	2
		Macaque Lion-tailed	0	1	0	1
		Macaque Pig Tailed	2	1	0	3

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Macaque Rhesus	3	2	0	5
		Macaque Stump Tailed	6	4	0	10
		Mongoose Common	1	1	7	9
		Myna Hill	0	0	16	16
		Otter Clawless	0	0	1	1
		Pangolin Chinese	1	0	3	4
		Peafowl	2	2	0	4
		Pheasant Kalij	0	0	1	1
		Python Indian - Rock	0	0	4	4
		Rhinoceros Indian One Horned	3	2	0	5
		Serow	0	2	0	2
		Snake Keelback Checkered	0	0	5	5
		Snake Rat / Dhaman	0	0	5	5
		Terrapin River (batagur)	0	0	1	1
		Terrapin Spotted Black	0	0	6	6
		Tiger Bengal	4	5	0	9
		Tiger Bengal (White)	1	1	3	5
		Turtle Fresh Water/Indian Soft-shelled	0	0	21	21
		Turtle Indian Black	0	0	3	3
		Turtle Indian Roofed	2	1	1	4
		Turtle Indian Tent	0	0	3	3
		Turtle Peacock-marked Soft-shelled	0	0	5	5
		Vulture Himalayan Giffon	0	0	6	6
ASSAM STATE ZOO CUM BOTANICAL GARDEN Total			**82**	**64**	**154**	**300**
AURANGABAD MUNICIPAL ZOO	**MAHARASHTRA**	Bear Sloth	1	1	0	2
		Black Buck (Krishna Mrig)	15	18	0	33
		Civet Common Palm - Cat Toddy	4	3	0	7
		Crocodile Marsh (Mugger)	2	1	0	3
		Elephant Indian	0	2	0	2
		Gazelle Indian (Chinkara)	0	1	0	1
		Jackal	0	1	0	1
		Langur Common	1	0	0	1
		Leopard (Panther)	1	1	0	2
		Macaque Rhesus	0	3	0	3
		Peafowl	2	0	0	2
		Peafowl White	1	1	0	2
		Tiger Bengal	2	3	0	5
		Tiger Bengal (White)	2	3	0	5
		Wolf Indian	0	1	0	1
AURANGABAD MUNICIPAL ZOO Total			**31**	**39**	**0**	**70**
BELLARY CHILDRENS PARK-CUM-ZOO (BELLARY ZOO)	**KARNATAKA**	Bear Himalayan Black	0	1	0	1
		Black Buck (Krishna Mrig)	29	54	11	94

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Crocodile Marsh (Mugger)	5	1	0	6
		Jackal	1	1	0	2
		Leopard (Panther)	1	0	0	1
		Peafowl	4	5	0	9
		Tiger Bengal	1	0	0	1
BELLARY CHILDRENS PARK-CUM-ZOO (BELLARY ZOO) Total			**41**	**62**	**11**	**114**
BHAGWAN BIRSA BIOLOGICAL PARK	**JHARKHAND**	Bear Sloth	5	3	0	8
		Bear Himalayan Black	1	3	3	7
		Black Buck (Krishna Mrig)	4	9	26	39
		Cat Jungle	5	4	0	9
		Cat Leopard	1	1	0	2
		Civet Common Palm - Cat Toddy	2	2	0	4
		Cobra Indian	0	0	4	4
		Crocodile Long Snouted (Gharial)	0	1	2	3
		Crocodile Marsh (Mugger)	0	0	1	1
		Elephant Indian	2	1	0	3
		Fox Common	0	0	2	2
		Gaur (Indian Bison)	1	1	1	3
		Hornbill Common Grey	1	0	0	1
		Jackal	3	3	5	11
		Langur Common	2	1	0	3
		Leopard (Panther)	2	2	0	4
		Macaque Rhesus	2	5	26	33
		Monitor Lizard / Common Indian	0	0	4	4
		Myna Hill	0	0	2	2
		Peafowl	5	1	2	8
		Peafowl White	2	3	0	5
		Python Indian - Rock	0	1	5	6
		Snake Keelback Checkered	0	0	3	3
		Snake Rat / Dhaman	0	0	2	2
		Tiger Bengal	1	1	0	2
		Viper Russells	0	0	3	3
BHAGWAN BIRSA BIOLOGICAL PARK Total			**39**	**42**	**91**	**172**
BIKANER ZOO	**RAJASTHAN**	Black Buck (Krishna Mrig)	22	31	10	63
		Gazelle Indian (Chinkara)	13	7	0	20
		Macaque Rhesus	3	7	0	10
		Peafowl	4	11	0	15
BIKANER ZOO Total			**42**	**56**	**10**	**108**
BIOLOGICAL PARK, CHIDYATAPU	**ANDAMAN & NICOBAR ISLANDS**	Civet Indian Large	0	1	0	1
		Crocodile Marsh (Mugger)	2	10	0	12
		Crocodile Salt Water	2	1	1	4

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Eagle White Bellied Sea	1	1	0	2
		Macaque Crab-eating/Long Tailed	6	2	0	8
		Macaque Rhesus	2	1	0	3
		Monitor Water Lizard	2	1	1	4
		Pig Wild Andaman	1	1	0	2
		Python Regal / Reticulated	1	1	1	3
		Turtle Fresh Water/Indian Soft-shelled	1	0	0	1
BIOLOGICAL PARK, CHIDYATAPU Total			**18**	**19**	**3**	**40**
BIOLOGICAL PARK, ITANAGAR	**ARUNACHAL PRADESH**	Bear Himalayan Black	5	3	0	8
		Cat Leopard	3	0	0	3
		Civet Common Palm - Cat Toddy	1	2	0	3
		Civet Himalayan Palm / Masked	0	1	0	1
		Crocodile Long Snouted (Gharial)	1	1	0	2
		Gibbon Hoolock	10	7	1	18
		Hornbill Malabar Pied	1	1	0	2
		Leopard (Panther)	3	2	0	5
		Leopard Clouded	1	0	0	1
		Loris Slow	4	0	1	5
		Macaque Assamese	3	2	0	5
		Macaque Rhesus	13	7	12	32
		Python Indian - Rock	2	1	0	3
		Tiger Bengal	3	3	0	6
BIOLOGICAL PARK, ITANAGAR Total			**50**	**30**	**14**	**94**
BONDLA ZOO	**GOA**	Antelope Four Horned (Chowsingha)	3	2	0	5
		Bear Sloth	2	2	0	4
		Black Buck (Krishna Mrig)	0	3	0	3
		Civet Common Palm - Cat Toddy	2	3	0	5
		Cobra Indian	0	0	3	3
		Cobra King	1	0	1	2
		Crocodile Marsh (Mugger)	2	2	13	17
		Gaur (Indian Bison)	4	2	0	6
		Jackal	1	1	0	2
		Leopard (Panther)	3	2	0	5
		Peafowl	1	1	0	2
		Python Indian - Rock	0	0	2	2
		Snake Keelback Checkered	0	0	3	3
		Snake Rat / Dhaman	0	0	2	2
		Tiger Bengal	1	1	0	2
		Turtle Fresh Water / Indian Soft-shelled	0	1	3	4
		Turtle Indian Black	4	4	0	8
		Viper Russells	0	0	2	2
BONDLA ZOO Total			**24**	**24**	**29**	**77**

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
CALCUTTA SNAKE PARK	WEST BENGAL	Cobra King	0	1	6	7
		Cobra Monocellate/accellate	23	18	1	42
		Crocodile Marsh (Mugger)	3	8	0	11
		Gecko Golden	0	0	5	5
		Monitor Lizard / Common Indian	0	0	2	2
		Monitor Lizard Yellow	2	5	21	28
		Monitor Water Lizard	0	0	17	17
		Python Bivittatus	1	2	1	4
		Python Indian - Rock	2	1	3	6
		Python Regal / Reticulated	0	1	0	1
		Snake Keelback Checkered	4	3	27	34
		Snake Keelback Olivaceous	0	0	2	2
		Snake Rat / Dhaman	5	4	0	9
		Viper Russells	2	3	0	5
CALCUTTA SNAKE PARK Total			**42**	**46**	**85**	**173**
CENTRE FOR BEAR REHABILITATION AND CONSERVATION	ARUNACHAL PRADESH	Bear Himalayan Black	2	2	0	4
CENTRE FOR BEAR REHABILITATION AND CONSERVATION Total			**2**	**2**	**0**	**4**
CENTRE FOR WILDLIFE REHABILITATION AND CONSERVATION	ASSAM	Leopard (Panther)	2	1	0	3
		Rhinoceros Indian One Horned	0	0	0	0
		Tiger Bengal	0	1	0	1
CENTRE FOR WILDLIFE REHABILITATION AND CONSERVATION Total			**2**	**2**	**0**	**4**
CHENNAI SNAKE PARK TRUST	TAMIL NADU	Cobra Indian	0	0	15	15
		Crocodile Long Snouted (Gharial)	3	3	0	6
		Crocodile Marsh (Mugger)	3	1	29	33
		Crocodile Salt Water	1	2	0	3
		Gecko Golden	0	0	7	7
		Monitor Lizard / Common Indian	0	0	3	3
		Python Indian - Rock	1	1	4	6
		Python Regal / Reticulated	1	2	11	14
		Snake Keelback Checkered	0	0	8	8
		Snake Keelback Olivaceous	0	0	8	8
		Snake Rat / Dhaman	0	0	9	9
		Turtle Fresh Water / Indian Soft-shelled	3	3	1	7
		Viper Russells	0	0	6	6
		Chameleon Indian	0	0	5	5
CHENNAI SNAKE PARK TRUST Total			**12**	**12**	**106**	**130**
CHILDREN PARK & ZOO (GADAG ZOO)	KARNATAKA	Bear Sloth	1	0	0	1
		Black Buck (Krishna Mrig)	16	4	4	24
		Civet Common Palm - Cat Toddy	1	1	0	2
		Crocodile Marsh (Mugger)	2	2	4	8
		Jackal	1	1	0	2

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Leopard (Panther)	0	1	0	1
		Peafowl	3	4	0	7
CHILDREN PARK & ZOO (GADAG ZOO) Total			**24**	**13**	**8**	**45**
CHILDRENS PARK	TAMIL NADU	Black Buck (Krishna Mrig)	3	13	0	16
		Civet Common Palm - Cat Toddy	2	2	0	4
		Cobra Indian	0	0	4	4
		Crocodile Long Snouted (Gharial)	0	0	1	1
		Crocodile Marsh (Mugger)	0	0	2	2
		Crocodile Salt Water	0	0	0	0
		Dog Wild (Dhole)	0	4	0	4
		Jackal	2	1	0	3
		Langur Common	0	0	0	0
		Macaque Rhesus	5	4	0	9
		Otter Common	1	0	0	1
		Peafowl	0	0	9	9
		Peafowl White	0	0	2	2
		Python Indian - Rock	0	0	2	2
		Snake Keelback Checkered	0	0	3	3
		Snake Rat / Dhaman	0	0	4	4
		Spoonbill White	0	0	6	6
		Viper Russells	0	0	2	2
CHILDRENS PARK Total			**13**	**24**	**35**	**72**
DEER PARK - SATYAM TECHNOLOGY CENTRE	ANDHRA PRADESH	Peafowl	5	2	0	7
		Peafowl White	1	2	0	3
DEER PARK - SATYAM TECHNOLOGY CENTRE Total			**6**	**4**	**0**	**10**
DEER PARK AT SHRI KSHETRA SOGAL, SOUDATTI	KARNATAKA	Black Buck (Krishna Mrig)	5	8	0	13
		Peafowl	1	3	0	4
DEER PARK AT SHRI KSHETRA SOGAL, SOUDATTI Total			**6**	**11**	**0**	**17**
DEER PARK, BIR MOTI BAGH (PATIALA ZOO)	PUNJAB	Black Buck (Krishna Mrig)	54	60	6	120
		Civet Common Palm - Cat Toddy	1	1	0	2
		Crocodile Marsh (Mugger)	1	0	0	1
		Macaque Assamese	3	2	0	5
		Macaque Rhesus	2	1	0	3
		Peafowl	1	1	0	2
DEER PARK, BIR MOTI BAGH (PATIALA ZOO) Total			**62**	**65**	**6**	**133**
DEER PARK, BIR TALAB	PUNJAB	Black Buck (Krishna Mrig)	34	39	0	73
		Peafowl	2	2	0	4
DEER PARK, BIR TALAB Total			**36**	**41**	**0**	**77**
DEER PARK, IFFCO TOWNSHIP, ANDA	UTTAR PRADESH	Black Buck (Krishna Mrig)	4	4	2	10
DEER PARK, IFFCO TOWNSHIP, ANDA Total			**4**	**4**	**2**	**10**
DEER PARK, KESORAM CEMENT	ANDHRA PRADESH	Black Buck (Krishna Mrig)	1	0	0	1
DEER PARK, KESORAM CEMENT Total			**1**	**0**	**0**	**1**

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
DEER PARK, N.M.D.C.LTD.	KARNATAKA	Black Buck (Krishna Mrig)	22	33	0	55
DEER PARK, N.M.D.C.LTD. Total			**22**	**33**	**0**	**55**
DEER PARK, NARAIN TEWARI DEWAL (ALMORA ZOO)	UTTARAKHAND	Bear Himalayan Black	1	0	0	1
		Leopard (Panther)	2	3	0	5
		Macaque Rhesus	1	0	0	1
DEER PARK, NARAIN TEWARI DEWAL (ALMORA ZOO) Total			**4**	**3**	**0**	**7**
DEER PARK, NEELON	PUNJAB	Black Buck (Krishna Mrig)	4	4	14	22
DEER PARK, NEELON Total			**4**	**4**	**14**	**22**
DEER PARK, NFCL GREEN BELT	ANDHRA PRADESH	Peafowl	2	5	6	13
DEER PARK, NFCL GREEN BELT Total			**2**	**5**	**6**	**13**
DEER PARK, PAPADAHANDI	ODISHA	Peafowl	2	1	0	3
		Python Indian - Rock	1	0	0	1
DEER PARK, PAPADAHANDI Total			**3**	**1**	**0**	**4**
DEER PARK, HISSAR	HARYANA	Black Buck (Krishna Mrig)	5	4	9	18
DEER PARK, HISSAR Total			**5**	**4**	**9**	**18**
DEER PARK, JAWAHAR LAKE TOURIST COMPLEX	ANDHRA PRADESH	Cat Jungle	2	0	0	2
		Monitor Lizard / Common Indian	3	0	0	3
		Pangolin	3	0	0	3
		Peafowl	2	2	0	4
		Python Indian - Rock	1	0	0	1
DEER PARK, JAWAHAR LAKE TOURIST COMPLEX Total			**11**	**2**	**0**	**13**
DHAULADHAR NATURE PARK	HIMACHAL PRADESH	Bear Himalayan Black	5	2	0	7
		Civet Indian Small	1	1	0	2
		Leopard (Panther)	7	7	0	14
		Peafowl	1	0	0	1
		Pheasant Cheer	2	1	0	3
		Pheasant Grey Peacock	1	1	0	2
		Pheasant Kalij	3	5	0	8
		Pheasant Monal / Impeyan	1	0	0	1
		Vulture White Backed - Bengal	0	0	1	1
DHAULADHAR NATURE PARK Total			**21**	**17**	**1**	**39**
DR. K. SHIVARMA KARANTH PILILKULA BIOLOGICAL PARK	KARNATAKA	Bear Sloth	0	1	0	1
		Black Buck (Krishna Mrig)	18	19	4	41
		Cat Jungle	1	1	0	2
		Cat Leopard	0	1	0	1
		Civet Common Palm - Cat Toddy	5	5	0	10
		Civet Indian Small	1	0	0	1
		Cobra Indian	0	0	18	18
		Cobra King	8	4	3	15
		Crocodile Long Snouted (Gharial)	1	0	0	1
		Crocodile Marsh (Mugger)	1	1	3	5
		Deer Mouse	2	4	9	15

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Deer Swamp (Barasingha)	1	0	0	1
		Eagle White Bellied Sea	0	0	1	1
		Elephant Indian	1	2	0	3
		Fowl Jungle Grey	1	0	0	1
		Jackal	7	7	2	16
		Langur Common	0	1	0	1
		Leopard (Panther)	3	4	0	7
		Mongoose Common	4	4	0	8
		Monitor Lizard / Common Indian	0	0	5	5
		Peafowl	5	3	0	8
		Python Indian - Rock	0	0	13	13
		Snake Keelback Checkered	0	0	10	10
		Snake Rat / Dhaman	0	0	12	12
		Squirrel Giant Malabar / Indian	3	1	0	4
		Tiger Bengal	5	3	0	8
		Turtle Fresh Water/Indian Soft-shelled	0	0	8	8
		Turtle Ganges Soft-shelled	0	0	1	1
		Turtle Indian Black	0	0	41	41
		Viper Russells	0	0	7	7
		Turtle Green Sea	0	0	1	1
DR. K.SHIVARMA KARANTH PILILKULA BIOLOGICAL PARK Total			**67**	**61**	**138**	**266**
DR. SHYAMAPRASAD MUKHARJEE ZOOLOGICAL GARDEN	**GUJARAT**	Antelope Four Horned (Chowsingha)	7	4		
		Bear Sloth	2	2		
		Bear Himalayan Black	1	0	0	1
		Black Buck (Krishna Mrig)	5	2	0	7
		Civet Himalayan Palm / Masked	1	0		
		Civet Indian Small	0	0		
		Crocodile Long Snouted (Gharial)	0	2	0	
		Crocodile Marsh (Mugger)	4	1		
		Deer Brow-antlered (Sangai)	1	0		
		Jackal	1	2		
		Langur Common	2	0		
		Leopard (Panther)	1	2	0	3
		Lion Indian	1	1	0	2
		Macaque Rhesus	3	6	0	9
		Otter Common	3	4	2	9
		Peafowl	2	4	0	6
		Peafowl White	2	4	2	8
		Python Indian - Rock	0	0	3	3
		Spoonbill White	2	2	10	14
		Tiger Bengal	0	2	0	2
DR. SHYAMAPRASAD MUKHARJEE ZOOLOGICAL GARDEN Total			**38**	**38**	**28**	**104**

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
G.V.K.INDUSTIRES DEER PARK	ANDHRA PRADESH	Peafowl	2	3	0	5
		Peafowl White	1	1	1	3
G.V.K.INDUSTIRES DEER PARK Total			**3**	**4**	**1**	**8**
GANDHI ZOOLOGICAL PARK	MADHYA PRADESH	Bear Sloth	0	1	0	1
		Bear Himalayan Black	0	2	0	2
		Black Buck (Krishna Mrig)	6	2	7	15
		Civet Indian Large	0	1	1	2
		Cobra Indian	1	2	0	3
		Crocodile Long Snouted (Gharial)	1	6	0	7
		Crocodile Marsh (Mugger)	1	2	14	17
		Gazelle Indian (Chinkara)	3	0	2	5
		Jackal	1	0	2	3
		Leopard (Panther)	3	2	2	7
		Macaque Rhesus	10	11	0	21
		Monitor Lizard / Common Indian	1	1	1	3
		Pheasant Kalij	2	1	0	3
		Python Indian - Rock	3	2	1	6
		Snake Rat / Dhaman	3	2	0	5
		Tiger Bengal (White)	3	1	0	4
		Viper Russells	1	2	1	4
		Vulture White Backed - Bengal	1	1	8	10
GANDHI ZOOLOGICAL PARK Total			**40**	**39**	**39**	**118**
GAR CHUMUK (ULUGHATA) DEER PARK	WEST BENGAL	Black Buck (Krishna Mrig)	1	0	0	1
		Peafowl	2	1	2	5
		Porcupine Bengal	2	1	0	3
GAR CHUMUK (ULUGHATA) DEER PARK Total			**5**	**2**	**2**	**9**
GHARIAL RESEARCH & CONSERVATION UNIT	ODISHA	Crocodile Long Snouted (Gharial)	0	4	0	4
		Crocodile Marsh (Mugger)	0	2	0	2
GHARIAL RESEARCH & CONSERVATION UNIT Total			**0**	**6**	**0**	**6**
HARISHANKAR DEER PARK	ODISHA	Peafowl	2	1	0	3
HARISHANKAR DEER PARK Total			**2**	**1**	**0**	**3**
HIMALAYAN NATURE PARK	HIMACHAL PRADESH	Bear Himalayan Black	3	0	0	3
		Bear Himalayan Brown	3	1	1	5
		Cat Leopard	1	3	0	4
		Leopard (Panther)	1	0	0	1
		Leopard Snow	1	0	0	1
		Pheasant Cheer	10	9	10	29
		Pheasant Grey Peacock	1	1	0	2
		Pheasant Kalij	7	5	0	12
		Pheasant Monal / Impeyan	2	2	1	5
		Tahr Himalayan	1	1	0	2
		Tragopan Western	2	0	0	2

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Wolf Tibetan	1	1	0	2
HIMALAYAN NATURE PARK Total			**33**	**23**	**12**	**68**
HIMALAYAN ZOOLOGICAL PARK, BULBULEY	SIKKIM	Bear Himalayan Black	1	1	0	2
		Cat Leopard	3	1	0	4
		Civet Himalayan Palm / Masked	1	1	0	2
		Civet Indian Large	1	1	0	2
		Leopard (Panther)	0	1	0	1
		Leopard Clouded	0	1	0	1
		Leopard Snow	1	1	0	2
		Panda Red / Lesser	9	5	0	14
		Pheasant Grey Peacock	1	1	0	2
		Pheasant Kalij	1	3	0	4
		Wolf Tibetan	2	0	0	2
		Yak Wild	1	1	0	2
HIMALAYAN ZOOLOGICAL PARK, BULBULEY Total			**21**	**17**	**0**	**38**
HIMAYAT SAGAR MINI ZOO	ANDHRA PRADESH	Peafowl White	2	4	0	6
HIMAYAT SAGAR MINI ZOO Total			**2**	**4**	**0**	**6**
INDIRA GANDHI PARK ZOO	ODISHA	Bear Sloth	1	1	0	2
		Crocodile Long Snouted (Gharial)	1	2	0	3
		Crocodile Marsh (Mugger)	1	1	0	2
		Mongoose Common	3	3	0	6
		Peafowl	3	0	1	4
		Peafowl White	0	1	0	1
		Python Indian - Rock	0	0	2	2
INDIRA GANDHI PARK ZOO Total			**9**	**8**	**3**	**20**
INDIRA GANDHI ZOOLOGICAL PARK	ANDHRA PRADESH	Antelope Four Horned (Chowsingha)	2	2	0	4
		Bear Sloth	2	6	0	8
		Bear Himalayan Black	1	1	0	2
		Black Buck (Krishna Mrig)	28	17	15	60
		Cat Jungle	1	0	0	1
		Civet Common Palm - Cat Toddy	1	1	0	2
		Civet Indian Small	0	1	0	1
		Cobra Indian	0	0	6	6
		Crocodile Long Snouted (Gharial)	3	3	1	7
		Crocodile Marsh (Mugger)	0	0	4	4
		Crocodile Salt Water	2	1	6	9
		Deer Swamp (Barasingha)	2	2	2	6
		Dog Wild (Dhole)	3	2	4	9
		Eagle White Bellied Sea	0	0	1	1
		Elephant Indian	1	0	0	1
		Fowl Jungle Grey	2	2	1	5
		Gaur (Indian Bison)	3	1	0	4

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Jackal	2	4	4	10
		Langur Common	0	2	0	2
		Leopard (Panther)	2	1	2	5
		Lion Indian	1	1	0	2
		Loris Slender	0	0	0	0
		Macaque Rhesus	6	8	1	15
		Macaque Stump Tailed	1	1	0	2
		Monitor Lizard / Common Indian	4	1	0	5
		Monitor Water Lizard	1	0	0	1
		Myna Hill	2	0	3	5
		Peafowl	11	9	0	20
		Peafowl White	2	2	0	4
		Pheasant Kalij	0	1	0	1
		Python Indian - Rock	4	2	0	6
		Snake Rat / Dhaman	0	0	9	9
		Squirrel Giant Malabar / Indian	1	1	0	2
		Tiger Bengal	4	8	4	16
		Turtle Indian Roofed	3	7	0	10
		Vulture Scavenger / Egyptian	0	0	3	3
INDIRA GANDHI ZOOLOGICAL PARK Total			**95**	**87**	**66**	**248**
INDIRA PRIYADARSHINI SANGRAHALAYA, ANAGODU	**KARNATAKA**	Bear Sloth	0	1	0	1
		Peafowl	2	3	0	5
		Turtle Fresh Water/Indian Soft-shelled	0	0	4	4
INDIRA PRIYADARSHINI SANGRAHALAYA, ANAGODU Total			**2**	**4**	**4**	**10**
INDRODA NATURE PARK	**GUJARAT**	Black Buck (Krishna Mrig)	46	49	20	115
		Cobra Indian	0	0	2	2
		Crocodile Marsh (Mugger)	0	0	46	46
		Gazelle Indian (Chinkara)	4	2	0	6
		Jackal	0	1	0	1
		Leopard (Panther)	2	2	0	4
		Peafowl White	2	2	0	4
		Porcupine Bengal	0	0	2	2
		Python Indian - Rock	1	0	1	2
		Snake Rat / Dhaman	0	0	3	3
		Spoonbill White	0	0	2	2
		Tiger Bengal	1	1	0	2
		Turtle Ganges Soft-shelled	0	0	1	1
		Viper Russells	0	0	1	1
INDRODA NATURE PARK Total			**56**	**57**	**78**	**191**
JAIPUR ZOO	**RAJASTHAN**	Bear Sloth	3	1	0	4
		Bear Himalayan Black	1	1	0	2
		Black Buck (Krishna Mrig)	6	8	54	68

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Civet Common Palm - Cat Toddy	1	0	3	4
		Crocodile Long Snouted (Gharial)	1	2	70	73
		Crocodile Marsh (Mugger)	8	4	2	14
		Deer Brow-antlered (Sangai)	1	1	0	2
		Gazelle Indian (Chinkara)	1	1	0	2
		Hornbill Indian Pied	0	1	0	1
		Jackal	2	1	0	3
		Leopard (Panther)	3	1	0	4
		Macaque Assamese	2	0	0	2
		Macaque Rhesus	1	1	0	2
		Peafowl	5	6	0	11
		Peafowl White	0	0	0	0
		Pheasant Kalij	1	0	0	1
		Python Indian - Rock	0	0	1	1
		Tiger Bengal	0	3	0	3
		Tiger Bengal (White)	0	0	0	0
		Turtle Fresh Water/Indian Soft-shelled	0	0	5	5
		Wolf Indian	2	0	5	7
JAIPUR ZOO Total			**38**	**31**	**140**	**209**
JAMMU ZOO	JAMMU & KASHMIR	Bear Himalayan Black	1	1	0	2
		Cat Jungle	1	0	0	1
		Cat Leopard	0	0	0	0
		Civet Common Palm - Cat Toddy	1	0	0	1
		Leopard (Panther)	4	3	0	7
		Peafowl	3	2	3	8
JAMMU ZOO Total			**10**	**6**	**3**	**19**
JAWAHARLAL NEHRU BIOLOGICAL PARK	JHARKHAND	Bear Himalayan Black	2	1	0	3
		Black Buck (Krishna Mrig)	14	19	0	33
		Civet Common Palm - Cat Toddy	1	1	0	2
		Crocodile Long Snouted (Gharial)	0	0	0	0
		Crocodile Marsh (Mugger)	1	1	0	2
		Langur Common	4	4	0	8
		Leopard (Panther)	0	3	0	3
		Macaque Rhesus	6	5	0	11
		Macaque Stump Tailed	1	0	0	1
		Peafowl	5	5	0	10
		Pheasant Kalij	1	1	0	2
		Python Indian - Rock	1	2	0	3
		Tiger Bengal	2	1	0	3
JAWAHARLAL NEHRU BIOLOGICAL PARK Total			**38**	**43**	**0**	**81**
JHARGRAM ZOO	WEST BENGAL	Bear Sloth	0	4	0	4
		Cat Fishing	1	0	0	1

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Cat Jungle	1	1	2	4
		Civet Indian Small	0	0	1	1
		Cobra Indian	0	0	1	1
		Crocodile Long Snouted (Gharial)	0	0	1	1
		Fox Common	1	1	0	2
		Langur Common	1	2	0	3
		Macaque Rhesus	6	3	2	11
		Monitor Lizard / Common Indian	2	0	0	2
		Peafowl	5	0	0	5
		Python Indian - Rock	0	0	6	6
JHARGRAM ZOO Total			**17**	**11**	**13**	**41**
JODHPUR ZOO	**RAJASTHAN**	Bear Himalayan Black	1	0	0	1
		Black Buck (Krishna Mrig)	2	0	11	13
		Civet Common Palm - Cat Toddy	1	0	0	1
		Crocodile Long Snouted (Gharial)	1	2	0	3
		Crocodile Marsh (Mugger)	2	1	0	3
		Gazelle Indian (Chinkara)	2	4	0	6
		Jackal	0	0	0	0
		Leopard (Panther)	1	1	0	2
		Macaque Rhesus	2	3	3	8
		Peafowl	5	1	2	8
		Peafowl White	2	2	0	4
		Spoonbill White	1	1	0	2
		Tiger Bengal	0	2	0	2
		Wolf Indian	0	1	0	1
JODHPUR ZOO Total			**20**	**18**	**16**	**54**
KAMLA NEHRU PRANI SANGHRAHALAYA ZOO	**MADHYA PRADESH**	Bear Sloth	1	1	0	2
		Bear Himalayan Black	1	1	0	2
		Black Buck (Krishna Mrig)	10	12	29	51
		Cat Jungle	2	0	0	2
		Crocodile Long Snouted (Gharial)	1	4	0	5
		Crocodile Marsh (Mugger)	2	2	16	20
		Elephant Indian	1	1	0	2
		Fox Common	1	1	0	2
		Jackal	0	3	0	3
		Langur Common	2	0	0	2
		Leopard (Panther)	3	1	0	4
		Macaque Rhesus	4	6	3	13
		Peafowl	2	2	0	4
		Peafowl White	2	2	1	5
		Python Indian - Rock	1	0	1	2
		Tiger Bengal	3	1	0	4

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Tiger Bengal (White)	0	5	0	5
		Wolf Indian	1	3	0	4
KAMLA NEHRU PRANI SANGHRAHALAYA ZOO Total			**37**	**45**	**50**	**132**
KAMLA NEHRU ZOOLOGICAL GARDEN	**GUJARAT**	Bear Sloth	1	0	0	1
		Bear Himalayan Black	1	1	0	2
		Black Buck (Krishna Mrig)	0	0	1	1
		Cat Leopard	0	0	0	0
		Cobra Indian	0	0	15	15
		Crocodile Long Snouted (Gharial)	0	0	4	4
		Crocodile Marsh (Mugger)	0	0	18	18
		Crocodile Salt Water	2	1	0	3
		Deer Swamp (Barasingha)	1	0	0	1
		Elephant Indian	0	1	0	1
		Jackal	2	3	6	11
		Langur Common	11	2	0	13
		Leopard (Panther)	4	4	0	8
		Lion Indian	1	1	0	2
		Macaque Rhesus	15	11	23	49
		Monitor Lizard / Common Indian	1	2	0	3
		Monitor Water Lizard	0	0	0	0
		Myna Hill	0	0	1	1
		Otter Common	0	1	0	1
		Peafowl	0	0	30	30
		Peafowl White	1	4	2	7
		Pigeon Nicobar	0	0	23	23
		Porcupine Bengal	0	0	41	41
		Python Indian - Rock	0	0	7	7
		Snake Keelback Checkered	0	0	7	7
		Snake Rat / Dhaman	0	0	3	3
		Spoonbill White	7	5	11	23
		Tiger Bengal	1	1	0	2
		Viper Russells	0	0	4	4
		Vulture White Backed - Bengal	0	0	12	12
KAMLA NEHRU ZOOLOGICAL GARDEN Total			**48**	**37**	**208**	**293**
KANAN PANDARI ZOO	**CHHATTISGARH**	Antelope Four Horned (Chowsingha)	1	1	0	2
		Bear Sloth	4	3	0	7
		Black Buck (Krishna Mrig)	4	9	0	13
		Cat Jungle	3	1	0	4
		Civet Common Palm - Cat Toddy	2	2	2	6
		Cobra Indian	0	0	10	10
		Crocodile Long Snouted (Gharial)	1	1	0	2
		Crocodile Marsh (Mugger)	0	1	1	2

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Fox Common	5	3	0	8
		Jackal	5	2	0	7
		Langur Common	2	2	0	4
		Leopard (Panther)	5	2	0	7
		Mongoose Common	0	0	1	1
		Monitor Lizard / Common Indian	0	2	0	2
		Peafowl	5	2	0	7
		Peafowl White	0	1	0	1
		Python Indian - Rock	0	0	8	8
		Ratel	1	1	0	2
		Snake Rat / Dhaman	0	0	7	7
		Tiger Bengal	0	1	0	1
		Tiger Bengal (White)	1	1	0	2
		Viper Russells	0	0	4	4
KANAN PANDARI ZOO Total			**39**	**35**	**33**	**107**
KANPUR ZOOLOGICAL PARK	**UTTAR PRADESH**	Antelope Four Horned (Chowsingha)	1	1	1	3
		Bear Sloth	1	1	0	2
		Bear Himalayan Black	2	1	3	6
		Black Buck (Krishna Mrig)	10	27	25	62
		Civet Common Palm - Cat Toddy	0	0	1	1
		Crocodile Long Snouted (Gharial)	0	0	1	1
		Crocodile Marsh (Mugger)	0	0	37	37
		Deer Brow-antlered (Sangai)	4	1	25	30
		Deer Swamp (Barasingha)	6	7	20	33
		Elephant Indian	0	1	0	1
		Hornbill Common Grey	0	0	1	1
		Jackal	3	2	5	10
		Langur Common	1	2	0	3
		Leopard (Panther)	7	5	0	12
		Macaque Rhesus	2	2	0	4
		Peafowl	2	0	0	2
		Peafowl White	1	1	1	3
		Pheasant Kalij	0	0	6	6
		Porcupine Bengal	0	1	4	5
		Rhinoceros Indian One Horned	3	1	0	4
		Shikra	0	0	1	1
		Tiger Bengal	3	1	0	4
		Vulture Himalayan Giffon	0	0	0	0
		Vulture Asian King / Black Indian	0	0	1	1
KANPUR ZOOLOGICAL PARK Total			**46**	**54**	**132**	**232**
KAPILASH ZOO	**ODISHA**	Bear Himalayan Black	1	1	0	2
		Crocodile Marsh (Mugger)	1	1	0	2

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Elephant Indian	2	0	0	2
		Peafowl	2	3	0	5
		Python Indian - Rock	0	0	1	1
KAPILASH ZOO Total			**6**	**5**	**1**	**12**
KARIMNAGAR DEER PARK	ANDHRA PRADESH	Antelope Four Horned (Chowsingha)	0	1	0	1
		Black Buck (Krishna Mrig)	8	2	0	10
		Peafowl	12	16	0	28
KARIMNAGAR DEER PARK Total			**20**	**19**	**0**	**39**
KARUNA SOCIETY FOR ANIMALS AND NATURE-RESCUE CENTRE	ANDHRA PRADESH	Bear Sloth	2	2	0	4
		Black Buck (Krishna Mrig)	4	6	0	10
		Peafowl	3	3	0	6
		Python Indian - Rock	0	0	0	0
KARUNA SOCIETY FOR ANIMALS AND NATURE-RESCUE CENTRE Total			**9**	**11**	**0**	**20**
KASHMIR ZOO	JAMMU & KASHMIR	Bear Himalayan Black	1	3	0	4
		Leopard (Panther)	1	1	0	2
KASHMIR ZOO Total			**2**	**4**	**0**	**6**
KITTUR RANI CANNAMMA NISARG DHAMA MINI ZOO	KARNATAKA	Antelope Four Horned (Chowsingha)	2	3	0	5
		Black Buck (Krishna Mrig)	3	3	0	6
		Crocodile Marsh (Mugger)	1	2	0	3
KITTUR RANI CANNAMMA NISARG DHAMA MINI ZOO Total			**6**	**8**	**0**	**14**
KOTA ZOO	RAJASTHAN	Black Buck (Krishna Mrig)	4	6	11	21
		Fox Common	0	1	0	1
		Gazelle Indian (Chinkara)	3	2	1	6
		Jackal	1	0	0	1
		Python Indian - Rock	2	1	0	3
		Tiger Bengal	2	1	0	3
KOTA ZOO Total			**12**	**11**	**12**	**35**
KUNJANAGAR ECO-PARK	WEST BENGAL	Crocodile Long Snouted (Gharial)	2	1	0	3
		Leopard (Panther)	0	1	0	1
		Peafowl	3	2	0	5
KUNJANAGAR ECO-PARK Total			**5**	**4**	**0**	**9**
KURUMBAPATTI ZOOLOGICAL PARK	TAMIL NADU	Crocodile Marsh (Mugger)	2	2	0	4
		Peafowl	2	5	0	7
		Peafowl White	3	2	0	5
KURUMBAPATTI ZOOLOGICAL PARK Total			**7**	**9**	**0**	**16**
LADY HYDARI PARK ANIMAL LAND (MEGHALAYA ZOO)	MEGHALAYA	Bear Himalayan Black	3	2	0	5
		Cat Leopard	1	2	3	6
		Civet Common Palm - Cat Toddy	0	0	1	1
		Fox Common	0	0	2	2
		Hornbill Indian Pied	0	1	0	1
		Jackal	0	0	2	2
		Leopard Clouded	0	0	1	1

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Loris Slow	2	1	0	3
		Macaque Rhesus	1	4	3	8
		Macaque Stump Tailed	1	1	0	2
		Marten Yellow Throated	1	0	0	1
		Serow	1	0	0	1
		Vulture Long Billed	0	0	1	1
LADY HYDARI PARK ANIMAL LAND (MEGHALAYA ZOO) Total			**10**	**11**	**13**	**34**
LEOPARD RESCUE CENTRE	**MAHARASHTRA**	Leopard (Panther)	19	6	0	25
LEOPARD RESCUE CENTRE Total		**19**	**6**	**0**	**25**	
LION SAFARI - VASONA	**DADRA & NAGAR HAVELI**	Lion Indian	1	1	0	2
LION SAFARI - VASONA Total			**1**	**1**	**0**	**2**
LION SAFARI PARK AT NAYYAR DAM (NAYYAR MINI ZOO)	**KERALA**	Lion Indian	2	5	0	7
LION SAFARI PARK AT NAYYAR DAM (NAYYAR MINI ZOO) Total			**2**	**5**	**0**	**7**
LUCKNOW ZOOLOGICAL PARK	**UTTAR PRADESH**	Bear Sloth	1	2	0	3
		Bear Himalayan Black	1	2	0	3
		Black Buck (Krishna Mrig)	6	14	9	29
		Cat Fishing	1	2	0	3
		Cat Leopard	1	1	0	2
		Civet Common Palm - Cat Toddy	1	2	2	5
		Cobra Indian	1	1	1	3
		Crocodile Long Snouted (Gharial)	3	5	0	8
		Crocodile Marsh (Mugger)	1	1	24	26
		Deer Swamp (Barasingha)	3	5	62	70
		Gazelle Indian (Chinkara)	0	0	11	11
		Gibbon Hoolock	1	1	0	2
		Jackal	0	2	0	2
		Leopard (Panther)	5	5	1	11
		Macaque Lion-tailed	1	0	0	1
		Macaque Rhesus	2	0	0	2
		Macaque Stump Tailed	2	2	0	4
		Myna Hill	0	0	2	2
		Otter Common	1	2	0	3
		Peafowl White	3	3	1	7
		Pheasant Kalij	1	0	12	13
		Python Indian - Rock	1	0	21	22
		Rhinoceros Indian One Horned	1	0	0	1
		Snake Rat / Dhaman	1	0	3	4
		Spoonbill White	0	0	3	3
		Squirrel Giant Malabar / Indian	1	1	0	2
		Tiger Bengal	2	1	0	3
		Tiger Bengal (White)	1	1	0	2

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Viper Russells	0	0	8	8
		Wolf Indian	1	1	0	2
LUCKNOW ZOOLOGICAL PARK Total			**43**	**54**	**160**	**257**
LUDHIANA ZOO	PUNJAB	Bear Himalayan Black	1	1	0	2
		Black Buck (Krishna Mrig)	5	1	0	6
		Jackal	0	0	4	4
		Peafowl	42	43	0	85
		Tiger Bengal	2	3	0	5
LUDHIANA ZOO Total			**50**	**48**	**4**	**102**
MADRAS CROCODILE BANK TRUST/ CENTRE FOR HERPETOLOGY	TAMIL NADU	Cobra Indian	1	0	0	1
		Crocodile Long Snouted (Gharial)	3	6	53	62
		Crocodile Marsh (Mugger)	0	0	1972	1972
		Crocodile Salt Water	6	5	4	15
		Python Indian - Rock	0	2	24	26
		Python Regal / Reticulated	1	0	0	1
		Terrapin River (batagur)	0	2	0	2
		Turtle Crowned River/Roof	0	0	77	77
		Turtle Fresh Water/Indian Soft-shelled	0	0	22	22
		Turtle Ganges Soft-shelled	0	0	9	9
		Turtle Indian Roofed	0	0	17	17
		Turtle Indian Tent	0	0	2	2
MADRAS CROCODILE BANK TRUST/CENTRE FOR HERPETOLOGY Total			**11**	**15**	**2180**	**2206**
MAHARAJA SHAHAJI CHHATRAPATI ZOO	MAHARASHTRA	Black Buck (Krishna Mrig)	3	2	2	7
MAHARAJA SHAHAJI CHHATRAPATI ZOO Total			**3**	**2**	**2**	**7**
MAHARAJBAG ZOO	MAHARASHTRA	Bear Sloth	1	1	0	2
		Black Buck (Krishna Mrig)	2	2	0	4
		Crocodile Marsh (Mugger)	1	1	0	2
		Gazelle Indian (Chinkara)	1	0	0	1
		Jackal	2	2	0	4
		Langur Common	0	0	0	0
		Leopard (Panther)	3	4	0	7
		Macaque Rhesus	4	3	0	7
		Peafowl	2	2	1	5
		Tiger Bengal	0	3	0	3
MAHARAJBAG ZOO Total			**16**	**18**	**1**	**35**
MAHATMA GANDHI RASHTRIYA UDYAN ZOO	MAHARASHTRA	Black Buck (Krishna Mrig)	18	14	46	78
		Crocodile Long Snouted (Gharial)	1	1	1	3
		Leopard (Panther)	0	0	0	0
		Macaque Assamese	1	0	0	1
		Macaque Rhesus	2	1	2	5
		Peafowl	2	2	0	4
		Porcupine Bengal	2	1	0	3

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
MAHATMA GANDHI RASHTRIYA UDYAN ZOO Total			**26**	**19**	**49**	**94**
MAHENDRA CHAUDHURY ZOOLOGICAL PARK	PUNJAB	Antelope Four Horned (Chowsingha)	2	3	0	5
		Bear Sloth	3	2	0	5
		Bear Himalayan Black	4	7	0	11
		Black Buck (Krishna Mrig)	1	8	11	20
		Cat Leopard	1	1	0	2
		Civet Common Palm - Cat Toddy	0	1	1	2
		Crocodile Long Snouted (Gharial)	1	2	1	4
		Crocodile Marsh (Mugger)	0	3	0	3
		Deer Brow-antlered (Sangai)	1	2	0	3
		Deer Swamp (Barasingha)	2	3	4	9
		Elephant Indian	2	4	0	6
		Gaur (Indian Bison)	1	2	3	6
		Gazelle Indian (Chinkara)	1	2	11	14
		Jackal	0	2	4	6
		Langur Common	2	0	0	2
		Leopard (Panther)	3	2	0	5
		Macaque Assamese	9	8	0	17
		Macaque Lion-tailed	1	0	0	1
		Macaque Pig Tailed	1	2	1	4
		Macaque Rhesus	0	5	5	10
		Monitor Lizard / Common Indian	0	0	4	4
		Peafowl	4	2	3	9
		Peafowl White	1	0	0	1
		Pheasant Kalij	0	0	7	7
		Python Indian - Rock	1	1	0	2
		Shikra	1	1	2	4
		Tiger Bengal	6	3	0	9
		Tiger Bengal (White)	1	1	0	2
MAHENDRA CHAUDHURY ZOOLOGICAL PARK Total			**49**	**67**	**57**	**173**
MAITRI BAAGH ZOO	CHHATTISGARH	Bear Sloth	2	1	0	3
		Bear Himalayan Black	1	1	0	2
		Civet Common Palm - Cat Toddy	1	1	3	5
		Crane Black-necked	0	0	0	0
		Crocodile Long Snouted (Gharial)	0	0	4	4
		Crocodile Marsh (Mugger)	0	0	1	1
		Deer Brow-antlered (Sangai)	0	2	0	2
		Langur Common	2	2	3	7
		Leopard (Panther)	2	1	0	3
		Macaque Lion-tailed	0	1	0	1
		Macaque Rhesus	3	4	4	11
		Mongoose Common	1	1	2	4

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Owlet Forest Spotted	0	0	4	4
		Peafowl	4	3	0	7
		Python Indian - Rock	1	1	4	6
		Tiger Bengal	4	4	0	8
		Tiger Bengal (White)	3	7	0	10
MAITRI BAAGH ZOO Total			**24**	**29**	**25**	**78**
MALSI DEER PARK (DEHRADUN BIOLOGICAL PARK)	**UTTARAKHAND**	Black Buck (Krishna Mrig)	0	1	0	1
		Leopard (Panther)	1	1	0	2
		Peafowl	1	1	0	2
MALSI DEER PARK (DEHRA DUN BIOLOGICAL PARK) Total			**2**	**3**	**0**	**5**
MANIPUR ZOOLOGICAL GARDEN	**MANIPUR**	Bear Himalayan Black	8	4	0	12
		Cat Jungle	1	0	0	1
		Cat Leopard	3	4	0	7
		Civet Common Palm - Cat Toddy	1	0	0	1
		Civet Indian Small	2	0	0	2
		Deer Brow-antlered (Sangai)	4	10	2	16
		Gibbon Hoolock	1	0	0	1
		Hornbill Indian Pied	0	1	0	1
		Jackal	0	1	0	1
		Leopard (Panther)	1	1	0	2
		Loris Slow	3	4	0	7
		Macaque Rhesus	0	0	40	40
		Marten Yellow Throated	0	0	1	1
		Monitor Water Lizard	0	0	3	3
		Pheasant Humes Bar-backed	2	1	0	3
		Pheasant Kalij	2	3	3	8
		Python Indian - Rock	0	0	2	2
		Squirrel Giant Malabar / Indian	1	0	0	1
		Vulture White Backed - Bengal	0	0	3	3
MANIPUR ZOOLOGICAL GARDEN Total			**29**	**29**	**54**	**112**
MARBLE PALACE ZOO	**WEST BENGAL**	Antelope Four Horned (Chowsingha)	5	5	0	10
		Hornbill Common Grey	2	2	7	11
		Hornbill Indian Pied	2	2	0	4
		Hornbill Malabar Pied	1	0	0	1
		Hornbill Rufous Necked	1	1	0	2
		Langur Common	1	1	0	2
		Macaque Rhesus	1	1	0	2
		Macaque Stump Tailed	1	1	0	2
		Myna Hill	1	1	0	2
		Peafowl	5	9	0	14
		Peafowl White	1	1	0	2
		Pheasant Grey Peacock	1	1	0	2

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Pheasant Monal / Impeyan	0	1	0	1
		Porcupine Bengal	1	1	0	2
		Spoonbill White	1	1	0	2
		Squirrel Giant Malabar / Indian	2	2	0	4
MARBLE PALACE ZOO Total			**26**	**30**	**7**	**63**
MIAO MINI ZOO	ARUNACHAL PRADESH	Bear Himalayan Black	0	0	4	4
		Cat Leopard	0	0	2	2
		Crocodile Long Snouted (Gharial)	0	0	2	2
		Gibbon Hoolock	0	0	4	4
		Loris Slow	0	0	5	5
		Macaque Assamese	0	0	1	1
		Macaque Stump Tailed	0	0	2	2
		Python Indian - Rock	0	0	1	1
MIAO MINI ZOO Total			**0**	**0**	**21**	**21**
MINI ZOO A. M. GUDI BALVANA	KARNATAKA	Bear Sloth	0	2	0	2
		Black Buck (Krishna Mrig)	7	10	0	17
		Crocodile Marsh (Mugger)	1	1	0	2
		Leopard (Panther)	1	2	0	3
		Peafowl	3	1	0	4
		Python Indian - Rock	1	1	0	2
MINI ZOO A. M. GUDI BALVANA Total			**13**	**17**	**0**	**30**
MINI ZOO CUM CHILDREN PARK	KARNATAKA	Black Buck (Krishna Mrig)	6	3	0	9
		Civet Common Palm - Cat Toddy	1	1	0	2
		Crocodile Marsh (Mugger)	6	5	0	11
		Langur Common	2	1	0	3
		Peafowl	3	3	0	6
		Python Indian - Rock	1	1	0	2
MINI ZOO CUM CHILDREN PARK Total			**19**	**14**	**0**	**33**
MINI ZOO, ROING	ARUNACHAL PRADESH	Cat Leopard	1	1	0	2
		Civet Common Palm - Cat Toddy	0	0	0	0
		Macaque Assamese	1	0	0	1
		Macaque Rhesus	3	3	0	6
		Porcupine Himalayan Crestless	0	0	0	0
MINI ZOO, ROING Total			**5**	**4**	**0**	**9**
MINI ZOO,BHIWANI	HARYANA	Bear Himalayan Black	1	1	0	2
		Crocodile Long Snouted (Gharial)	1	1	0	2
		Crocodile Marsh (Mugger)	8	2	12	22
		Fox Desert	2	1	0	3
		Leopard (Panther)	1	1	0	2
		Tiger Bengal	1	0	0	1
MINI ZOO, BHIWANI Total			**14**	**6**	**12**	**32**
MINI ZOO, PIPLI	HARYANA	Black Buck (Krishna Mrig)	4	2	1	7

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Crocodile Marsh (Mugger)	0	0	2	2
		Langur Common	1	1	1	3
		Tiger Bengal	1	0	0	1
MINI ZOO,PIPLI Total			**6**	**3**	**4**	**13**
MUGGER BREEDING CENTRE (MUTA ZOO)	JHARKHAND	Crocodile Marsh (Mugger)	2	0	0	2
		Peafowl	1	1	0	2
MUGGER BREEDING CENTRE (MUTA ZOO) Total			**3**	**1**	**0**	**4**
NAGALAND ZOOLOGICAL PARK, RANGAPAHAR	NAGALAND	Bear Himalayan Black	5	2	3	10
		Cat Leopard	0	1	1	2
		Fox Common	2	0	7	9
		Gibbon Hoolock	1	0	0	1
		Hornbill Great Indian / Great Pied	1	0	0	1
		Hornbill Indian Pied	2	3	0	5
		Hornbill Rufous Necked	0	1	0	1
		Hornbill Wreathed	0	1	0	1
		Langur Capped	0	4	0	4
		Leopard (Panther)	0	1	0	1
		Loris Slow	4	0	1	5
		Peafowl	0	1	0	1
NAGALAND ZOOLOGICAL PARK, RANGAPAHAR Total			**15**	**14**	**12**	**41**
NANDAN VAN ZOO	CHHATTISGARH	Antelope Four Horned (Chowsingha)	6	4	0	10
		Bear Himalayan Black	2	2	0	4
		Black Buck (Krishna Mrig)	2	8	9	19
		Crocodile Marsh (Mugger)	0	0	9	9
		Fox Common	0	0	0	0
		Jackal	1	1	0	2
		Leopard (Panther)	5	4	0	9
		Macaque Rhesus	3	5	2	10
		Monitor Lizard / Common Indian	2	1	0	3
		Peafowl	12	5	0	17
		Python Indian - Rock	0	0	7	7
		Squirrel Giant Malabar / Indian	0	1	0	1
NANDAN VAN ZOO Total			**33**	**31**	**27**	**91**
NANDANKANAN BIOLOGICAL PARK	ODISHA	Antelope Four Horned (Chowsingha)	3	3	4	10
		Bear Sloth	4	3	0	7
		Bear Himalayan Black	1	2	0	3
		Black Buck (Krishna Mrig)	3	2	0	5
		Cat Jungle	1	0	0	1
		Cat Leopard	0	2	0	2
		Civet Common Palm - Cat Toddy	3	1	0	4
		Civet Indian Small	0	0	1	1
		Cobra Indian	0	0	2	2

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Cobra King	0	0	1	1
		Cobra Monocellate/accellate	0	0	3	3
		Crocodile Long Snouted (Gharial)	0	12	88	100
		Crocodile Marsh (Mugger)	0	0	3	3
		Crocodile Salt Water	0	0	2	2
		Deer Brow-antlered (Sangai)	1	1	0	2
		Deer Mouse	1	0	0	1
		Deer Swamp (Barasingha)	1	2	5	8
		Elephant Indian	0	3	0	3
		Jackal	1	0	0	1
		Langur Nilgiri	0	0	0	0
		Leopard (Panther)	3	2	0	5
		Loris Slow	0	1	0	1
		Macaque Assamese	1	0	0	1
		Macaque Rhesus	3	0	0	3
		Mongoose Common	1	1	0	2
		Monitor Lizard / Common Indian	1	1	0	2
		Monitor Water Lizard	1	1	21	23
		Pangolin	0	1	4	5
		Peafowl	2	1	1	4
		Peafowl White	0	0	5	5
		Pigeon Nicobar	1	0	0	1
		Python Bivittatus	0	0	1	1
		Python Indian - Rock	1	1	0	2
		Python Regal / Reticulated	0	0	1	1
		Ratel	0	1	1	2
		Rhinoceros Indian One Horned	1	0	0	1
		Snake Rat / Dhaman	0	0	1	1
		Spoonbill White	0	1	0	1
		Tiger Bengal	3	10	3	16
		Tiger Bengal (White)	3	5	0	8
		Turtle Fresh Water/Indian Soft-shelled	0	0	44	44
		Turtle Ganges Soft-shelled	0	0	1	1
		Viper Russells	1	0	0	1
		Vulture Scavenger / Egyptian	0	0	1	1
		Chameleon Indian	0	0	2	2
NANDANKANAN BIOLOGICAL PARK Total			**41**	**57**	**195**	**293**
NATIONAL PARK, BANNERGHATTA ZOOLOGICAL GARDEN	**KARNATAKA**	Bear Sloth	59	45	0	104
		Bear Himalayan Black	4	2	0	6
		Black Buck (Krishna Mrig)	6	17	0	23
		Civet Common Palm - Cat Toddy	1	1	2	4
		Cobra Indian	10	10	0	20

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Cobra King	1	1	0	2
		Crocodile Long Snouted (Gharial)	1	1	0	2
		Crocodile Marsh (Mugger)	2	2	0	4
		Deer Brow-antlered (Sangai)	1	4	0	5
		Deer Mouse	0	1	0	1
		Elephant Indian	4	9	0	13
		Fowl Jungle Grey	2	0	0	2
		Gaur (Indian Bison)	5	4	0	9
		Gazelle Indian (Chinkara)	1	0	0	1
		Hornbill Great Indian / Great Pied	1	0	0	1
		Jackal	2	4	0	6
		Langur Common	1	3	0	4
		Leopard (Panther)	14	10	0	24
		Lion Indian	1	0	0	1
		Loris Slender	0	0	0	0
		Macaque Assamese	0	0	0	0
		Macaque Lion-tailed	1	0	0	1
		Macaque Rhesus	2	6	0	8
		Monitor Lizard / Common Indian	0	0	1	1
		Peafowl	4	5	0	9
		Peafowl White	2	1	1	4
		Pheasant Kalij	2	4	0	6
		Python Indian - Rock	1	3	0	4
		Snake Rat / Dhaman	0	0	30	30
		Spoonbill White	1	0	0	1
		Squirrel Giant Malabar / Indian	1	3	0	4
		Terrapin River (batagur)	7	4	9	20
		Tiger Bengal	21	20	0	41
		Tiger Bengal (White)	4	3	0	7
		Turtle Fresh Water/Indian Soft-shelled	0	0	5	5
		Viper Russells	0	0	8	8
NATIONAL PARK, BANNERGHATTA ZOOLOGICAL GARDEN Total			**162**	**163**	**56**	**381**
NATIONAL ZOOLOGICAL PARK	**DELHI**	Antelope Four Horned (Chowsingha)	2	2	0	4
		Bear Sloth	2	2	0	4
		Bear Himalayan Black	2	3	1	6
		Black Buck (Krishna Mrig)	56	66	36	158
		Cat Leopard	1	0	0	1
		Civet Common Palm - Cat Toddy	5	2	6	13
		Civet Indian Small	1	0	0	1
		Cobra Indian	1	1	7	9
		Crocodile Long Snouted (Gharial)	1	1	0	2
		Crocodile Marsh (Mugger)	1	0	0	1

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Deer Brow-antlered (Sangai)	7	26	15	48
		Deer Swamp (Barasingha)	1	6	2	9
		Elephant Indian	1	1	0	2
		Fox Common	1	1	0	2
		Gaur (Indian Bison)	3	1	0	4
		Gazelle Indian (Chinkara)	3	1	0	4
		Gibbon Hoolock	1	1	0	2
		Hornbill Common Grey	2	1	0	3
		Hornbill Great Indian / Great Pied	1	0	0	1
		Jackal	3	2	3	8
		Langur Common	1	1	0	2
		Leopard (Panther)	1	2	0	3
		Lion Indian	3	4	0	7
		Macaque Lion-tailed	3	2	0	5
		Macaque Rhesus	1	1	0	2
		Macaque Stump Tailed	1	1	0	2
		Monitor Lizard / Common Indian	1	1	8	10
		Myna Hill	0	0	3	3
		Peafowl White	1	0	0	1
		Pheasant Kalij	1	1	0	2
		Python Indian - Rock	4	3	2	9
		Rhinoceros Indian One Horned	1	2	0	3
		Shikra	2	2	0	4
		Snake Rat / Dhaman	0	0	7	7
		Spoonbill White	2	3	0	5
		Tiger Bengal	2	4	0	6
		Tiger Bengal (White)	2	7	0	9
		Wolf Indian	0	0	0	0
NATIONAL ZOOLOGICAL PARK Total			**121**	**151**	**90**	**362**
NEHRU PARK ZOO, DANAKGRE, TURA	MEGHALAYA	Bear Himalayan Black	1	3	0	4
		Cat Jungle	0	0	0	0
		Cat Leopard	2	0	0	2
		Hornbill Indian Pied	0	1	0	1
		Macaque Rhesus	4	2	0	6
		Macaque Stump Tailed	2	0	0	2
		Python Indian - Rock	0	1	2	3
		Turtle Fresh Water/Indian Soft-shelled	0	2	0	2
NEHRU PARK ZOO, DANAKGRE, TURA Total			**9**	**9**	**2**	**20**
NEHRU PHESANTARY	HIMACHAL PRADESH	Pheasant Kalij	7	3	0	10
		Pheasant Monal / Impeyan	8	4	0	12
NEHRU PHESANTARY Total			**15**	**7**	**0**	**22**
NEHRU ZOOLOGICAL PARK	ANDHRA PRADESH	Antelope Four Horned (Chowsingha)	0	1	0	1

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Bear Sloth	5	4	0	9
		Bear Himalayan Black	1	3	0	4
		Bear Sun - Malayan	1	2	0	3
		Black Buck (Krishna Mrig)	11	15	2	28
		Cat Leopard	2	1	0	3
		Civet Common Palm - Cat Toddy	4	3	0	7
		Civet Indian Small	0	0	1	1
		Cobra Indian	2	8	0	10
		Crocodile Long Snouted (Gharial)	0	12	0	12
		Crocodile Marsh (Mugger)	20	16	0	36
		Crocodile Salt Water	1	1	0	2
		Deer Brow-antlered (Sangai)	2	2	0	4
		Deer Mouse	7	13	0	20
		Deer Swamp (Barasingha)	2	4	1	7
		Dog Wild (Dhole)	0	1	0	1
		Elephant Indian	1	4	0	5
		Fowl Jungle Grey	3	4	0	7
		Fox Common	0	2	0	2
		Gaur (Indian Bison)	2	0	0	2
		Hornbill Great Indian / Great Pied	1	1	0	2
		Hornbill Indian Pied	1	1	0	2
		Jackal	1	1	2	4
		Langur Capped	1	0	0	1
		Langur Nilgiri	1	1	1	3
		Leopard (Panther)	3	4	0	7
		Lion Indian	9	7	0	16
		Loris Slender	1	1	0	2
		Macaque Lion-tailed	1	1	0	2
		Macaque Pig Tailed	0	1	0	1
		Macaque Rhesus	0	2	0	2
		Monitor Lizard / Common Indian	0	2	0	2
		Otter Smooth Indian	1	0	0	1
		Peafowl	17	19	0	36
		Pheasant Grey Peacock	1	1	0	2
		Pheasant Kalij	4	2	0	6
		Python Indian - Rock	1	2	0	3
		Python Regal / Reticulated	1	0	0	1
		Ratel	1	1	0	2
		Rhinoceros Indian One Horned	1	1	0	2
		Shikra	3	0	0	3
		Snake Rat / Dhaman	4	2	0	6
		Spoonbill White	5	4	0	9

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Tiger Bengal	3	7	3	13
		Tiger Bengal (White)	3	2	0	5
		Turtle Fresh Water/Indian Soft-shelled	45	25	0	70
		Viper Russells	1	1	0	2
		Vulture Scavenger / Egyptian	1	1	0	2
		Vulture White Backed - Bengal	3	2	0	5
		Wolf Indian	2	0	0	2
		Chameleon Indian	1	2	0	3
NEHRU ZOOLOGICAL PARK Total			**181**	**190**	**10**	**381**
NISARGAKAVI BAHINABAI CHOUDHARY PRANISANGAHALAYA	**MAHARASHTRA**	Cobra Indian	2	3	2	7
		Crocodile Marsh (Mugger)	1	1	10	12
		Leopard (Panther)	1	1	0	2
		Macaque Rhesus	2	1	0	3
		Peafowl	3	4	3	10
		Python Indian - Rock	1	1	0	2
		Shikra	0	0	2	2
		Snake Keelback Checkered	3	3	0	6
		Snake Rat / Dhaman	2	3	4	9
		Turtle Fresh Water / Indian Soft-shelled	0	0	3	3
		Viper Russells	2	2	1	5
NISARGAKAVI BAHINABAI CHOUDHARY PRANISANGAHALAYA Total			**17**	**19**	**25**	**61**
PADMAJA NAIDU HIMALAYAN ZOOLOGICAL PARK	**WEST BENGAL**	Bear Himalayan Black	2	2	0	4
		Cat Leopard	2	0	0	2
		Civet Himalayan Palm / Masked	3	2	0	5
		Deer Musk (Kasturi Mrig)	0	0	0	0
		Himalayan Newt	6	6	11	23
		Jackal	1	1	0	2
		Langur Common	2	4	3	9
		Leopard (Panther)	3	2	0	5
		Leopard Clouded	1	1	0	2
		Leopard Snow	4	3	0	7
		Loris Slow	0	0	0	0
		Myna Hill	0	0	3	3
		Panda Red / Lesser	10	5	0	15
		Pheasant Cheer	1	1	0	2
		Pheasant Grey Peacock	1	1	3	5
		Pheasant Kalij	3	1	11	15
		Pheasant Monal / Impeyan	2	2	0	4
		Sheep Blue (Bharal)	3	3	0	6
		Tahr Himalayan	3	3	0	6
		Tiger Bengal	1	2	0	3
		Tragopan Satyr / Crimsion	0	1	0	1

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Wolf Tibetan	2	13	0	15
		Yak Wild	2	0	0	2
PADMAJA NAIDU HIMALAYAN ZOOLOGICAL PARK Total			**52**	**53**	**31**	**136**
PANCHWATI DEER PARK	RAJASTHAN	Black Buck (Krishna Mrig)	0	0	0	0
		Gazelle Indian (Chinkara)	0	0	0	0
PANCHWATI DEER PARK Total			**0**	**0**	**0**	**0**
PARASSINIKKADAVU REPTILE PARK	KERALA	Cat Jungle	2	0	0	2
		Civet Common Palm - Cat Toddy	4	0	0	4
		Cobra Indian	3	2	0	5
		Cobra King	1	1	0	2
		Crocodile Marsh (Mugger)	34	10	0	44
		Fox Common	1	0	0	1
		Macaque Lion-tailed	1	1	0	2
		Mongoose Common	2	1	0	3
		Monitor Lizard / Common Indian	1	1	0	2
		Peafowl	3	1	0	4
		Python Indian - Rock	9	6	0	15
		Snake Keelback Checkered	12	11	0	23
		Snake Rat / Dhaman	5	7	0	12
		Viper Russells	4	5	0	9
PARASSINIKKADAVU REPTILE PARK Total			**82**	**46**	**0**	**128**
PEOPLE FOR ANIMALS - RESCUE CENTRE	KARNATAKA	Civet Common Palm - Cat Toddy	0	0	0	0
		Cobra Indian	0	0	6	6
		Jackal	0	0	0	0
		Macaque Assamese	0	0	1	1
		Monitor Lizard / Common Indian	0	0	0	0
		Pangolin	0	0	0	0
		Python Indian - Rock	0	0	0	0
		Shikra	0	0	0	0
		Snake Keelback Checkered	0	0	7	7
		Snake Keelback Olivaceous	0	0	0	0
		Snake Rat / Dhaman	0	0	0	0
		Turtle Fresh Water/Indian Soft-shelled	0	0	1	1
		Viper Russells	0	0	1	1
		Chameleon Indian	0	0	0	0
PEOPLE FOR ANIMALS - RESCUE CENTRE Total			**0**	**0**	**16**	**16**
PEOPLE FOR ANIMALS, SHELTER HOUSE	MAHARASHTRA	Civet Common Palm - Cat Toddy	0	0	0	0
		Langur Common	0	0	0	0
		Peafowl	0	0	0	0
		Snake Rat / Dhaman	0	0	0	0
PEOPLE FOR ANIMALS, SHELTER HOUSE Total			**0**	**0**	**0**	**0**
PILLALAMARRI DEER PARK	ANDHRA PRADESH	Antelope Four Horned (Chowsingha)	1	-1	0	0

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Black Buck (Krishna Mrig)	1	2	0	3
		Peafowl	4	1	0	5
PILLALAMARRI DEER PARK Total			**6**	**2**	**0**	**8**
PT. GOVIND BALLABH PANT HIGH ALTITUDE ZOO	UTTARAKHAND	Bear Sloth	0	0	0	0
		Bear Himalayan Black	0	2	0	2
		Cat Leopard	0	1	0	1
		Civet Himalayan Palm / Masked	1	0	0	1
		Leopard (Panther)	6	5	0	11
		Marten Yellow Throated	1	1	0	2
		Peafowl White	1	1	0	2
		Pheasant Cheer	2	2	0	4
		Pheasant Kalij	13	10	0	23
		Serow	0	0	0	0
		Tiger Bengal	1	1	0	2
		Wolf Tibetan	2	2	0	4
PT. GOVIND BALLABH PANT HIGH ALTITUDE ZOO Total			**27**	**25**	**0**	**52**
PUGMARKS - PFA SANITIKETAN RESCUE CENTRE	WEST BENGAL	Cat Jungle	0	0	0	0
		Jackal	1	0	0	1
		Macaque Rhesus	0	2	0	2
PUGMARKS - PFA SANITIKETAN RESCUE CENTRE Total			**1**	**2**	**0**	**3**
PURULIA MINI ZOO, SURULIA	WEST BENGAL	Langur Common	1	1	0	2
		Macaque Rhesus	1	1	0	2
		Porcupine Bengal	0	0	1	1
PURULIA MINI ZOO, SURULIA Total			**2**	**2**	**1**	**5**
RAJIV GANDHI ZOOLOGICAL PARK AND WILDLIFE RESEARCH CENTER	MAHARASHTRA	Antelope Four Horned (Chowsingha)	2	5	0	7
		Bear Sloth	3	1	0	4
		Black Buck (Krishna Mrig)	12	16	0	28
		Cat Jungle	1	0	0	1
		Cobra Indian	3	7	0	10
		Cobra King	1	1	0	2
		Cobra Monocellate/accellate	0	0	0	0
		Crocodile Long Snouted (Gharial)	0	3	0	3
		Crocodile Marsh (Mugger)	2	1	0	3
		Elephant Indian	0	2	0	2
		Gaur (Indian Bison)	1	1	0	2
		Gazelle Indian (Chinkara)	3	2	0	5
		Jackal	3	5	1	9
		Kestrel	0	0	1	1
		Leopard (Panther)	1	2	0	3
		Macaque Rhesus	3	6	0	9
		Monitor Lizard / Common Indian	1	1	1	3
		Peafowl	1	2	3	6

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Python Indian - Rock	2	3	0	5
		Python Regal / Reticulated	2	1	0	3
		Shikra	0	0	2	2
		Snake Keelback Checkered	13	14	0	27
		Snake Rat / Dhaman	6	9	0	15
		Tiger Bengal	1	3	0	4
		Tiger Bengal (White)	1	2	0	3
		Turtle Fresh Water/Indian Soft-shelled	1	2	0	3
		Turtle Indian Roofed	2	1	0	3
		Viper Russells	2	3	0	5
		Vulture Long Billed	1	1	0	2
		Wolf Indian	1	2	0	3
RAJIV GANDHI ZOOLOGICAL PARK AND WILDLIFE RESEARCH CENTER Total			**69**	**96**	**8**	**173**
RAJKOT ZOO	GUJARAT	Bear Himalayan Black	1	1	0	2
		Black Buck (Krishna Mrig)	2	4	2	8
		Crocodile Marsh (Mugger)	1	1	0	2
		Leopard (Panther)	1	1	0	2
		Lion Indian	4	9	0	13
		Tiger Bengal	1	2	0	3
RAJKOT ZOO Total			**10**	**18**	**2**	**30**
RAMNABAGAN MINI ZOO	WEST BENGAL	Antelope Four Horned (Chowsingha)	1	0	0	1
		Bear Sloth	1	1	0	2
		Black Buck (Krishna Mrig)	1	0	0	1
		Crocodile Marsh (Mugger)	1	0	0	1
		Macaque Rhesus	6	3	0	9
		Peafowl	2	4	0	6
		Vulture White Backed - Bengal	0	0	1	1
RAMNABAGAN MINI ZOO Total			**12**	**8**	**1**	**21**
RASIKBEEL MINI ZOO	WEST BENGAL	Crocodile Long Snouted (Gharial)	2	6	0	8
		Leopard (Panther)	2	5	0	7
		Peafowl	3	4	0	7
		Python Indian - Rock	0	0	4	4
RASIKBEEL MINI ZOO Total			**7**	**15**	**4**	**26**
RENUKE MINI ZOO	HIMACHAL PRADESH	Bear Himalayan Black	1	2	3	6
		Black Buck (Krishna Mrig)	2	5	0	7
		Leopard (Panther)	1	0	0	1
		Pheasant Kalij	4	2	0	6
RENUKE MINI ZOO Total			**8**	**9**	**3**	**20**
RESCUE AND REHABILITATION HOME	HIMACHAL PRADESH	Bear Himalayan Black	2	3	3	8
		Leopard (Panther)	0	1	4	5
RESCUE AND REHABILITATION HOME Total			**2**	**4**	**7**	**13**
REWALSAR MINI ZOO	HIMACHAL PRADESH	Bear Himalayan Black	4	1	0	5

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Porcupine Himalayan Crestless	2	0	0	2
REWALSAR MINI ZOO Total			**6**	**1**	**0**	**7**
ROHTAK ZOO	**HARYANA**	Black Buck (Krishna Mrig)	3	2	0	5
		Crocodile Marsh (Mugger)	3	2	0	5
		Jackal	0	2	0	2
		Langur Common	1	0	0	1
		Leopard (Panther)	1	1	0	2
		Spoonbill White	1	1	0	2
		Tiger Bengal	1	1	0	2
ROHTAK ZOO Total			**10**	**9**	**0**	**19**
SAKKARBAUG ZOO	**GUJARAT**	Antelope Four Horned (Chowsingha)	7	23	3	33
		Ass Wild Indian	9	5	0	14
		Bear Sloth	3	2	0	5
		Bear Himalayan Black	1	0	0	1
		Black Buck (Krishna Mrig)	9	23	22	54
		Cat Jungle	0	2	2	4
		Cobra Indian	0	1	1	2
		Crocodile Long Snouted (Gharial)	1	1	0	2
		Crocodile Marsh (Mugger)	2	0	1	3
		Deer Brow-antlered (Sangai)	5	5	2	12
		Deer Swamp (Barasingha)	1	1	1	3
		Fox Common	0	1	0	1
		Gaur (Indian Bison)	1	1	0	2
		Gazelle Indian (Chinkara)	9	34	3	46
		Hornbill Indian Pied	1	1	0	2
		Jackal	2	2	0	4
		Langur Common	0	1	0	1
		Leopard (Panther)	33	18	0	51
		Lion Indian	28	43	0	71
		Macaque Rhesus	3	1	1	5
		Peafowl	1	5	0	6
		Peafowl White	9	9	0	18
		Pheasant Kalij	1	1	0	2
		Pigeon Nicobar	0	1	0	1
		Python Indian - Rock	1	2	1	4
		Snake Keelback Checkered	0	0	2	2
		Snake Rat / Dhaman	0	0	2	2
		Spoonbill White	0	2	12	14
		Squirrel Giant Malabar / Indian	0	1	0	1
		Tiger Bengal	2	4	0	6
		Tiger Bengal (White)	1	2	0	3
		Viper Russells	0	0	2	2

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Vulture Long Billed	0	1	4	5
		Vulture Scavenger / Egyptian	0	0	0	0
		Vulture White Backed - Bengal	0	0	49	49
		Wolf Indian	2	3	0	5
SAKKARBAUG ZOO Total			**132**	**196**	**108**	**436**
SANJAY GANDHI BIOLOGICAL PARK	**BIHAR**	Bear Sloth	4	2	0	6
		Bear Himalayan Black	3	1	0	4
		Black Buck (Krishna Mrig)	10	26	12	48
		Cat Golden	1	1	0	2
		Cat Jungle	2	2	0	4
		Cat Leopard	0	5	1	6
		Civet Common Palm - Cat Toddy	4	6	0	10
		Cobra Indian	0	0	14	14
		Crocodile Long Snouted (Gharial)	2	7	98	107
		Crocodile Marsh (Mugger)	1	1	0	2
		Deer Brow-antlered (Sangai)	4	1	0	5
		Deer Swamp (Barasingha)	1	3	4	8
		Elephant Indian	0	1	0	1
		Hornbill Common Grey	0	0	3	3
		Hornbill Great Indian / Great Pied	0	1	0	1
		Hornbill Indian Pied	0	0	2	2
		Jackal	2	3	3	8
		Langur Common	2	3	1	6
		Leopard (Panther)	1	3	0	4
		Lion Indian	1	1	0	2
		Loris Slow	0	1	0	1
		Macaque Assamese	1	2	0	3
		Macaque Lion-tailed	1	1	0	2
		Macaque Rhesus	10	9	2	21
		Macaque Stump Tailed	2	1	0	3
		Monitor Water Lizard	0	0	5	5
		Myna Hill	0	0	6	6
		Otter Smooth Indian	1	1	0	2
		Peafowl	2	3	8	13
		Peafowl White	1	1	0	2
		Pheasant Kalij	0	2	0	2
		Python Indian - Rock	3	1	19	23
		Rhinoceros Indian One Horned	5	6	0	11
		Snake Rat / Dhaman	0	0	6	6
		Spoonbill White	0	0	1	1
		Squirrel Giant Malabar / Indian	1	2	0	3
		Tiger Bengal	1	1	0	2

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Tiger Bengal (White)	1	1	0	2
		Tragopan Satyr / Crimsion	0	1	0	1
		Turtle Fresh Water/Indian Soft-shelled	35	25	250	310
		Turtle Ganges Soft-shelled	5	8	8	21
		Viper Russells	0	0	3	3
SANJAY GANDHI BIOLOGICAL PARK Total			**107**	**133**	**446**	**686**
SANJAY GANDHI NATIONAL PARK AND ZOO	MAHARASHTRA	Antelope Four Horned (Chowsingha)	1	6	8	15
		Cat Rusty-spotted	1	4	0	5
		Jackal	0	0	0	0
		Leopard (Panther)	12	10	0	22
		Peafowl	0	1	0	1
		Tiger Bengal	3	3	0	6
		Tiger Bengal (White)	2	1	0	3
SANJAY GANDHI NATIONAL PARK AND ZOO Total			**19**	**25**	**8**	**52**
SARAHAN PHESANTRY	HIMACHAL PRADESH	Pheasant Cheer	0	1	0	1
		Pheasant Kalij	7	1	0	8
		Pheasant Monal / Impeyan	7	0	0	7
		Tragopan Western	9	9	0	18
SARAHAN PHESANTRY Total			**23**	**11**	**0**	**34**
SARNATH DEER PARK	UTTAR PRADESH	Black Buck (Krishna Mrig)	5	3	0	8
		Crocodile Long Snouted (Gharial)	0	1	0	1
		Crocodile Marsh (Mugger)	1	2	0	3
SARNATH DEER PARK Total			**6**	**6**	**0**	**12**
SAYAJI BAUG ZOO	GUJARAT	Bear Himalayan Black	1	1	0	2
		Black Buck (Krishna Mrig)	3	3	4	10
		Crocodile Long Snouted (Gharial)	1	3	0	4
		Crocodile Marsh (Mugger)	1	1	2	4
		Deer Brow-antlered (Sangai)	1	2	0	3
		Hornbill Indian Pied	2	1	0	3
		Jackal	1	1	0	2
		Langur Common	2	0	0	2
		Leopard (Panther)	4	2	0	6
		Lion Indian	1	1	0	2
		Macaque Pig Tailed	2	3	0	5
		Macaque Rhesus	3	4	0	7
		Myna Hill	0	0	1	1
		Peafowl	4	1	0	5
		Peafowl White	3	4	2	9
		Pheasant Grey Peacock	0	1	0	1
		Tiger Bengal	1	2	0	3
		Turtle Ganges Soft-shelled	2	2	20	24
SAYAJI BAUG ZOO Total			**32**	**32**	**29**	**93**

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
SEPAHIJALA ZOOLOGICAL PARK	TRIPURA	Bear Himalayan Black	5	7	0	12
		Binturong	2	3	0	5
		Black Buck (Krishna Mrig)	1	1	0	2
		Cat Fishing	1	1	0	2
		Cat Jungle	1	1	0	2
		Cat Leopard	3	2	3	8
		Civet Common Palm - Cat Toddy	2	1	0	3
		Civet Himalayan Palm / Masked	1	1	0	2
		Civet Indian Large	0	0	0	0
		Civet Indian Small	0	0	0	0
		Crocodile Marsh (Mugger)	2	0	0	2
		Gibbon Hoolock	2	0	0	2
		Hornbill Indian Pied	1	1	1	3
		Jackal	1	1	0	2
		Langur Capped	1	0	0	1
		Langur Common	1	1	1	3
		Leopard (Panther)	2	4	0	6
		Leopard Clouded	6	4	7	17
		Macaque Pig Tailed	2	3	15	20
		Macaque Rhesus	3	3	0	6
		Marten Yellow Throated	1	0	0	1
		Monitor Lizard / Common Indian	3	2	1	6
		Monkey Spectacled Leaf	5	7	2	14
		Peafowl	1	2	0	3
		Pheasant Kalij	2	2	0	4
		Python Regal / Reticulated	2	0	1	3
		Rhinoceros Indian One Horned	1	0	0	1
		Terrapin Eastern Hill	1	2	0	3
		Tiger Bengal	1	1	0	2
		Turtle Fresh Water/Indian Soft-shelled	1	0	0	1
		Vulture Himalayan Giffon	0	0	1	1
		Vulture White Backed - Bengal	3	0	0	3
SEPAHIJALA ZOOLOGICAL PARK Total			**58**	**50**	**32**	**140**
SIR PETER SCOTT NATURE PARK	GUJARAT	Black Buck (Krishna Mrig)	34	47	0	81
		Crocodile Marsh (Mugger)	0	1	0	1
		Hornbill Great Indian / Great Pied	4	0	0	4
SIR PETER SCOTT NATURE PARK Total			**38**	**48**	**0**	**86**
SNAKE PARK, MALAMPUZHA	KERALA	Cobra Indian	0	0	9	9
		Cobra King	0	1	3	4
		Crocodile Marsh (Mugger)	0	0	1	1
		Python Indian - Rock	0	0	10	10
		Snake Rat / Dhaman	0	0	4	4

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Viper Russells	0	0	2	2
SNAKE PARK, MALAMPUZHA Total			**0**	**1**	**29**	**30**
SNAKE PARK, SHIKSHAN MANDAL	MAHARASHTRA	Cobra Indian	4	3	0	7
		Snake Rat / Dhaman	3	4	1	8
		Viper Russells	4	2	0	6
SNAKE PARK, SHIKSHAN MANDAL Total			**11**	**9**	**1**	**21**
SOUTH KHAIRBARI LEOPARD SAFARI AND REHABILITATION CENTRE	WEST BENGAL	Leopard (Panther)	4	4	0	8
		Tiger Bengal	4	2	0	6
SOUTH KHAIRBARI LEOPARD SAFARI AND REHABILITATION CENTRE Total			**8**	**6**	**0**	**14**
SRI CHAMARAJENDRA ZOOLOGICAL GARDENS	KARNATAKA	Antelope Four Horned (Chowsingha)	3	4	6	13
		Bear Sloth	5	5	0	10
		Bear Himalayan Black	3	2	0	5
		Black Buck (Krishna Mrig)	7	11	13	31
		Cat Jungle	3	3	0	6
		Cat Leopard	1	0	0	1
		Cat Rusty-spotted	0	1	0	1
		Civet Common Palm - Cat Toddy	2	2	0	4
		Civet Indian Small	0	3	0	3
		Cobra Indian	2	2	1	5
		Cobra King	3	2	0	5
		Crocodile Long Snouted (Gharial)	0	0	7	7
		Crocodile Marsh (Mugger)	2	2	1	5
		Crocodile Salt Water	1	1	0	2
		Deer Brow-antlered (Sangai)	11	6	0	17
		Deer Mouse	0	3	0	3
		Deer Swamp (Barasingha)	3	8	2	13
		Dog Wild (Dhole)	5	4	0	9
		Duck White Winged Wood	1	1	0	2
		Elephant Indian	3	5	0	8
		Fowl Jungle Grey	1	3	4	8
		Gaur (Indian Bison)	16	14	1	31
		Gazelle Indian (Chinkara)	0	1	0	1
		Hornbill Common Grey	1	1	0	2
		Hornbill Great Indian / Great Pied	2	0	0	2
		Jackal	3	5	0	8
		Langur Common	0	3	0	3
		Langur Nilgiri	0	1	0	1
		Leopard (Panther)	4	3	0	7
		Lion Indian	1	1	0	2
		Macaque Lion-tailed	4	4	0	8
		Macaque Rhesus	1	2	0	3
		Monitor Lizard / Common Indian	0	0	1	1

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Otter Smooth Indian	1	0	0	1
		Peafowl	13	9	6	28
		Peafowl White	1	1	8	10
		Pheasant Kalij	1	0	0	1
		Pheasant Monal / Impeyan	1	0	0	1
		Python Indian - Rock	1	0	1	2
		Python Regal / Reticulated	1	0	0	1
		Snake Rat / Dhaman	2	0	1	3
		Spoonbill White	2	3	3	8
		Squirrel Giant Malabar / Indian	1	2	0	3
		Terrapin River (batagur)	0	0	5	5
		Tiger Bengal	6	2	0	8
		Tiger Bengal (White)	0	2	0	2
		Tragopan Satyr / Crimsion	1	1	0	2
		Turtle Fresh Water/Indian Soft-shelled	0	0	15	15
		Turtle Indian Black	0	0	6	6
		Viper Russells	0	0	2	2
		Wolf Indian	8	3	0	11
SRI CHAMARAJENDRA ZOOLOGICAL GARDENS Total			**127**	**126**	**83**	**336**
SRI VENKATESWARA ZOOLOGICAL PARK	**ANDHRA PRADESH**	Antelope Four Horned (Chowsingha)	5	10	15	30
		Bear Sloth	3	2	0	5
		Black Buck (Krishna Mrig)	7	8	12	27
		Crocodile Long Snouted (Gharial)	0	0	4	4
		Crocodile Marsh (Mugger)	2	1	1	4
		Crocodile Salt Water	1	2	2	5
		Deer Swamp (Barasingha)	1	2	0	3
		Dog Wild (Dhole)	1	0	0	1
		Elephant Indian	2	2	0	4
		Fowl Jungle Grey	5	7	31	43
		Gaur (Indian Bison)	1	2	0	3
		Jackal	2	1	4	7
		Langur Common	3	1	0	4
		Leopard (Panther)	4	2	0	6
		Lion Indian	4	4	0	8
		Macaque Rhesus	2	5	0	7
		Macaque Stump Tailed	1	1	0	2
		Peafowl	3	8	30	41
		Peafowl White	0	0	4	4
		Pheasant Kalij	2	1	0	3
		Python Indian - Rock	0	0	4	4
		Snake Rat / Dhaman	0	0	4	4
		Terrapin River (batagur)	0	0	20	20

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Tiger Bengal	1	0	0	1
		Tiger Bengal (White)	4	4	0	8
SRI VENKATESWARA ZOOLOGICAL PARK Total			**54**	**63**	**131**	**248**
STATE MUSEUM & ZOO	**KERALA**	Bear Himalayan Black	1	1	0	2
		Cat Jungle	2	2	0	4
		Civet Common Palm - Cat Toddy	3	2	1	6
		Cobra Indian	0	0	7	7
		Cobra King	0	0	2	2
		Crocodile Long Snouted (Gharial)	3	0	0	3
		Crocodile Marsh (Mugger)	1	0	0	1
		Jackal	2	6	0	8
		Leopard (Panther)	2	1	0	3
		Macaque Lion-tailed	1	0	0	1
		Macaque Rhesus	2	0	0	2
		Monitor Lizard / Common Indian	0	0	1	1
		Peafowl	7	6	0	13
		Python Indian - Rock	0	0	3	3
		Snake Keelback Checkered	0	0	1	1
		Snake Rat / Dhaman	0	0	2	2
		Squirrel Giant Malabar / Indian	0	0	0	0
		Tiger Bengal	1	0	0	1
		Turtle Ganges Soft-shelled	0	0	2	2
		Viper Russells	0	0	2	2
STATE MUSEUM & ZOO Total			**25**	**18**	**21**	**64**
SUNDERVAN NATURE DISCOVERY CENTRE	**GUJARAT**	Cobra Indian	0	0	6	6
		Crocodile Marsh (Mugger)	0	0	0	0
		Monitor Lizard / Common Indian	0	0	3	3
		Python Indian - Rock	0	0	8	8
		Snake Keelback Checkered	0	0	4	4
		Snake Rat / Dhaman	0	0	5	5
		Viper Russells	0	0	1	1
SUNDERVAN NATURE DISCOVERY CENTRE Total			**0**	**0**	**27**	**27**
TAPTAPANI DEER PARK	**ODISHA**	Black Buck (Krishna Mrig)	0	0	0	0
TAPTAPANI DEER PARK Total			**0**	**0**	**0**	**0**
TATA STEEL ZOOLOGICAL PARK	**JHARKHAND**	Bear Sloth	1	2	0	3
		Black Buck (Krishna Mrig)	6	2	22	30
		Crocodile Long Snouted (Gharial)	1	3	0	4
		Crocodile Marsh (Mugger)	0	1	0	1
		Langur Common	3	1	2	6
		Leopard (Panther)	2	3	0	5
		Macaque Rhesus	1	1	3	5
		Myna Hill	0	1	0	1

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Peafowl	2	4	7	13
		Peafowl White	0	1	0	1
		Pheasant Kalij	1	0	0	1
		Tiger Bengal	1	1	0	2
		Tiger Bengal (White)	0	0	0	0
TATA STEEL ZOOLOGICAL PARK Total			**18**	**20**	**34**	**72**
THIRUVANANTHAPURAM ZOO	**KERALA**	Bear Sloth	1	1	1	3
		Bear Himalayan Black	0	1	0	1
		Black Buck (Krishna Mrig)	12	4	7	23
		Cat Jungle	2	0	0	2
		Cobra Indian	5	3	3	11
		Cobra King	1	1	0	2
		Crocodile Long Snouted (Gharial)	2	4	0	6
		Crocodile Marsh (Mugger)	1	1	0	2
		Eagle White Bellied Sea	0	0	1	1
		Elephant Indian	1	1	0	2
		Gaur (Indian Bison)	1	2	0	3
		Hornbill Malabar Pied	0	0	0	0
		Jackal	0	0	0	0
		Langur Common	1	1	0	2
		Langur Nilgiri	1	1	0	2
		Leopard (Panther)	2	2	0	4
		Macaque Lion-tailed	6	6	0	12
		Macaque Rhesus	2	4	1	7
		Peafowl	10	4	0	14
		Pheasant Kalij	1	1	0	2
		Python Indian - Rock	2	1	2	5
		Rhinoceros Indian One Horned	1	0	0	1
		Snake Keelback Checkered	0	1	2	3
		Snake Rat / Dhaman	1	2	0	3
		Spoonbill White	1	1	0	2
		Squirrel Giant Malabar / Indian	1	0	0	1
		Tiger Bengal	4	3	0	7
		Turtle Fresh Water/Indian Soft-shelled	0	0	1	1
		Turtle Indian Black	2	2	2	6
		Viper Russells	0	0	5	5
		Vulture Asian King / Black Indian	0	0	0	0
THIRUVANANTHAPURAM ZOO Total			**61**	**47**	**25**	**133**
TIGER & LION SAFARI	**KARNATAKA**	Bear Sloth	1	1	0	2
		Black Buck (Krishna Mrig)	5	2	0	7
		Crocodile Marsh (Mugger)	0	0	3	3
		Jackal	2	2	0	4

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
		Leopard (Panther)	9	5	0	14
		Lion Indian	1	3	0	4
		Macaque Rhesus	0	0	0	0
		Peafowl	3	1	0	4
		Python Indian - Rock	1	1	0	2
		Tiger Bengal	7	5	0	12
TIGER & LION SAFARI Total			**29**	**20**	**3**	**52**
TUNGABHADRA DAM MINI ZOO	**KARNATAKA**	Black Buck (Krishna Mrig)	3	5	3	11
		Peafowl	1	5	0	6
TUNGABHADRA DAM MINI ZOO Total			**4**	**10**	**3**	**17**
UDAIPUR ZOO	**RAJASTHAN**	Antelope Four Horned (Chowsingha)	3	2	2	7
		Bear Himalayan Black	1	1	0	2
		Black Buck (Krishna Mrig)	1	2	0	3
		Crocodile Marsh (Mugger)	1	1	0	2
		Gazelle Indian (Chinkara)	0	2	0	2
		Jackal	1	1	10	12
		Langur Common	1	1	0	2
		Leopard (Panther)	3	1	0	4
		Macaque Rhesus	4	2	0	6
		Peafowl	7	3	2	12
		Peafowl White	0	0	4	4
		Porcupine Bengal	0	0	9	9
		Spoonbill White	1	1	0	2
		Tiger Bengal	0	1	0	1
		Vulture Long Billed	0	0	0	0
UDAIPUR ZOO Total			**23**	**18**	**27**	**68**
V.O.C. PARK MINI ZOO	**TAMIL NADU**	Civet Common Palm - Cat Toddy	3	4	0	7
		Civet Indian Small	1	1	0	2
		Cobra Indian	0	0	2	2
		Crocodile Marsh (Mugger)	3	2	8	13
		Hornbill Common Grey	1	0	0	1
		Hornbill Malabar Pied	0	0	1	1
		Jackal	3	2	0	5
		Macaque Rhesus	3	1	0	4
		Monitor Lizard / Common Indian	0	0	1	1
		Peafowl	6	7	0	13
		Python Indian - Rock	1	1	0	2
		Snake Rat / Dhaman	0	0	8	8
		Viper Russells	0	0	1	1
V.O.C. PARK MINI ZOO Total			**21**	**18**	**21**	**60**
VAN PRANI UDYAN, I.V.R.I.	**UTTAR PRADESH**	Black Buck (Krishna Mrig)	8	4	0	12
VAN PRANI UDYAN, I.V.R.I. Total			**8**	**4**	**0**	**12**

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
VAN VIHAR NATIONAL PARK ZOO	MADHYA PRADESH	Antelope Four Horned (Chowsingha)	7	3	0	10
		Bear Sloth	19	17	0	36
		Bear Himalayan Black	1	0	0	1
		Black Buck (Krishna Mrig)	23	28	10	61
		Crocodile Long Snouted (Gharial)	2	6	0	8
		Crocodile Marsh (Mugger)	2	4	11	17
		Gaur (Indian Bison)	1	1	0	2
		Gazelle Indian (Chinkara)	2	2	0	4
		Jackal	0	0	40	40
		Leopard (Panther)	5	8	0	13
		Lion Indian	0	0	0	0
		Tiger Bengal	5	4	0	9
		Tiger Bengal (White)	0	1	0	1
		Turtle Fresh Water/Indian Soft-shelled	0	0	46	46
VAN VIHAR NATIONAL PARK ZOO Total			**67**	**74**	**107**	**248**
VANAVIGYAN KENDRA, HUNTER ROAD, HANAMKONDA	ANDHRA PRADESH	Antelope Four Horned (Chowsingha)	3	3	5	11
		Bear Sloth	1	1	2	4
		Crocodile Marsh (Mugger)	3	2	0	5
		Peafowl	15	15	0	30
VANAVIGYAN KENDRA, HUNTER ROAD, HANAMKONDA, Total			**22**	**21**	**7**	**50**
VEERMATA JIJABAI BHOSALE UDYAN & ZOO	MAHARASHTRA	Antelope Four Horned (Chowsingha)	0	4	4	8
		Bear Himalayan Black	0	1	0	1
		Black Buck (Krishna Mrig)	9	43	0	52
		Civet Common Palm - Cat Toddy	0	1	0	1
		Cobra Indian	1	0	1	2
		Crocodile Long Snouted (Gharial)	2	0	0	2
		Crocodile Marsh (Mugger)	2	2	3	7
		Elephant Indian	0	2	0	2
		Hornbill Indian Pied	0	1	0	1
		Macaque Rhesus	3	6	2	11
		Myna Hill	4	4	0	8
		Peafowl	0	1	0	1
		Peafowl White	1	1	0	2
		Pheasant Grey Peacock	1	0	0	1
		Python Indian - Rock	0	1	4	5
		Rhinoceros Indian One Horned	1	0	0	1
		Snake Rat / Dhaman	0	0	3	3
		Spoonbill White	0	0	0	0
VEERMATA JIJABAI BHOSALE UDYAN & ZOO Total			**24**	**67**	**17**	**108**
VISAKHA SOCIETY FOR PROTECTION AND CARE OF ANIMALS	ANDHRA PRADESH	Macaque Rhesus	2	1	0	3
VISAKHA SOCIETY FOR PROTECTION AND CARE OF ANIMALS Total			**2**	**1**	**0**	**3**

Establishment Name	State Name	Animal Name	Male	Female	Unsex	Total
VULTURE CONSERVATION BREEDING CENTER	HARYANA	Vulture Himalayan Giffon	0	0	2	2
		Vulture Long Billed	10	10	54	74
		Vulture Slender billed	5	5	11	21
		Vulture White Backed - Bengal	15	15	33	63
VULTURE CONSERVATION BREEDING CENTER Total			**30**	**30**	**100**	**160**
WEST BENGAL SNAKE PARK & LABORATORY, BADU	WEST BENGAL	Cobra Indian	3	2	0	5
		Cobra Monocellate/accellate	31	22	0	53
		Python Indian - Rock	1	1	0	2
		Snake Rat / Dhaman	9	6	0	15
		Viper Russells	10	9	0	19
WEST BENGAL SNAKE PARK & LABORATORY, BADU Total			**54**	**40**	**0**	**94**
WILD ANIMAL CONSERVATION CENTER	ODISHA	Antelope Four Horned (Chowsingha)	3	5	9	17
		Bear Sloth	2	3	0	5
		Civet Common Palm - Cat Toddy	3	3	0	6
		Leopard (Panther)	1	0	0	1
		Macaque Rhesus	1	1	4	6
		Peafowl	2	2	0	4
		Python Indian - Rock	1	2	0	3
		Ratel	1	0	0	1
WILD ANIMAL CONSERVATION CENTER Total			**14**	**16**	**13**	**43**
WILDLIFE RESCUE & REHABILITATION CENTRE	KARNATAKA	Cobra Indian	0	0	1	1
		Loris Slender	1	0	0	1
		Turtle Indian Tent	0	0	2	2
WILDLIFE RESCUE & REHABILITATION CENTRE Total			**1**	**0**	**3**	**4**
WILDLIFE RESCUE CENTRE	HARYANA	Langur Common	0	1	0	1
		Macaque Rhesus	44	61	0	105
		Peafowl	5	3	0	8
WILDLIFE RESCUE CENTRE Total			**49**	**65**	**0**	**114**
Grand Total			**4015**	**4171**	**6305**	**14491**

Indian Zoo Directors' Association
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