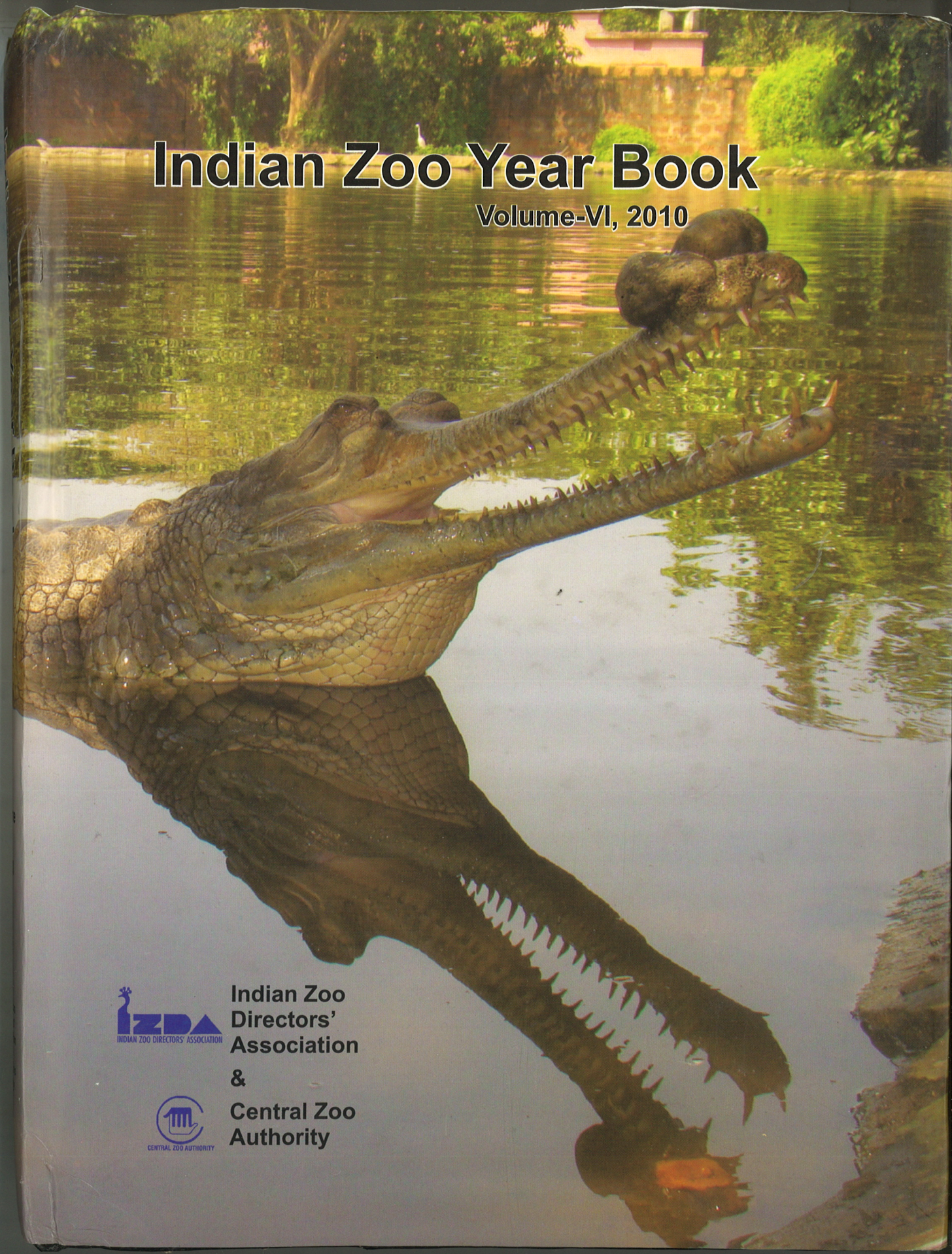
Indian Zoo Year Book

Volume-VI, 2010



Indian Zoo Directors' Association

&

Central Zoo Authority

INDIAN ZOO YEAR BOOK

VOLUME - VI, 2010

Editors

L.N. Acharjyo
S. Panda

Published by

INDIAN ZOO DIRECTORS' ASSOCIATION
&
CENTRAL ZOO AUTHORITY

IZDA
INDIAN ZOO DIRECTORS' ASSOCIATION

CENTRAL ZOO AUTHORITY

Contact Address:
Secretary
Indian Zoo Directors' Association
C/o- Director, National Zoological Park
Mathura Road, New Delhi - 110 003

Designed and printed at
Jyoti Graphics
Bhubaneswar, Orissa
Phone : 0674-2544209
e-mail: jyotigraphics@gmail.com

CONTENTS

PREFACE

Nineteen ninety six was a land mark year for us as the Indian Zoo Year Book was published in that year for the first time as a joint venture of Indian Zoo Directors' Association and Central Zoo Authority. A pledge was made to publish the Year Book every year as the name denotes to disseminate scientific knowledge on captive wildlife management in Indian zoos. The beginning was good and enthusiastically welcomed by all those connected with this wonderful subject. However, it is worth mentioning here that we have been able to bring out only five volumes of 'Indian Zoo Year Book' so far.

No doubt, something interesting is happening every day in the zoos all over India. These need to be recorded and published for the benefit of zoo personnels. We all know, there is no substitute for power than knowledge. The publication of Indian Zoo Year Book provided a platform for knowledge to spread and brought about togetherness of zoos. We feel, despite repeated requests from Central Zoo Authority and the Director, Nandankanan Zoological Park, Bhubaneswar in charge of publication, the response from the contributors was not encouraging. We have to rise above this morass and enrich our knowledge through regular contribution of articles and their publication. This may not be possible without cooperation from all quarters.

May we renew our pledge to publish the Indian Zoo Year Book more regularly than before with significant and valuable contributions from our fraternity when we are full of talented people.

We are thankful to all the contributors. We record our gratitude to the Central Zoo Authority for the timely financial support to enable us to publish the sixth volume of Indian Zoo Year Book, 2010.

We record our sincere appreciation of the assistance rendered by Dr. D. N. Mohanty for editing some of the papers and for his valuable suggestions.

Any suggestion for the qualitative improvement of the subsequent issues will be gratefully received and acted upon for the betterment of the inhabitants of our Zoos.

Editors

PLANNING AND DEVELOPMENT OF ZOOS IN INDIA

Brij Kishore Gupta[1], S.C. Sharma[2] and B.S. Bonal[3]

Summary

The Central Zoo Authority has done a commendable work in the last 18 years by way of pursuing the various zoos of the country to modernize themselves and has also provided requisite technical and financial assistance for the purpose. The assistance has been provided by the Central Zoo Authority to zoos to upgrade the animal housing, veterinary healthcare, upkeep facilities, improved signage, interpretation facilities and other supporting infrastructures. Outstanding efforts have been made to upgrade technical know-how on various aspects of zoo management amongst the personnels working in zoos at various levels. However, the results have not been commensurate to the investments because of the lack of requisite number of professionally qualified and experienced persons for carrying out various operations in the zoo. The decision making level persons both in the Zoo Operators and the zoos have not shown the sensitivity to recognize the need of professionally qualified manpower management of zoos. It is high time fort the zoos to strive upon from mere centre of exhibition to the centre for wildlife conservation.

Key Words: *Zoo Management, Planning, Development and Ex-situ Wildlife Conservation.*

Introduction

Zoo management is a productivity related work, the output of which would depend on relevant inputs for each operation and meticulous compliance of prescribed procedures by the persons involved in zoo operations. Each individual has to be always vigilant about the likely bottlenecks that may come in these operations and have innovative thinking to resolve the same. Theory of weakest chain-link of the determining the success/failures of any programme is well known. Any laxicity in zoo operations at particular stage jeopardizes the entire programme of conservation breeding or

[1] Evaluation & Monitoring Officer, Central Zoo Authority (Ministry of Environment & Forests), Anjnexe VI, Bikaner House, Shahjahan Road, New Delhi-110 011, Email-brijkishore68@yahoo.com

[2] Former Member Secretary, Central Zoo Authority C/o 411, New Delhi Apartments, Plot No.7, Vasundhara Enclave, Delhi-110096

[3] Member Secretary, Central Zoo Authority, (Ministry of Environment & Forests), Annexe VI, Bikaner House, Shahjahan Road, New Delhi-110 011

research of any endangered species or in driving home amongst the visitors a message for conservation of wildlife which is the main goal of zoo management. For successful management of animals in zoos and their planned breeding, in depth knowledge, of the anatomy of animals, their physiology, behaviour, feed requirement, population dynamics, enrichment of animal enclosures etc. is required, which could be acquired only by appointing professionally qualified persons and that too after remaining in close association with animals for long period and meticulously making observations on every aspect of the animals' life history and recording the same meticulously. The World Zoo Conservation Strategy has recognized that the zoos can not function successfully unless they carry out research and studies on various aspects and planned breeding of wildlife.

Zoos as they are functioning in India are the products of the 19th century and represent an era when our knowledge about biological behaviour of various species of wild animals was quite meager and people were struggling to get control over powerful animals. Since then the mankind have traveled a long distance, we have very reliable data about the biology, behaviour and upkeep of various species of wild animals. The strategies for their planned breeding have also been developed. All this has been achieved by the co-operative efforts of eminent zoos across the globe. The examples of such species are Arabian Oryx, Pere David's Deer, Golden-lion tamarin, Black-footed ferret, Californian condor and others.

As the number of animals pertaining to various species in *in situ* populations in the natural ecosystem is declining, the concern for learned and appropriate intervention which could arrest this declining trend is increasing. The Government of India have taken some concrete steps to rehabilitate species like crocodiles, turtles, pigmy hogs, red pandas and vultures from zoos because of having significant collection of animals pertaining to large number of species which have a great potential to contribute to the cause of planned breeding of identified endangered species and raise suitable stock for reintroduction of captive bred animals in the wild. The plans are underway to release the captive bred Asiatic lions into the Kuno Palpur Wildlife Sanctuary in Madhya Pradesh. However, the methodologies to be developed for keeping the self fending skills among carnivores should have to be followed along with various other species bred in zoos intact and identifying the suitable habitat for release in the wild. The guidelines issued by Central Zoo Authority and IUCN for Rehabilitation and Restocking should also be adhered.

Achievement of goal requires highest skill of animal husbandry, genetic management, behavioural enrichment etc. The document "Vision 2020" developed by the Central Zoo Authority shall become the road map for orienting the management of zoos in the country in such a way that they evolved into serious scientific institutions having an ideal mission and achieving the clear vision for conservation of wildlife. Under "Vision 2020", the zoos are being identified to function as Centres of Excellence, Model Zoos and potential Model Zoos.

Historical perspective of zoos in India

Indian civilization has evolved in close proximity of nature, in "*Gurukuls:* where every young person had ample opportunity to closely watch and observe the wild animals in their natural habitat. The necessity of having zoos was therefore, never felt then. Even during the "*moughal period*" there were no zoos in India, despite the fact that some of the rulers had large personal collections of various species of wild animals. The first zoo was established in India at Barrackpore in 1800, well after Britishers had landed here in Barrackpore cantonment near Calcutta, which was subsequently shifted to Alipore, Calcutta during 1876-78. First public zoo was established at Madras in 1855. It was followed by establishment of a zoo at Byculla, Bombay in 1863. Spurred by the initiatives of establishing the zoos at Madras and Bombay by the Britishers, the Ruling Kings of various princely states of India went for establishing zoos in their own states too. The name of the zoos established during the later half of nineteenth century are Marble Palace zoo, Calcutta (1854), Alipore zoo, Calcutta (1875), Trivandrum zoo (1857), Junagarh zoo (1863), Jaipur zoo (1877), Udaipur zoo (1878), Baroda zoo (1879), Thrissur zoo (1885) and Mysore zoo (1892). The trend continued in the first quarter of the 20th century. The names of the zoos established in the first quarter of 20th century are Gwalior zoo (1922), Kota zoo (1905), Bikaner zoo (1922). Jagirdars of Avadh established prince of Wales zoo, Lucknow (1921) to commemorate the visit of Prince of Wales to India. Bellilius Deer Park and Jogmaya Deer Park were established in 1936. Thus at the time of India getting independence, there were 18 zoos in India. Like elsewhere in the globe the prime objective of the zoo management in pre-independence era was displaying the wild animals in park like settings and satisfy the public curiosity by exhibiting as many species of wild animals as possible, representing different continents of the world. At that time wildlife were plentiful and no restrictions being in place for acquisition of wild animals from the

natural ecosystems, the longevity and health of the animals displayed by the zoo were hardly an area of concern.

Keeping up with global trends, Government of India also started making efforts to enhance the conservation role of zoos, soon after India becoming a Democratic Republic. The Indian Board for Wildlife resolved in 1952 that the Central Government should set up modern zoos in major cities of the country for educating the people at large on the rich fauna of the country and the need to conserve them. Consequently the construction work of Delhi zoo was started in 1955. The government wanted the Delhi zoo to be really a world class zoo and therefore, hired the services of world's most renowned zoo designer of that era, Carl Hegenbeck owner of Hamburg zoo to prepare the master plan of Delhi zoo. The services of Director of Colombo zoo were also hired to assist the government officials in the construction phase of the zoo. The construction work of the zoo was completed by 1959, when the zoo was opened to the public. A specialized zoo for high hill fame was also set up by the Department of Science and Technology, Government of India in collaboration with the Government of West Bengal at Darjeeling in 1958 and was renamed Padmaja Naidu Himalayan Zoological Park in the name of the then Governor of West Bengal in 1975. Keeping the 1952 resolution of the Indian Board for Wildlife in view large and well planned zoos were set up by the State Governments of Assam, Andhra Pradesh and Orissa at Guwahati (1957), Hyderabad (1959) and Bhubaneswar (1960) respectively. Setting up of these zoos should have led to the beginning of a new era in the history of development of zoos, however, the traditional perception of viewing zoos as mere centres of recreation continued to prevail and the State Governments and various other organizations continued to set up new menageries and deer parks, caring little to provide requisite financial and technical inputs required for planning and management of the newly created wild animal displaying facilities.

The Central Government were worried about the disturbing trend of unplanned establishment of new zoos and therefore, appointed an "Expert Committee on Zoos" under the chairmanship of Dr. A. P. Kapoor, Director, Zoological Survey of India on 19th June, 1973 to study various zoos in the country and formulate norms on the basis of which the zoos can be classified. The main aspects to be considered in this regard were the over all area of the zoo, the space available for animals in individual enclosures and facilities available for feeding the animals. The committee was also required to suggest measures for improving the efficiency of various operations forming part of

zoo management. The committee visited some of the important zoos in the country and held detailed discussions with the forest officials, the zoo officials and the animal traders, to identify the constraints in the field of zoo management and to design a strategy for redressing the same so that the planned development of zoos in the country takes place. The committee finalized its recommendations on various aspects of zoo management and submitted its report to the Government of India in November, 1973. The report was accepted by the Government of India and circulated to all concerned for implementation. The report not only highlighted the major problems that were plaguing the management of zoos in the country but also made very pertinent recommendations for improvement to the management of zoos in the country, some of which are relevant even today, after a lapse of four decades: In this regard the following recommendations need special mention:-

(i) The director of the zoo should be a whole time officer-in-charge of the zoo operations at the site.

(ii) There should be a second officer to assist the zoo director in day to day functioning and holding the post in absence of the director.

(iii) In category 'A' zoos there should be curator for various animal branches. The curator should have appropriate technical qualifications and requisite training.

(iv) Category A and B zoos should have a whole time veterinarian as in-charge of the hospital, quarantine facility, animal health and hygiene. He should be responsible for checking the quality of food also. There should be specialized training courses on wild animal healthcare for the existing zoo veterinarians.

(v) Category 'A' zoo should have a whole time officer for educational activities.

(vi) There should be adequate promotional avenue for the lower staff. The promotions should be associated with various trade tests and training courses proposed.

(vii) Frequent interchange programmes of staff between various zoos for fairly long periods to widen the outlook and enhancing the technical skills of each personnel. Adequate financial incentive should be provided to staff during such interchanges, to mitigate the financial hardships that they may face.

The report considered an area of less than 50 hectares to be inadequate to meet the requirement of display of zoo animals in accordance with modern concepts of zoo

management. It also highlighted the need of providing the zoo animals sufficient space for their movement and exercise and meeting their biological requirements. The report goes further to suggest that the soil, water and vegetation of the animal enclosures should be manipulated so as to make the animals homely. These recommendations in conjunction with the recommendations of providing every animal species an environment as close to their natural habitat make quite comprehensive guidelines about designing of animal enclosures. On feeding, upkeep and hygiene the committee has made very relevant recommendations. The report highlights the importance of breeding of endangered species and makes the following important recommendations in this regard :-

(i) Enclosures should be sufficiently large to give fullest opportunity for breeding rituals like chasing, dancing and exploration.

(ii) Enclosures should have hiding places and privacy of the animals.

(iii) Enclosures should simulate the natural habitat of the animal housed as closely as possible.

(iv) Availability and adequate breeding stock with appropriate sex ratio should be ensured.

(v) Careful observation on animal behaviour and adequate technical knowledge on the part of the zoo staff is the key to successful breeding of endangered species. Manipulation in the form of matching compatible pairs and changing animals' partners, brining animals together at the right time and acting judiciously in case of fights etc. are necessary for successful breeding.

(vi) In case of incompatible pairs, exchange of animals/loaning of animals should be tried. The committee went to the extent of recommending the use of artificial insermination in case of important species, if traditional methods did not succeed. The committee also highlighted the need of under taking further research in breeding and rearing of endangered species particularly standardizing successful rearing methods of each endangered species and giving the same wide publicity.

The committee made very relevant recommendations on collection and dissemination of data and provided detailed formats for recording observations on various aspects of zoo management which are being followed by most of the zoos of the country.

It is quite sad that the invaluable recommendations of the committee have totally been overlooked both by the Government and the zoo operators alike for decades and mushrooming of ill planned and inappropriately designed zoos continued for decades, which has made "zoo" a derogatory word in the contemporary world. If the zoos had any respectability in this country today, the credit of it goes to a few enthusiastic persons in the Government/Department. The modern zoos with adequate space and appropriately designed enclosures were established during the seventh and eighth decade of the last century. The names of zoos which need special mention in this regard are :-

Indira Gandhi zoo, Visakhapatnam (1972-250 hectares); Kanpur zoo (1972-76.5 hectares), M. C. Zoological Park, Chhatbir, Punjab (1977-202 hectares), Sanjay Gandhi Zoological Park, Patna (1973-61.00 hectares), Arignar Anna Zoological Park, Chennai (1985-602 hectares) and Sri Venkateswara Zoological Park, Tirupati (1987-400 hectares).

Zoos named after maharajas, kings, leaders, conservationist, freedom fighters, social workers and social activists:

It is to mention that to provide greater respect and draw the attention of the Government, the following zoos were named using the name of the maharajas, kings, leaders, conservationists, freedom fighters, social workers and social activists:

Name of the Zoo	Year of Establishment
Sanjay Gandhi Biological Park, Patna	1973
Sanajay Gandhi Naitonal Park Zoo, Borivali, Mumbai	1975
Rajiv Gandhi Zoological Park & Wildlife Research Centre, Pune	1999
Indira Gandhi Zoological Park, Vishakhapatnam	1972
Indira Gandhi Zoo & Deer Park, Rourkela	1988
Mahatma Gandhi Zoo, Solapur	1977
Nehru Zoological Park, Hyderabad	1959
Jawaharlal Nehru Biological Park, Bokaro	1989
Nehru Park Zoo, Danakgre, Tura	1967
Dr. Shyamaprasad Mukharjee Zoological Garden, Surat	1984
Dr. Shivarama Karanth Pilikula Biological Park, Mangalore	2001

Kamla Nehru Zoological Garden, Kankaria, Ahmedabad	1951
Kamla Nehru Prani Sangrahalaya, Indore	1974
Gandhi Zoo, Gwalior	1922
Padmaja Naidu Himalayan Zoological Park, Darjeeling	1958
Atal Bihar Bajpayee Zoo Bellary(previously know as children's Park-cum-Zoo, Bellary)	1981
Sh. A. N. Jha Deer Park, Hauz Khas, Delhi	1970
Bharat Ratan Pt. G. B. Pant High Altitude Zoo, Nainital	1995
Mahendra Choudhary Zoological Park, Chhatbir	1977
Maharaja Shahji Chhatrapati Zoo, Kolhapur	1971
Sir Peter Scott Nature Park, Jamnagar	1970
Sri Chamarajendra Zoological Gardens, Mysore	1892
Veermata Jijabai Bhosle Udyan Zoo, Byculla, Mumbai	1863
Amte's Animal Arc (Orphanage cum Rescue Centre), Distt. Gadchiroli	1974

Era of mushrooming of unplanned and substandard zoos

These zoos had excellent layout plans and very well designed enclosures for various species of wild animals. The knowledgeable visitors were extremely pleased to see these zoos. However, the State Governments and the other zoo operators hardly derived any motivation from these zoos to establish modern zoos in their states/cities and their fascination to have cramped menageries at every picturesque location/ important towns continued scaling new heights. Advent of World Bank Funded Social Forestry Project and growing industrialization gave a further boost to the tendency of setting up new mini zoos and deer parks caring little for providing adequate space for exercise, movement, infrastructure for upkeep and healthcare of the animals. Paucity of budgetary provisions became chronic problems plaguing the zoos all over the country. Even the large and well managed zoos became victims of poor maintenance and substandard upkeep and healthcare of zoo animals.

The Central Government did extend a helping hand to the State Governments in mitigating the deterioration in the standards of the management of zoos and enhancing their conservation role by launching new centrally sponsored schemes namely "Development to zoos" and "Assistance for conservation of endangered species of wild animals" under the VII Five Year Plan. As the funding under the schemes was on

50:50 basis states hardly showed any interest in the schemes, only the enthusiastic Chief Wildlife Wardens available in few states took the advantage of the schemes to improve the zoos under their charge.

Setting up of Central Zoo Authority

By the beginning of the 9th decade of the last century it had become amply clear that no qualitative improvement of zoos in the country can be brought without mandatory standards and norms for regulation of their management. The Central Government, therefore, through the amendment of Wild Life (Protection) Act, 1972 in 1991 made a provision that no zoo in the country can function without getting prior recognition of the Central Zoo Authority. It was also provided in the Act that recognition would be granted to the zoos having due regard to the interest of conservation of wildlife. Following mandatory functions were assigned to the Central Zoo Authority under the Act -

(a) To specify the minimum standards for housing, upkeep and veterinary care of the animals kept in a zoo.

(b) Evaluate and assess the functioning of the zoos with respect to standards or norms prescribed.

(c) Recognize or derecognize zoos

(d) Identify endangered species of wild animals for purposes of captive breeding and assigning the responsibility in this regard to a zoo.

(e) Coordinate the acquisition through exchange and loaning of animals for breeding purpose.

(f) Ensure maintenance of studbooks of endangered species of wild animals bred in captivity

(g) Identify the priority and themes with regard to display of captive animals in a zoo.

(h) Coordinate training of zoo personnel in India and abroad.

(i) Coordinate research in captive breeding and educational programmes for the purposes of zoos.

(j) Provide technical and other assistance to the zoos for their proper management and development on scientific lines

(k) Perform such other functions as may b e necessary to carry out the purposes of this Act with regard to zoos.

Action taken by the Central Zoo Authority to carry out mandated functions under the Act.

The Central Zoo Authority, after it came into existence in February, 1992, adopted following line of action to discharge the mandated functions under the Act and to provide proper direction and thrust to the management of zoos in the country:

(1) Specification of standards and norms for housing, upkeep, health care and other issues related with zoo management.

(2) Evaluation of zoos with reference to the specified standards and norms and grant recognition/ refuse recognition to the evaluated zoos keeping due regard to the interests of wildlife conservation.

(3) Facilitate and monitor the zoos granted recognition in compliance of conditions stipulated in the letter of recognition, particularly the one related to housing, upkeep and health care of zoo animals.

(4) Upgrading the technical skills of the zoo personnel at various levels of zoo hierarchy through training programmes and workshops.

(5) Encouraging zoos to exchange, loan, pool the animals available in their stock in the best interest of conservation and approve the proposals that are in accordance with the guidance issued by the Central Zoo Authority.

(6) Facilitate zoos in identifying priority and themes of display of wild animals held in their stock with the objective of enhancing the conservation value of zoos.

(7) Identification of endangered species for planned conservation breeding and identification of zoos to carry out the breeding programmes.

(8) Helping zoos in carrying out the planned breeding programmes of identified endangered species by providing necessary technical know-how and infrastructure.

(9) Ensure maintenance of studbooks in respect of all animals pertaining to endangered species and to persuade zoos to avoid inbreeding through proper genetic management.

(10) Encourage and facilitate zoos in carrying out research aiming on improving the performance of zoos in breeding of endangered species and imparting conservation education to the visitors.

The initiatives taken and the progress made by the Central Zoo Authority on each action point are briefly summarized here under.

1. Specifying the minimum standards on housing, upkeep, health care and other related issues

Several meetings of Central Zoo Authority were held soon after the authority came into existence to finalize the minimum standards and norms on various aspects of zoo management taking due consideration of the provisions of zoo rules in United Kingdom. On the basis of the report of the Expert Committee on Zoos in 1973, guidelines on management of zoos were prepared by Wildlife Institute of India, Dehradun. The views expressed by knowledgeable persons on zoo management and the views expressed by the zoo directors were also taken into consideration. Due care was taken that the standards and norms finalized by it are not too complicated and can be complied by most of the zoos within reasonable time frame with reasonable technical and financial inputs. Minimum standards and norms finalized by the Central Zoo Authority were then submitted to the Central Government, who after appropriate amendments/ modifications notified the same as "Recognition of Zoo Rules" on 4th August, 1992.

The Central Zoo Authority maintained the compliance of the rules by the zoos granted recognition on a regular basis and whenever required the rules were complemented with detailed guidelines on issues like the maximum number of animals to be kept in any enclosure, management of safaris, expediting movement of unpaired/ single animals, disposal of carcasses of larger cats only by burning etc.

Being concerned about large number of deaths of animals like tigers and rhinos in some zoos and reluctance of zoos to part away the unpaired/single animals of endangered species, the Central Zoo Authority got the "Recognition of Zoo Rules, 1992" amended to make it mandatory for every zoo to (a) have only a whole time officer as In-charge (director of zoo) (b) appoint requisite number of veterinarians and curator with prescribed qualifications (c) proper equipping of zoo hospitals (d) appointment of qualified lab assistants/ compounders to assist the veterinarians in treatment of animals (e) not keeping any animal without mate for a period exceeding one year and (f) reporting every death of critically endangered species to Central Zoo Authority within

24 hours. In addition, the important guidelines mentioned above were also made a part of the rules.

The rules amended once again on 06.02.2004 consequent to 2003 amendment of Wild Life (Protection) Act, 1972 bringing "Rescue Centres and Circuses" under the ambit of zoos for making special provision in the rules enabling the continued operation of Rescue Centres and Circuses. At this point of time, amendments were also made in the rules for environmental enrichment of animal enclosures, planting of trees and bamboos around every enclosure to screen it from the adjoining enclosures, post-mortem of zoo animals being done only by veterinarians registered with Veterinary Council of India/ State Veterinary Council, making it mandatory for zoos to comply the directions of the Central Zoo Authority regarding exchange of animals for breeding programmes.

The rules were again rationalized in 2009 to put greater emphasis on upgrading the standards of animal upkeep and husbandry, zoos having appropriate collection plans and management plans, acquisition of animals and planned conservation breeding and carrying out research. Provisions were also made for due care and protections to be taken while euthanzing and tranquilizing the zoo animals. To avoid confusion arising out of repeated amendments the rules were drafted *denovo* and notified as "Recognition of Zoo Rules, 2009". Procedural details regarding implementation of Rules and clarifications of other routine matters on operational details were separately notified as guidelines of Central Zoo Authority.

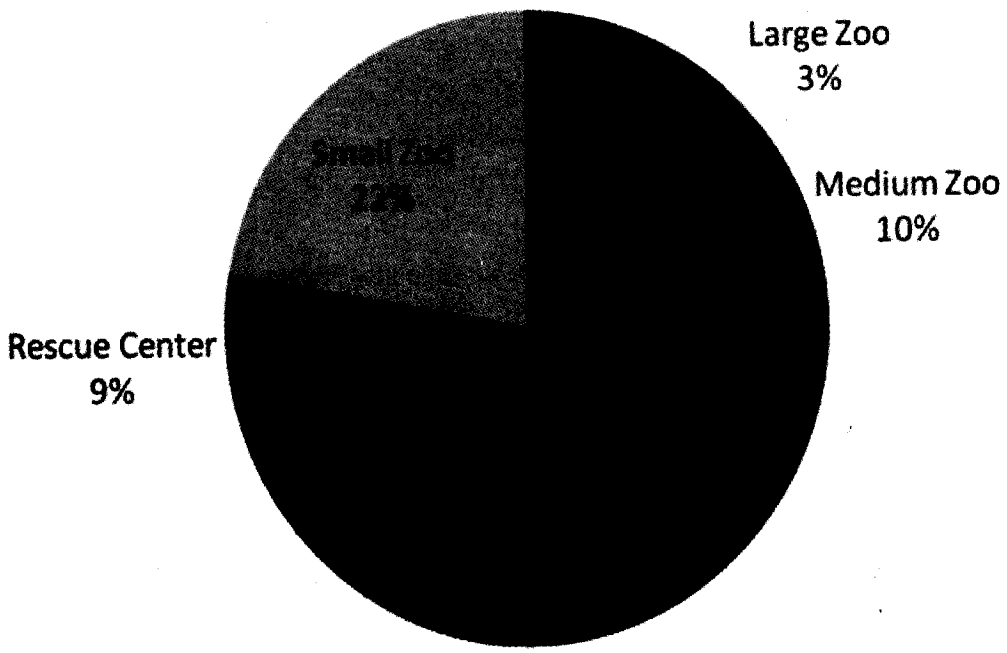
2. Evaluation of zoos and grant/refusal of recognition of zoos

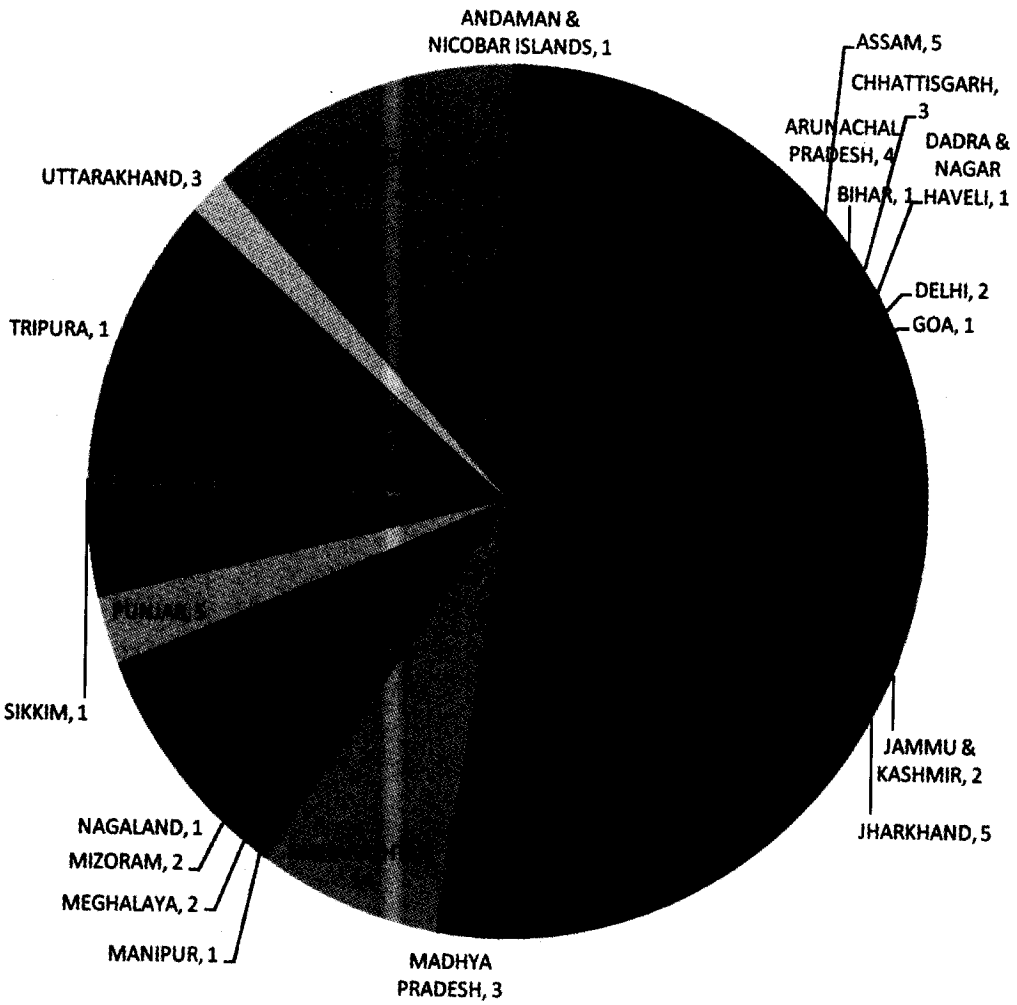
Provisions of Section 38H of Wild Life (Protection) Act, 1972 came into effect from 30.09.1992. Consequent to issue of notification in this regard it became incumbent for every zoo of the country to make an application of recognition to the Central Zoo Authority positively before 31.08.1993. The zoos which failed to make the application of recognition by the prescribed date i.e 31.08.1993 were issued show-cause notices. Advertisements were also given by the Central zoo Authority about the said provisions both in the national and regional newspapers.

In response to these advertisements and the letters written to State Governments, the Central Zoo Authority received 497 applications for grant of recognition. After preliminary scrutiny, it was revealed that out of 497 applicants, only 322 organizations qualified as "zoos" as per provisions of the Wild Life (Protection) Act, 1972. Rest of

the organizations were either in the offing or were not involved in exhibition of wild animals. Hence, their applications were summarily rejected.

Evaluation of 322 zoos was got done expeditiously through teams of experts. The evaluation revealed that even the best managed zoos of the country did not fulfil all the stipulated conditions for grant of recognition. The Central Zoo Authority, therefore, decided to divide the zoos seeking i.e. the one who have the potential, standards and norms with reasonable inputs and the zoos which are too small and incapable of providing the animals under their charge requisite quality of life and comply the prescribed standards and norms. This category included 23 mobile zoos, which moved from place to place taking animals in small crates from place to place. 222 zoos, which qualified in the first category, were granted conditional recognition by the end of year 1993-94 and the remaining 106 zoos were refused grant of recognition. Conditional recognitions granted by the Central Zoo Authority required the zoos to improve their animal housing and upkeep infrastructure, making provisions of well-equipped hospitals, hygienic storage of food, round the clock supply of potable water and proper sewage disposal. All these works required substantial capital investments that too within a limited time frame. At present there are 198 recognized zoos in the country which includes large zoo, medium zoo, small zoo, mini zoos, deer parks and 23 circuses also. The details are given below:-





3. Facilitating the zoos in compliance of stipulated standards and norms

The Ministry of Environment & Forests and the Central Zoo Authority being fully aware about the financial stringencies prevailing in various states, had a clear perception that ensuring the compliance of stipulated conditions would not be possible unless financial assistance is also provided by the Central Zoo Authority for carrying out the capital intensive activities like upgradation/construction of animal housing facilities, construction of veterinary hospitals, feed stores, provision of water supply and sanitary fittings. Therefore, a scheme for "grant-in-aid" to Central Zoo Authority was launched under the VIII Plan under which the zoos could be provided 100% funding for carrying

out such works on the basis of stipulation made by the Central Zoo Authority. For the remaining works like construction of boundary wall and other supporting infrastructure, the funding was to be made available on 50:50 basis. Till the end of period of 2008-09, a sum of Rs.150.00 crores has been made available to the zoos for carrying out the improvement works stipulated by the Central Zoo Authority. As the work of evaluation of zoos and monitoring based on the works stipulated by the Central Zoo Authority picked up, it was realized that quite a significant number of zoos did not even had the adequate land to carry out the stipulated works. Such zoos were given option of either moving to alternative site and create a good zoo with the assistance of funding being made available by the Central Zoo Authority or close down. To optimize the impact of the financial assistance being provided to the zoos, the financial assistance was made available to large, medium and small category zoos operated by the government and the trusts wholly funded by the Central Government.

The decision to keep mini zoos out of the ambit of funding by Central Zoo Authority was taken with a primary objective of keeping the focus on improving the zoos, which had the potential to develop into effective conservation centres. It was not considered worth while as there was limited financial resources of the Authority on zoos with minimal conservation value. It was left to the State Governments either to provide funds for operation of such zoos or to close them. Later on, it was felt by the Authority that funding should also be provided to some of the mini zoos to redress the public criticism regarding poor maintenance of upkeep and health care of zoo animals by mini zoos.

The Central Zoo Authority continued to evaluate and monitor the compliance of stipulated conditions by the Central Zoo Authority and funding was provided to zoos to carry out works on the basis of priority indicated in the evaluation reports. The carrot and the stick policy has paid rich dividend and has brought out a qualitative improvement in the upkeep and health care. Many zoos have also increased the area of the zoo to provide adequate space for creating appropriately designed housing facilities for the species housed by them. The others have opted to shift to alternate sites and constructed new zoos based on modern concepts of zoo architecture and planning.

However, certain State Governments did not show necessary sensitivity to take advantage of the good gesture shown by the Central Government and continued to stagnate and therefore, were refused recognition on the basis of subsequent evaluations. Some forest blocks where captive bred deer had been released and were being fed by zoo authorities were initially classified as zoos. Once the deer became capable of feeding themselves these zoos were also taken out of the list of recognized zoos.

During intervening years, some new zoos and deer parks with adequate and financial resources have come up. Accordingly, recognition has been granted to these zoos. At present, only 198 zoos are operating in the country. The graphical representation of the area of zoos in 1993 and 2009 would reveal that zoos that are operational today have much more land and those substantial numbers of cramped zoos have been phased out over a period of time. What is most encouraging is the fact many of erstwhile menageries have shifted to alternative sites/extended their area and have converted themselves into large zoos with naturalistic and well laid out enclosures. Following need special mention in this regard -

Sl. No.	Name of the existing zoo	Area	Name of new zoo	Area
1.	Rustomjee Deer Park, Gangtok	2 Hectares	Himalayan Zoological Park, Balbuly, Gangtok	205 Hectares
2.	Peshwe Park, Pune	3 Hectares	Rajiv Gandhi Zoological Park, Katraj, Pune	65 Hectares
3.	Sakkarbaug Zoo, Junagadh	6 Hectares	Sakkarbaug Zoo Junagadh	198 Hectares
4.	Kamla Nehru Prani Udyan, Surat	1Hectares	Dr. Shyama Prasad Mukherji Prani Udyan	32 Hectares
5.	Sayaji Baug Zoo, Vadodara	15 Hecares	Azwa Dam (Proposed)	40 Hectares
6.	Kohima Zoo, Kohima	2 Hectares	Rangapahar Zoo	161 Hectares
7.	Mini Zoo, Haddo (Port Blair)	-	Biological Park, Chidiyatapu, Port Blair	40 Hectares
8.	Rajkot Zoo	5 Hectares	Rajkot Zoo	55.37Hectares

In addition to above, Aizawl zoo, which was located at a very refractory site and an area with very difficult approach has been shifted to an alternative site and has been developed into a modern zoo. Action to increase the areas of several other zoos mainly Tutikandi and Rewalsar are in the pipeline. Proposals to shift Bellary zoo (Karnataka), Trichi zoo (Tamil Nadu) and Thrissur zoo (Kerala) and creation of modern zoo at Gorewada are also under consideration.

The ban on display of tigers, panthers, lions, bears and monkeys in circuses forced the Central Zoo Authority to take the additional responsibility of housing, upkeep

and health care of the animals surrendered to the government by circuses. The Central Zoo Authority has created rescue centres earmarked for upkeep of these animals at Bannerghatta (Bangalore), Arignar Anna Zoological Park (Vandalur, Chenai) Tirupati, Visakhapatnam, Bhopal and South Khairabari. The total cost of upkeep of these animals is being met by the Central Zoo Authority.

List of zoos which have been major beneficiaries (financial assistance) of the Central Zoo Authority are as follows:

Sl. No.	Name of the Zoo	Main works carried out
1.	Aizawl Zoo, Aizawl	Construction of zoo at new site.
2.	National Zoological Park, New Delhi	Renovation of old enclosures, construction of new enclosures, construction of boundary wall, feed supply vehicle.
3.	Arignar Anna Zoological Park, Vandalur, Chennai	Augmentation of water supply, improvement of sanitation and hygiene, improvement of enclosures and signages, construction of new enclosures, procurement of veterinary equipments and treatment van, construction of boundary wall.
4.	Biological Park, Itanagar	Construction/improvement of enclosures, up-gradation of veterinary facilities procurement of veterinary equipments, augmentation of water supply, up-gradation of feed storage facility.
5.	Nandankanan Zoological Park, Bhubaneswar.	Augmentation of water supply, improvement of sanitation and hygiene, construction of boundary wall, construction of new enclosures, up-gradation of existing enclosures, up-gradation of veterinary facilities, construction of off-display enclosures for breeding of endangered species.
6.	Padmaja Naidu Himalayan Zoological Park, Darjeeling	Construction of veterinary hospital, feed stores, procurement of veterinary equipments, improvement of enclosures, construction of breeding enclosures, improvement of sanitation, augmentation of water supply, construction of boundary wall.
7.	Sri Venkateshwara Zoo, Tirupati	Development of modern zoo-Almost all facilities

8.	Assam State Zoo, Guwahati	Construction of new enclosures, veterinary hospital, feed store, augmentation of water supply, improvement of drainage, improvement of sanitation.
9.	Nehru Zoological Park, Hyderabad	Construction of feed store, veterinary hospital, procurement of veterinary equipments, construction of new enclosures and improvement of existing enclosures, augmentation of water supply, sanitary fittings and conservation breeding facilities.
10.	Kamla Nehru Prani Udyan, Indore	Construction of new enclosures, improvement of sanitation, hygiene, water supply, construction of boundary wall.
11.	Thiruvananthapuram Zoo, Kerala	Construction of veterinary hospital, construction of new enclosure, interpretation centre and education
12.	Biological Park, Chidiyatapu, Port Blair	Construction of all facilities for a modern zoo.
13.	Rajiv Gandhi Zoological Park and Wildlife Research Centre, Pune	Construction of all facilities for a modern zoo
14.	Rangapahar Zoo, Nagaland	Construction of all facilities for a modern zoo.
15.	M.C. Zoological Park, Chhatbir, Punjab	Augmentation of water supply, construction of new enclosures, upgradation of veterinary facilities, procurement of veterinary equipments improvement of sanitation and hygiene.
16.	Sri Chamarajendra Zoological Park, Mysore	Augmentation of water supply, improvement of sanitation and hygiene, construction of new enclosures and improvement of existing enclosures, veterinary hospital and quarantine facilities.
17.	Himalayan Zoological Park, Bulbuley, Sikkim	Construction of modern zoo inclusive of all facilities.
18.	Indira Gandhi Zoological Park, Visakhapatnam	Improvement of existing enclosures and construction of new enclosures, construction of feed store, procurement of veterinary equipments construction of boundary wall, water supply.

19.	Van Vihar National Park, Bhopal	Construction of veterinary hospital, post-mortem room, feeding kraals, rescue centre, augmentation of water supply and conservation breeding centre
20.	Bhagvan Birsa Biological Park, Ranchi	Construction of new enclosures, augmentation of water supply, purchase of veterinary equipments.
21.	Indroda Nature Park, Gandhinagar	Construction of enclosures for various animals and other supporting infrastructure including veterinary facilities.
22.	Sanjay Gandhi Biological Park, Patna	Construction of boundary wall, augmentation of water supply, construction and renovation of animal enclosures, upgradation of veterinary hospital, improvement of feed storage, power supply and zoo education.
23.	Gandhi Zoological Park, Gwalior	Construction of new enclosures, veterinary hospital, augmentation of water supply and construction of boundary wall.

Other zoos that have been substantially benefited by the funding provided by the Central Zoo Authority are Sepahijala Zoological Park Tripura; Sakkarbaug zoo, Junagarh; Lion Safari, Shimoga; Alipore zoo, Kolkata, Dr. Shyma Prasad Mukherji Zoological Park, Surat, Rajkot Municipal zoo, Rajkot. Lucknow zoo, Kanpur zoo and Manipur zoo also received substantial assistance but have not shown any marked improvement.

The list of zoos, where veterinary facilities have been created/renovated with Central Zoo Authority funding are as follows -

1. Veermata Jijabai Bhosle Udyan zoo, Byculla, Mumbai.
2. Sakkarbaug Zoo, Junagadh
3. Tiger Safari, Shimoga
4. Kanpur Zoological Park, Kanpur
5. Dr. Shyama Prasad Mukherji zoo, Surat
6. Pt. Govind Ballabh Pant High Altitude zoo, Nainital
7. Sepahijala Zoological Park, Tripura
8. Himalayan Zoological Park, Kufri

4. Upgrading the technical skills of zoo personnel

Initiatives taken by Central Zoo Authority for upgrading the technical skills of the zoo personnel at different levels comprise of:

1. Annual training capsule course of 15 days organized through Wildlife Institute of India for Zoo Directors and Zoo Supervisors alternatively
2. Two week training programmes for zoo keepers organized at regional level i.e at Nandankanan zoo, Kanpur zoo, Assam State zoo, Nehru Zoological Park, Hyderabad and Kamla Nehru zoo, Ahmadabad. The Central Zoo Authority provides funding at the rate of Rs.1.00 lac per zoo.
3. One zoo director and one zoo veterinarian are deputed every year for three weeks training course on conservation of endangered species at Jersey Wildlife Preservation Trust, UK. So far 16 zoo directors, 15 Zoo veterinarians, two supervisors and one deputy director have attended this course.
4. Annual meetings of zoo directors are organized to discuss various technical issues related with zoo management. Similarly, meetings of zoo veterinarians are organized periodically to discuss issues related with disease diagnosis, prevention and treatment.
5. Quarterly zoo newsletter and zoo year book are published for exchange of information on technical issues.
6. Workshops on issues related with conservation of identified endangered species, animal nutrition, health care, zoo education and other technical aspects were organized.
7. Standard text books on management of zoos and health care were supplied to zoo hospitals for reference purposes.
8. Many technical bulletins and books were published to provide scientific information to zoos.
9. Indian Veterinary Research Institute, Bareilly had been organizing nine months diploma course for zoo veterinarians. Besides, one week training programmes were organized for zoo veterinarians at Indian Veterinary Research Institute.
10. Regional centres for disease diagnosis and treatment of zoo animals were created at Veterinary College, Khanpara, Guwahati; Madras Veterinary College, Chennai; Veterinary College, Anand; Indian Veterinary Research Institute, Bareilly; Agriculture University, Jammu and veterinary college, Bhubaneswar to upgrade

the skill of zoo veterinarians and help them in diagnosis and prevention of diseases as well as to assist in treatment of seriously sick zoo animals.

The following research projects have been successfully concluded recently and concerned zoos/institutions have submitted final reports to the Central Zoo Authority-

1. "Model disaster management plan for Indian zoos" by Kanpur Zoological Park, Kanpur
2. "Record Keeping in Zoos" by Padmaja Naidu Himalayan Zoological Park, Darjeeling
3. "Pilot study on common foot ailments in captive Asian elephant of Tamil Nadu" by Madras Veterinary College, Chennai.
4. "Develop guidelines for upkeep of reptiles in Zoos and Parks in India" by Rajiv Gandhi Zoological Park and Wildlife Research Centre, Pune.
5. "Behavioral study for the Conservation breeding of Himalayan black bear" by Padmaja Naidu Himalayan Zoological Park, Darjeeling.
6. "Standards, guidelines and protocol on disease diagnosis and cure of wild animals in Indian Zoos" by Indian Veterinary Research Institute, Bareilly.
7. "Research project on developing master education plan for zoos in India' by CEE, Ahmadabad.

5. Exchange of animals in the best interest of conservation

The Central Zoo Authority kept on monitoring the inventory of zoos and requesting zoos to formulate the exchange proposals with the following objectives in mind -

(1) Providing partners to single and unpaired animals.

(2) To make viable breeding groups of agreed species

(3) Infusing new blood to a breeding group

The proposals submitted by the zoos on mutual agreement basis were approved by the Technical Committee of Central Zoo Authority giving due regard to the facilities available at various zoos. However, the priority of zoos continued to be on acquiring more animals for display. Recognition of Zoo Rules were also amended to pursue the zoos to fall in line but success has been possible to a very limited degree. Possessiveness of zoos about animals and unwillingness even to part away the single animals/ unpaired animals continued to be major bottleneck in exchange of animals.

6. Facilitate zoos in identifying the priority and themes of display of wild animals

During the process of evaluation of zoos and in the workshops and meetings attended by the zoo directors, the need of displaying the animals in thematic manner was highlighted. Even the concept of mixed displays was introduced but reluctance to change was the main hurdle. Now all zoos have been convinced to adopt themes identified on the basis of mutual discussion and the same have been incorporated in the Master Plans of development prepared by the zoos and the same would be followed after the master plans have been approved by the Central Zoo Authority.

7. Identification of species for planned conservation breeding

The Central Zoo Authority soon after coming into existence had a meeting of experts, who identified 72 species for planned conservation breeding. However, founder animals for carrying out the conservation breeding programme of most of the species were not available. Therefore, it was decided to confine the conservation breeding at present to the following prioritized species -

Sl. No.	Name of the Species	Name of the coordinating zoo	Names of the participating zoos	Number of animals of the species in captivity
1.	Asiatic lion *(Panthera leo persica)*	Junagarh	Hyderabad, Bhopal, New Delhi, Rajkot	108
2.	Snow leopard *(Panthera uncia)*	Darjeeling	Leh, Kufri, Nainital, Gangtok	14
3.	Clouded leopard *(Panthera nebulosa)*	Sepahijala	Guwahati	23
4.	Red Panda *(Ailurus fulgens)*	Darjeeling	Gangtok, Yachuli	20
5.	Indian Pangolin *(Manis crassicaudata)*	Bhubaneswar		8
6.	Lion-tailed monkey *(Macaca silenus)*	Chennai	Mysore, Trivandrum	69
7.	Golden langur *(Trachypithecus geei)*	Guwahati	Island near Guwahati	6
8.	Hoolock gibbon *(Hoolock leuconedys)*	Itanagar	Aizawl, Guwahati, Sepahijala	38

9.	Rhinoceros *(Rhinoceros unicornis)*	Guwahati	Patna, New Delhi, Kanpur	30
10.	Wild buffalo *(Buballus bubalis)*	Udanti	-	1
11.	Wild ass *(Equus hemionus khur)*	Junagarh	-	14
12.	Nilgiri tahr *(Nilgiritragus hylocrius)*	Ooty	-	1
13.	Swamp deer *(Cervus duvauceli)*	Lucknow	Jaldapara WLS	147
14.	Thamin deer *(Cervus eldii)*	Manipur	Guwahati, Kolkata, New Delhi	183
15.	Mouse deer *(Tragulus meminna)*	Hyderabad	Bhubaneswar	9
16.	Musk deer *(Moschus chrysogaster)*	Dharamghar, Bageshwar	Gulmarg, Ganttok, Kufri	17
17.	Hangul *(Cervus elaphus hanglu)*	*Shikargah*	-	0
18.	Chinkara *(Gazella bennettii)*	*Meham*	Junagarh, Gandhinagar, Chhatbir	148
19.	Blue sheep *(Pseudois nayaur)*	*Darjeeling*	-	6
20	Pygmy hog *(Sus salvanius)*	*Basistha*	Guwahati	112
21.	Himalayan monal *(Lophophorus impejanus)*	*Manali*	Darjeeling, Gangtok	23
22.	Cheer pheasant *(Catreus wallichi)*	*Chail*	Almora	22
23.	Hume's pheasant *(Syrmaticus humiae humaie)*	*Aizawl*	-	33
24.	Blyth's tragopan *(Tragopan blythii)*	*Kohima*	-	12
25.	Western Tragopan *(Tragopan melanocephalus)*	*Sarahan*	-	23

26.	Grey jungle fowl *(Gallus sonnerati)*	*Tirupati*	-	52
27.	Red jungle fowl *(Gallus gallus gallus)*	Morni	Chail, New Delhi, Aizawl	240
28.	Long billed Vulture *(Gyps indicus)*	Pinjore	Hyderabad, Bhopal, Junagarh, Bhubaneswar, RAjabhatkhawa, Guwahati	93
29.	Slender billed vulture *(Gyps tenuirostris)*	Pinjore	Hyderabad, Bhopal, Junagarh, Bhubaneswar, Rajabhatkhawa, Guwahati	15
30.	White backed vulture *(Gyps benegalensis)*	Pinjore	Hyderabad, Bhopal, Junagarh, Bhubaneswar, Rajabhatkhawa, Guwahati	67
31.	Shahin falcons *(Falco peregrinus)*	Chhatbir	Jaipur	0
32.	Bustards *(Great Indian bustard, Lesser florican, Bengal florican, Hubara bustard)*	Jaisalmer	-	0
33.	King cobra *(Ophiophagus Hannah)*	Pilikula	Bangalore, Mammalapuram	36
34.	Painted roof turtle *(Kachuga kachuga)*	Kukrail	Mammalpuram	2
35.	Himalayan salamander *(Tyletotriton verrucosus)*	Darjeeling	-	9

*Status of the animals as on 30th May 2010.

Zoos for breeding various species have been identified and species breeding coordinators/ studbook keeper were also identified. Reliable data about the suitable animals for the breeding programmes was made available. Plans for movement of animals for the designated zoos were prepared but the same could not be implemented due to reluctance of zoos to part away the animals.

To encourage zoos to have greater interaction and participate in the breeding programmes, regional coordinators for breeding programmes were appointed. This scheme also remained a non-starter except for Southern Region where several meetings were held and the strategy for breeding of Nilgiri langur and lion-tailed macaque were held. As a consequence of this, reasonable success has been achieved in breeding of these two species. Mysore zoo single handedly has done excellent work in breeding of Indian bison or gaur. Padmaja Naidu Himalayan Zoological Park has also done good work in breeding of snow leopard and red panda. However, the animals for infusing new blood into group of Indian bison and group of snow leopard could not be available. Only success story that India could have in planned breeding is red panda breeding in Darjeeling zoo, where because of international cooperation and involvement of scientists reasonable heterozygosity has been maintained and a self-sustaining population has been developed. Scientists have single handedly bred significant number of pygmy hog at Basistha near Guwahati. Alarmed with decline in in-situ population of vultures, Breeding Centres have been set up at Pinjore, Junagarh, Hyderabad, Bhubaneswar, Bhopal, Rajaphatkhawa (West Bengal).

It was in this background that the Central Zoo Authority had an international meeting of zoo experts and identified seventy two species for planned conservation breeding. The coordinating and participating zoos for breeding of each species have been identified.

8. Helping zoos in planned breeding of endangered species

The Central Zoo Authority is already committed to provide 100% funding for the movement of animals and their housing, accordingly to conservation breeding management plan and their housing at participating and coordinating zoos. Technical support staff for the breeding programme is also provided in the project mode. In accordance with the accepted policy, funding has already been provided by the Central Zoo Authority during the year 2008 - 09 for construction of conservation breeding centres for falcon at M.C. Zoological Park, Chhatbir; brow-antlered deer at Manipur zoo; mouse-deer at Nehru Zoological Park, Hyderabad; wild ass at Sakkarbaug zoo, Junagarh; clouded leopard and binturong at Sepahijala Zoo, Tripura; hoolock gibbon and Humes pheasant at Aizawl zoo; hoolock gibbon at Itanagar zoo; Indian pangolin at Nandankanan zoo, Bhubaneswar; Cheer pheasant at Kufri zoo; Himalayan monal at Nature Park, Manali; Shikargah in Jammu & Kashmir for hangul; grey jungle fowl at Sri Venkateswara Zoological Park, Tirupati and western tragopan at Sarahan Pheasantry. Thus quite substantial amount has been sanctioned for creation of conservation breeding centes for the following 14 species by the Central Zoo Authority:

1. Western Tragopan Conservation Breeding Programme - Sarahan Pheasantry, Himachal Pradesh
2. Himalayan Monal - Nature Park, Manali, Himachal Pradesh
3. Cheer Pheasant Conservation Breeding Programme - Chail Pheasantry with Himalayan Nature Park Kufri, Himachal Pradesh
4. Grey Jungle fowl Conservation Breeding Programme - Tirupati zoo, Andhra Pradesh
5. Indian Pangolin Conservation Breeding Programme - Nandankanan Zoological Park, Bhubaneswar, Orissa.
6. Mouse-deer Conservation Breeding Programme - Nehru Zoological Park, Hyderabad, Andhra Pradesh.
7. Lion-tailed macaque Conservation Breeding Programme - Arignar Anna Zoological Park, Vandalur, Tamil Nadu
8. Red panda Conservation Breeding Programme - Padmaja Naidu Himalayan Zoological Park, Darjeelijng, West Bengal
9. Hangul Conservation Breeding Programme - Saikargah, Traal, South Kashmir Wildlife Protection Department, Jammu & Kashmir
10. Shaheen Falcon Conservation Breeding Programme - M. C Zoological Park, Chhatbir, Punjab.
11. Vulture Conservation Breeding - zoos at Bhopal, Hyderabad, Junagarh and Bhubaneswar.
12. Hoolock gibbon Conservation Breeding Programme - Biological Park, Itanagar, Arunachal Pradesh.
13. King cobra Conservation Breeding Programme at Dr. Shivaram Karan Pilikula Biological Park, Mangalore, Karnataka.
14. Brow-antlered deer Conservation Breeding Programme at Manipur Zoological Park, Imphal, Manipur.

All the above zoos are coordinating zoos for the species and they will be exchanging animals with participating zoos identified by the Central Zoo Authority.

9. Ensuring preparation and maintenance of studbooks

The Recognition of Zoo Rules, 2009 contained a form for maintaining the studbooks for endangered species. Evaluating officers during evaluation ensure that forms are being filled in duly. The Central Zoo Authority soon after coming into effect hired the biologists to collect data from all zoos and prepare the studbooks for Asiatic lions and Indian tigers. This was done with an objective to provide model studbook to the zoo directors. Subsequently, the following zoos were appointed as studbook keeper for different species of wild animals as shown against their names, however, the same is not pursued -

Sl. No.	Species	Name of the Zoo
1.	Wild ass	Sakkarbaug zoo, Junagarh
2.	Brow-antlered Deer	Zoological Garden, Alipore, Kolkata
3.	Golden langur	Assam State zoo, Guwahati
4.	Swamp deer	National Zoological Park, New Delhi
5.	Bengal tiger	Nehru Zoological Park, Hyderabad
6.	One horned rhinoceros	Kanpur zoo, Kanpur
7.	Sloth bear	Prince of Wales Zoological Garden, Lucknow
8.	Gaur	Nandankanan zoo, Bhubaneswar
9	Red panda	Padmaja Naidu Himalayan Zoological Park, Darjeeling
10.	Snow leopard	Padmaja Naidu Himalayan Zoological Park, Darjeeling
11.	Lion-tailed macaque and Nilgiri langur	Arignar Anna Zoological Park, Vandalur, Chennai

The biggest limitation in preparation of studbook had been the problems of marking the animals participating in the breeding programme suitably. In absence of proper marking of animals, maintenance of studbooks bas remained incomplete. However, it has provided reliable data for exchange of animals of the species.

The Central Zoo Authority in the year 2007 – 08 and 2008 – 09, had provided the zoos appropriate marking materials required for marking of animals of various species. Quite a large number of animals have been fixed with transponders, leg bands, ear tags etc.

Keeping in view of the problems faced by the zoo, the Central Zoo Authority has outsourced the work of preparation of studbooks to Wildlife Institute of India, Dehradun.

They have already submitted studbooks for clouded leopard, hoolock gibbon, Indian one-horned rhinoceros, Indian gaur and Tibetan wolf. Rest of the studbooks would be available shortly. Consequent to establishment of conservation breeding centres and appointment of coordinating zoos, the work of keeping the basic information regarding various species of wild animals would be maintained by the coordinating zoos.

The compiled data and the studbooks under the programme will also be uploaded on the website of Central Zoo Authority, as well as of the Wildlife Institute of India, Dehradun.

The Central Zoo Authority has also sponsored joining of all the major Indian zoos (57) and related organizations (4) as members of International Species Information System/Zoological Information Management System (ISIS/ZIMS) from 1st January, 2009. The Authority has been paying for the membership for all the zoos and organizations along with the training cost for the next 5 years. The zoos have already started sharing data with ISIS and Central Zoo Authority under the programme. International Species Information System (ISIS) has also adopted Member Secretary, Central Zoo Authority as Trustee in the ISIS Board. The training programmes were organized at Bhubaneswar, Chandigarh and Pune. Workshop to teach on the use SPARKS are under way at Chennai (in October, 2010) and Guwahati (in December, 2010).

10. Encourage and facilitate the zoos to carry out research

At the time of Recognition of Zoo Rules, 1992 coming into effect, only one zoo i.e Arignar Anna Zoological Park, Vandalur, Chennai had biologists in position. The National Zoological Park at New Delhi had a Curator (Education), Dr. Shivarama Karanth Pilikula Biological Park, Mangalore has a biologist and few more also have, however, other zoos had no staff totally dedicated for research and education. Under these circumstances, the research activities in zoos were mainly confined to recording of biological behaviour of various species by the keepers and supervisors.

In view of the facts stated above, the Central Zoo Authority had given special projects and studies for research on various aspects of conservation breeding, nutrition, education and other issues related to zoos.

A list of the projects under implementation are given below -

Sl. No.	Name of the projects of CZA	Purpose
1.	Creation of National Referral Centre for diagnosis of diseases affecting captive wild animals - IVRI, Bareilly	To provide service and advice to Indian zoos related to healthcare issues.

2.	Use of Biotechnological Intervention for Conservation of Endangered Species of animals - LaCONES, Hyderabad	To analyze heterogygosity of zoo animals, create frozen bank and to develop techniques for assisted reproduction for zoo animals.
3.	Research project on Standards, guidelines and protocol on disease diagnosis and cure of wild animals in Indian Zoos - IVRI, Bareilly.	To prepare Standards, guidelines and protocol on disease diagnosis and cure of wild animals in Indian Zoos.
4.	Developing guidelines on principles of Zoo Designing for Zoos in India-School of Planning and Architecture, New Delhi	Developing guidelines on principles of Zoo Designing for Zoos in India
5.	Research project on Developing Master Education Plan for Zoos in India - CEE, Ahmedabad	Research project on Developing Master Education Plan for Zoos in India.
6.	Maintenance of stud/herd book for endangered species in Indian zoos - Wildlife Institute of India, Dehradun.	Maintenance of stud/herd book for endangered species in Indian zoos.
7.	Studies on housing and enclosure enrichment of some species in selected Indian zoos - Wildlife Institute of India.	To provide guidelines to zoos on housing and enclosure enrichment.
8.	Standardization of animal diet in captive conditions -IVRI, Bareilly.	To develop guideline for animal diet in captive conditions.
Small Grant Fellowship Projects awarded to the zoos		
1.	Reproductive biology, breeding behaviour and enrichment needs of the wild dog in captivity and observation on growth and cub development - Indira Gandhi Zoological Park, Visakhapatnam	To study the animals' behaviour and prepare husbandry guidelines.
2.	Research project on Ecto and endo parasites of zoo animals and birds - Nandankanan Zoological Park, Bhubaneswar	To prepare guidelines for detection and treatment for Ecto and endo parasites of zoo animals and birds
3.	Behavioural study for the conservation breeding of Himalayan black bear - Padmaja Naidu Himalayan Zoological Park, Darjeeling	To prepare conservation breeding management plan for Himalayan black bear.

4.	Status of upkeep, breeding and conservation status of exotic animals in Indian zoos - Indian Zoos Association.	To assess the status of exotic animals in Indian zoos.
5.	Research project to develop guidelines for upkeep or reptiles in Zoos and Parks in India - Pune zoo	To develop guidelines for upkeep of reptiles in zoos and parks in India.
6.	Research project on Pilot study on common foot ailments in captive Asian elephant of Tamil Nadu -Madras Veterinary College, Chennai.	To develop guidelines for the treatment of Asian elephants against foot disease.
7.	Project proposal for Conservation Breeding of Brow-antlered deer at National level in Indian zoos -Zoological Garden, Alipore.	To prepare conservation management breeding plan for Thamin deer or Blow-antlered deer.
8.	Research activity n detailed study on captive breeding behaviour of stump-tailed macaque at Aizawl zoo with reference to type of habitat in the enclosure - Aizawl zoo, Mizoram.	To prepare conservation breeding management plan.
9.	Project on preparation of manual on the transportation cages and nest boxes of different animals species -National Zoological Park, Delhi	To prepare manual on cages for carrying wild animals.
10.	Research on Record Keeping in zoos - Padmaja Naidu Himalayan Zoological Park, Darjeeling	To prepare guidelines for Indian zoos for keeping of zoo records.
11.	Research proposal for population control measures of prolifically breeding animals - Arignar Anna Zoological Park, Vandalur, Chennai	To suggest measures for controlling prolifically breeding species in zoos.
12.	Behavioural study on Clouded leopard - Sepahijala zoo, Agartala, Tripura	To develop husbandry guidelines for the clouded leopard in zoos.
13.	Conservation breeding of Indian pangolin in Nandankanan Zoological Park, Bhubaneswar.	To develop husbandry guidelines for the Indian pangolin in the zoos.
14.	To prepare Model disaster management plan for Indian zoos – Kanpur Zoological Park, Kanpur	To provide guidelines to deal disaster events in the zoos.

10. Creation of life-time care facility for rescued animals:

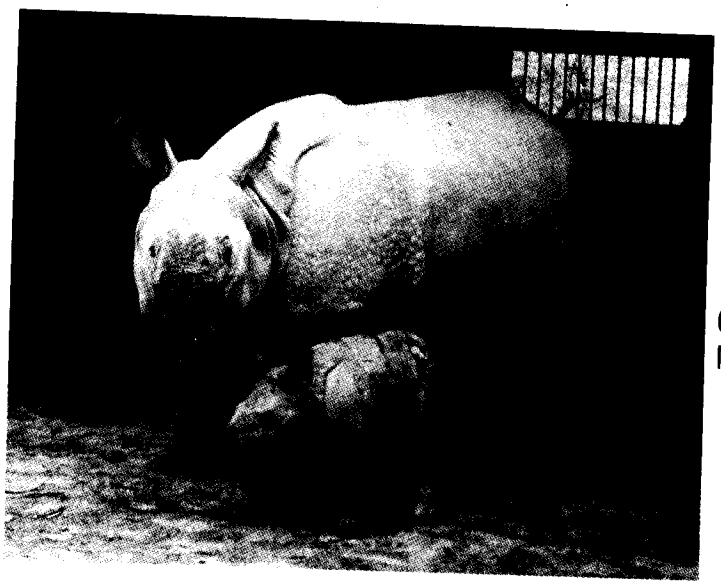
Although providing accommodation to the rescued animals is not one of mandated functions of Central Zoo Authority, however, as per the objective laid under the National Zoo Policy, 1998, the rescued wild animals particularly, tigers, sloth bears, monkeys, leopards and deer received as rescued, injured, orphaned are to be housed in off-display areas of the recognized zoos.

It is high time that the Central Zoo Authority should aim at developing the zoos of the country into institutions working for the course of conservation of wildlife in a right earnest and professional manner so that they can compare favourably with the best managed zoos across the globe both in respect of animal husbandry and genetic management and quality displays conveying the message of conservation to the visitors loud and clear.

The annual conference of the World Association of Zoos and Aquariums (WAZA) is to be held in New Delhi in 2014, therefore, it gives a challenging task to the zoos in the country to come up with desired standards and prove that zoos in India are not mere centres of recreation/ entertainment but they have been also serving the objectives as laid in National Zoo Policy, 1998 and that they are establishing vital linkages between the *in-situ* and *ex-situ* wildlife conservation.

PLANNING AND DEVELOPMENT OF ZOOS IN INDIA

Brij Kishore Gupta, S. C. Sharma and B. S. Bonal



One-horned rhino at National zoo, New Delhi

Chimpanzee enclosure at Nehru zoo, Hyderabad - Best example of open-air enclosure

STUDIES ON ENDOPARASITIC INFECTION IN TIGERS OF NANDANKANAN ZOOLOGICAL PARK, BHUBANESWAR

N. Sahoo*, M. Dehuri$, P. Sahoo$, P.K. Roy* and A.K. Misra+

Introduction

Modern zoos play crucial role in conservation of wildlife through captive breeding, rehabilitation, education and research. These objectives can not be achieved successfully unless the animals are maintained in optimum health. But, available literatures are the testimony of the fact that there is a rising incidence of various diseases/disorders among wild animals in the Indian zoos. If not exaggerated, gastrointestinal helminthiasis among mammals is comparatively common in India as the exogenous factors are conducive for propagation of developmental stages of the parasites. The damages due to this macroparasites could be in the form of sharing the host's ingested food, damaging body tissues, sucking body fluids, causing mechanical obstruction in tubular structures of the alimentary tract, producing toxic substance, transmitting other infections and affecting the host's physiological functions leading to retarded growth rate, poor body condition and increased susceptibility to diseases. Though death is an uncommon sequela, the possibility of mortality can not be ruled out on heavy infestation especially in young stock. It is a common observation that under suitable management practices animals seldom exhibit clinical signs suggestive of parasitism rather they harbour the gastrointestinal endoparasites in a subclinical state.

To combat the loss of zoo animals, administration of effective drugs at regular interval is a common practice. But, frequent treatment practices may encourage the development of resistant strains which in turn would, no doubt, squeeze the spectrum of effective drugs. Under such situation control measures aimed at breaking the life cycle of parasites would be a feasible and encouraging choice. Keeping these facts in the back drop, a study was undertaken on the endoparasitic infection in tigers of Nandankanan Zoological Park with respect to prevalence, comparative anthelmintic efficacy and evaluation of control measures.

* Project coordinator, Centre for Wildlife Health, Veterinary College, OUAT, Bhubaneswar.
$ Post-graduate students, College of Veterinary Science and Animal Husbandry, OUAT, Bhubaneswar
* Senior Veterinary Officer, Nandankanan Zoological Park, Bhubaneswar.
+ Assistant Director, Nandankanan Zoological Park, Bhubaneswar.

Materials and Methods

The present study was carried out during April 2007 to March 2010 on 25 tigers, both white and normal-coloured tigers, reared in individual enclosures in the Nandankanan Zoological Park, Bhubaneswar. Of the total stock, 15 heads were between 10-15 years of age; 6 were between 3-5 years and the rest were less than 3 years-old.

The prevalence of gastrointestinal parasitic diseases during three seasons i.e., summer or pre-monsoon (February-May), rainy or monsoon (June-September) and winter or post-monsoon (October-January) were ascertained on the basis of faecal examination. Qualitative examination of faecal sample consisted of both, Sedimentation and Floatation techniques (Soulsby, 1982).

Efficacy of the commercially available anthelmintics and turmeric powder was evaluated against mixed infection due to *Toxocara cati* and *Ancylostoma sp* in 15 adult tigers of either sex whose approximate body weight were between 110-160 kg Five allopathic drugs i.e., Pyrental pamoate (Nemocid Tablet[1]), Levamisole (Dewormis Tablet[2]), Albendazole (Valbazen Tablet[3]) and Ivermectin (Neomec Tablet[4] or Hitek injection[5]) were administered once @ 20.0 mg 4.4 mg 25.0 mg and 200 mcg per kg b.wt., respectively. Turmeric (*Curcuma longa*) powder prepared from the locally purchased rhizomes was administered @ 5.0 gram/per tiger daily orally for seven days. Each oral preparation was administered along with the buffalo meat whereas Hitek injection was given through subcutaneous route. All the medications were performed under direct supervision. The epg (Eggs per gram) count was carried out using Willi's Technique (Soulsby, 1982) on pretreatment and on day 3, 7 and 10 post-treatment. The efficacy of the drugs was calculated using the following formula -

$$\text{Efficacy \%} = \frac{\text{Pretreatment EPG - Post-treatment EPG}}{\text{Pretreatment EPG}} \times 100$$

---

[1] Manufactured by M/S Ipca Laboratories Ltd, 63-E, Ipca House, Kandivili West, Mumbai.,Each tablet contain 250mg pyrantel pamoate

[2] Manufactured by M/S GlaxoSmithkline Ltd, Dr Annie Besant Road, Worli, Mumbai.,Each tablet contain 150mg of Levamisole.

[3] Manufactured by M/S Pfizer Animal Health Division Limited, Mumbai-400102. Each tablet contains 600mg of Albendazole

[4] Manufactured by M/S Intas Pharmaceuticals Ltd, Matoda-382210, Ahmedabad, India. Each tablet contains 10mg of ivermectin.

[5] Marketed by M/S Agrivet Farm Care, Virbac Animal Health India Pvt. Ltd., Mumbai, each 10ml vial contains 1.0% W/V ivermectin solution

Approximately two grams of freshly passed faeces was collected from the individual enclosure/animal in a clean, dry and air tight plastic container and subjected to qualitative and quantitative examination. Untreated tigers were considered as control. There were 2-3 tigers under each treatment group.

Another study was carried out to assess the impact of certain control measures i.e., change of top soil (partial/complete) from the enclosures and/or oral administration of turmeric powder. Five tiger enclosures i.e., 20, 21C, 28, 30C and 33C having an area of 208, 68, 35, 357 and 66 sq mt respectively were selected for the study. There was one adult tiger in each enclosure with a history of reinfection of gastrointestinal nematodes after each deworming practiced regularly at three months interval. In enclosure No 30C, the entire top soil upto six inches (15 cm) depth was dug out whereas in the enclosure No.20, the top soil upto the similar depth was removed in the portion upto 5ft (1.5 m) from the periphery of the enclosure (partial change of soil), the area of habitual defecation. The voids were filled with river sand. Due attention was given to the proper disposal of removed soil with a view to avoid contamination to the adjacent areas. Turmeric powder was given @ 5.0 g orally daily with buffalo meat to the tigers with and without partial change of top soil in the enclosure No.28 and 33C, respectively. The tiger in the enclosure No. 21C was reared without any control measure. Prior to trial all the tigers were given Hitek injection and faecal samples were confirmed to be negative for helminthic ova on 10th day post administration. The epg counts were undertaken on monthly basis for 10 months after implementation of control program.

Results and Discussion

Based on the morphological characteristics, the eggs of *Toxocara cati* and *Ancylostoma sp* were identified as single or mixed infections. The results depicted in the Table-1 indicated that the prevalence of such endoparasitic infection in tigers showed a decreasing trend from 82.8% at the beginning of the study period (2007-08) to 28.7% at the end of the study period (2009-10). Mixed infection due to *Toxocara cati* and *Ancylostoma sp* was always in higher side than the single infection due to either of the parasite (Fig.-1). Maximum rate of infection was recorded in post-monsoon period followed by monsoon and pre-monsoon (Table-1). Prevalence of such nematode infections among wild carnivores of Indian zoos has been documented by a number of investigators (Table-2).

Table-1. Prevalence of endoparasitic infections in tigers at Nandankanan Zoological Park, Bhubaneswar during 2007-10

Sl. No.	Periods	Seasons	No. of faecal samples examined	No. of samples positive for parasitic infection	Percentage of infection	Overall percentage of infection
1	2007-08	Pre-monsoon	20	14	70.0	82.8
		Monsoon	25	22	88.0	
		Post-monsoon	21	19	90.5	
2	2008-09	Pre-monsoon	21	13	61.9	73.0
		Monsoon	20	14	70.0	
		Post-monsoon	23	20	87.0	
3	2009-10	Pre-monsoon	18	5	27.7	28.7
		Monsoon	21	6	28.5	
		Post-monsoon	20	6	30.0	

Fig.-1. Year-wise prevalence of nematode infection in tigers of Nandankanan Zoological Park, Bhubaneswar during 2007-2010

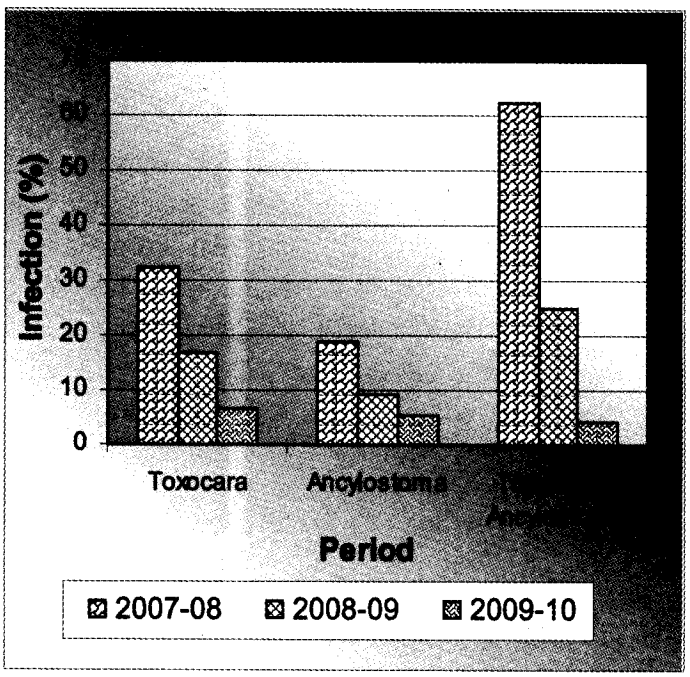


Table-2. Reports on occurrence of endoparasitic infection in large carnivores of Indian zoos

No. Sl.	Name of the investigator(s)	Year of study	Name of the zoo	Species of wild carnivores	Endoparasitic infection detected
1	Tripathy *et al.*	1971	Nandankanan, Bhubaneswar, Orissa	Jaguars, lions and tigers.	*Ancylostoma* and *Toxocara* spp.
2	Chauhan *et al.*	1973	Lucknow and Delhi zoos	Lions and tigers	*Toxascaris* sp.
3	Gaur *et al.*	1979	Kanpur zoo,Uttar Pradesh	Carnivores	*Toxascaris leonina* and *Ancylostoma* sp.
4	Ghoshal *et al.*	1988	Kamala Nehru Park, Indore, Madhya Pradesh	Carnivores	*Toxocara cati, Toxascaris leonina,* and *Ancylostoma* sp.
5	Niphadkar *et al.*	1989	Zoo, Bombay	Lions and tigers	*Toxocara* and *Ancylostoma* sp.
6	Maske *et al.*	1990	Maharajbag Zoo, Nagpur, Maharastra	Lions and tigers	*Toxascaris leonina* and *Ancylostoma* sp.
7	Muraleedharan *et al.*	1990	Sri Chamarajendra Zoological Gardens, Mysore, Karnataka.	Lions and tigers	*Toxocara, Toxascaris* and *Ancylostoma*.spp
8	Gogoi B.K.	1994	Zoological Park, Itanagar, Arunachal Pradesh	Tigers	*Ancylostoma* sp.
9	Kisthwara *et al.*	1998	Himachal Pradesh zoo.	Lions	*Toxascaris leonina Toxocara* and *Ancylostoma* sp.
10	Varadharajan, and Pythal	1999	Zoological Garden, Thiruvananthapuram.	Lions and tigers	*Toxascaris, Toxocara* and *Ancylostoma* spp.
11	Varadharajan and Kandaswamy	2000	V.O.C Park and Mini Zoo, Coimbatore, Tamilnadu.	Carnivores	*Toxocara* and *Ancylostoma* spp.
12	Nashiruddullah and Chakraborty	2001	Assam State zoo, Guwahati.	Lions and tigers	*Toxascaris leonina.*
13	Dhoot *et al.*	2002	Maharajbag zoo, Nagpur, Maharastra.	Lions and tigers	*Toxascaris leonina* and *Ancylostoma* sp.
14	Kumar and Rao	2003	Vizag Zoo, Visakhapatnam, Andhra Pradesh	Lions and tigers	*Ancylostoma* and *Toxocara* sp.
15	Singh *et al.*	2006	Mahendra Choudhury Zoological Park, Chhatbir, Punjab.	Lions and tigers	*Toxascaris leonina, Toxocara cati* and *Ancylostoma* sp.

Anthelmintic trial conducted against nematode infection with *Toxocara cati* and *Ancylostoma* sp. in tigers on the basis of epg count revealed that all the anthelmintics used in the study i.e., ivermectin, levamisole, pyrantel pamoate and albendazole were highly effective against nematode infection which varied from 94-100% (Table-3). It is inferred from the study that the nematode strains at Nandankanan Zoological Park have not yet developed resistance against any of the anthelmintics used in the trial as the reduction of egg count was more than 90%. None of the tigers exhibited any drug related undesirable effects at the given dose rate during post-administration period. Turmeric (*Curcuma longa*) powder administered @ 5.0g/day/tiger for seven days to tigers reduced the epg count by 64% on 10th day post-treatment. Appearance of clinical signs suggestive of parasitism in the host was not recorded in any of the tigers though faecal samples were found positive for eggs of endoparasites.

Table-3. Comparative efficacy of anthelmintics and turmeric powder against *Toxocara cati* and *Ancylostoma sp* infection in tigers of Nandankanan Zoological Park, Bhubaneswar.

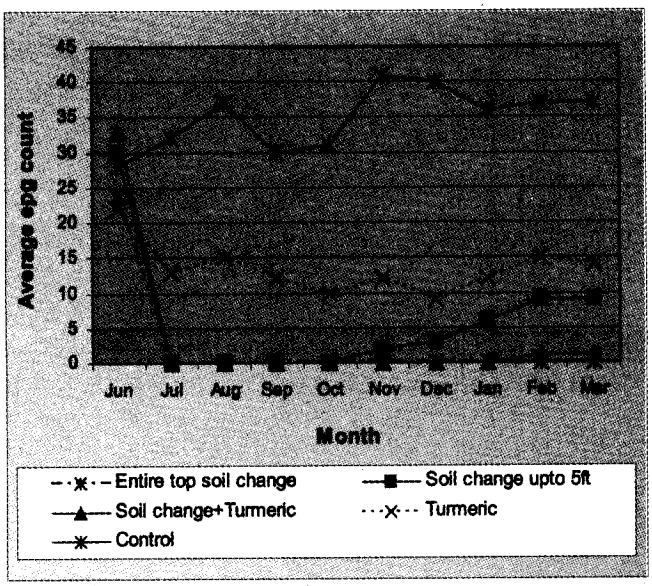
Drugs/preparation used	Average epg			
	Pre-treatment	Post-treatment		
		3rd day	7th day	10th day
Ivermectin Inj.	336	5(98.5)	0(100.0)	0(100.0)
Ivermectin Tab.	335	21(93.7)	2(99.4)	0(100.0)
Levamisole	266	32(88.0)	10(96.2)	10(96.2)
Albendazole	308	26(91.6)	6(98.05)	5(98.3)
Pyrantel pamoate	266	90(66.2)	14(94.7)	15(94.3)
Turmeric powder	284	224(21.1)	120(57.7)	102(64.0)
Control	273	329	474	584

Figures within parentheses indicate percentage of efficacy

Reinfection to *Toxocara cati* and *Anyclostoma sp* in tigers were recorded through detection of eggs in the faeces as early as 22 days post-administration of effective anthelmintics. It appeared difficult to completely eliminate the infective stages of the parasite from the environment and/or the host through regular administration of anthelmintic at three months interval. This hinted at the possibility of re-infection from the soil.

Comparison of control measures has been depicted in the Figure-2. It was observed that the epg count became negative for presence of helminthic ova during the observation period of 10 months where the entire top soil was changed upto a depth of the six inches (15 cm). It was observed from the study that instead of anthelmintic treatment alone, change of top soil and regular oral administration of turmeric would have synergistic action against control of gastrointestinal nematode infection in tigers. Undoubtedly, implementation of those measures would keep the exhibits in optimum health.

Fig.-2. Effects of control measures on epg count in tigers of Nandankanan Zoological Park, Bhubaneswar



(1.5 m)

Acknowledgement

The authors are grateful to the Central Zoo Authority, New Delhi for financial assistance and Nandankanan Zoological Park Authority for providing necessary facilities to carry out the investigation.

References

Chauhan, P.P.S., Bhatia, B.B., Arora, G.S., Agarwal, R.D. and Ahluwalia, S.S. (1973): A preliminary survey of parasitic infection among mammals and birds at Lucknow and Delhi zoos. *Indian.J.Anim.Sci.* 43: 163-168.

Dhoot, V.M., Upadhayay, S.V., Kolte, S.W. (2002): Prevalence of parasitism in wild animals and birds of Maharajbag Zoo, Nagpur. *Indian. Vet. J.* 79(3): 225-227.

Gaur, S.N.S., Tewari, H.C., Sethi, M.S. and Prakash, Om. (1979): A note on prevalence of helminth parasites in wild and zoo animals in Uttar Pradesh. *Indian J. Anim. Sci.* 49: 159-161.

Ghosal, S.B., Garg, U.K., Misraulia, K.S. and Jain, P.C. (1988): Helminth parasite in zoo animals of Kamala Nehru Park, Indore, Madhya Pradesh. *Livestock Advisor.* 13(1): 34-36.

Gogoi, B.K. (1994): A note on hookworm infestation of a tiger at Zoological Park, Itanagar, *Zoos' Print. J.* 9: 11.

Kistwara, R.S., Kanwar, M.S., Nigam, J.M. and Sharma, A.K. (1998): Hindquarter paralysis in lions (*Panthera leo*).Proceedings of 2nd commonwealth Veterinary Conference held at Bangalore.

Kumar, B.V. and Rao, A.N. (2003): Influence of age on prevalence of parasitic infection among felids in Animal Rescue Centre, Vizag Zoo, Visakhapatnam. *Zoos' Print. J.* 18(10): 11.

Maske, D.K., Sardey, M.R. and Bhilegaonkar, N.G. (1990): Helminth parasites in zoo animals of Maharajbag, Nagpur Maharastra. *Indian. J. Anim. Sci.* 60: 952.

Muraleedharan, V.I., Ziauddian, K.S. and Srinivasan, K. (1990): A survey of gastrointestinal parasites of animals of zoological gardens at Mysore. *Mysore J. Agri. Sci.* 24:250-256.

Nashiruddullah, N and Chakraborty, A. (2001): Parasites of captive wild carnivores of Assam State zoo. *Intas Polivet.* 2: 173-181.

Niphadkar, S.M., Narsapur, V.S., Deshpande, V.S. and Neheta, R.S. (1989): Parasitic infections of zoo animals in Bombay .*J. Bombay Vet. College.* 1(1): 37-40.

Singh, P., Gupta, M.P., Singh N. and Sharma, D.R. (2006): Prevalence and chemotherapy of gastrointestinal helminthic infections in wild carnivores in Mahendra Chowdhury Zoological Park, Punjab. *J. Vet. Parasitol.* 20(1):17-23.

Soulsby, E.J.L. (1982): Helminths, Arthropods and Protozoa of Domesticated Animals.7th Edn, Blackwell Scientific Publications, London: U.K.

Tripathy, S.B., Acharjyo, L.N., Rao, A.T., Pattanaik, K.C. and Mishra, S.K. (1971): Survey of intestinal parasitic infections in zoo animals and birds. *Indian.J.Anim.Hlth.* 10: 107-110.

Varadharajan, A and Pythal, C. (1999): Parasites of wildlife-1: A preliminary investigation on parasites of wild animals at the zoological garden, Thiruvananthpuram, Kerala. *Zoos' Print.J.* 14: 159-164.

Varadharajan, A and Kandaswamy. A. (2000): A survey of gastrointestinal parasites of wild animals in captivity in the V.O.C Park and Mini Zoo, Coimbatore. *Zoos' Print Journal.* 15(5): 257-258.

LONG DISTANCE ROAD TRANSPORTATION OF HIPPOPOTAMUS

K. Praveen Rao* and U.C. Srivastav**

Introduction

Hippopotamus *(Hippopotamus amphibius)* is a river-living mammalian species of tropical Africa. The animal spends most of its time standing or swimming underwater, where they feed on aquatic plants; it is herbivorous in nature. The animal is know to spend about 16 hours a day inside water. The Greeks named them "river horse." It has short-legs and broad body with a tough greyish brown coloured skin. The animal mostly defecates in water. It is the third largest land animal after elephant and white rhinoceros. The male has a shoulder height of about 160 cm and weighs about 5 tons whereas the female is slightly smaller. The body is nearly hairless. The mouth is wide, and the incisors and lower canines are large ivory tusks which grow throughout life. The eyes and nostrils are near the top of the head, so that the animal can see and breath when inside water in submerged condition. It breaths every 4 - 5 minutes. Hippopotamus usually live in herds. At night groups of animals feed on the shore. They also bask on the shoreline and the skin secretes droplets of moisture-a red oily substance and this gives rise to the popular statement that the hippos "sweat - blood". When alarmed, animal rushes to the water. Each breeding female can give birth to one calf every two years. The hippopotamus is hunted for meat and tusks. Africans have used the hide for shields and whips. Once widespread in Africa, the animal is now rare. Presently they are restricted to eastern, central and southern sub - Saharan Africa.

Hippopotamus in zoo environment - Hippos were in zoos and were popular among the visitors for many years. The first hippo was displayed in London zoo way back in the year 1850. First hippo was introduced in Kanpur Zoological Park in the year 1977 and was named "Dhiraj". Since then they have adopted to the climatic conditions of the zoo. The animals have been provided with an enclosure of the size of 1130 sq mt in which the water pool with a concave bottom occupies half the area. The open space has the feeding platforms and mangers. The entire pool is divided into two halves with one breeding pair kept on one side and four animals (two males, a female and a calf) on the other side to check territorial fight. The breeding history of the animals is one of the best in the zoo environment. Their numbers have increased to six. The animal

*Director, *Veterinary Officer, Kanpur Zoological Park, Kanpur, Uttar Pradesh

is a voracious feeder and consumes more than 80 kg of fodder every day. It is a bit costly affair to maintain a big herd under zoo conditions. The habit of the animal is to defecate in the pool of water, hence cleaning of the moat and change of water is needed at regular intervals. As the numbers increase, the rate of cleaning cycle also should be fastened to maintain hygienic conditions. To keep a balance on the above factors and to bring species diversity in the zoos, animal exchanges were proposed.

Animal exchange was planned between Kanpur Zoological Park, U. P. and Sakkarbaug zoo, Junagarh, Gujarat. According to the exchange programme a pair of hippopotamus, a pair of hog-deer and some birds were to be transferred to Junagarh in exchange of a pair of tigers along with some birds. The proposal was approved by the Central Zoo Authority (CZA) vide their letter F. No.23-1/2009-CZA (M), dated 23-11-09.

According to mutual agreement between both the zoos, one male hippo was to be transported from Kanpur zoo to Junagarh zoo by Kanpur zoo authorities and the female hippo would be transported later by Junagarh zoo authorities.

As a matter of routine, only younger and smaller individuals should be preferred for exchange due to ease of transportation. But in this case existing pair was selected for exchange, thus the larger male of about 20 years was to be transported. Hence the male hippopotamus, named "Neeraj" aged 20 years was transported under exchange programme from Kanpur Zoological Park, Kanpur to Sakkarbaug zoo, Junagarh.

Preparations for the transportation

The method of transportation and the modalities were discussed at length and many rounds of discussions were held between Director, Veterinarian, Forest Range Officers, Keepers and other field staff who participated in earlier exchange programmes. After the discussion the following activities were planed.

1. Construction of cage of suitable size
2. Acquaintance of the animal to the cage
3. Selection of route for transportation
4. Handpicked personnel for transporting the animal
5. Selection of season for transportation
6. Loading of the animal into the truck
7. Food reserve, Veterinary kit and other equipments

8. Frequency of water bath required during transportation
9. Precautions to be adopted during transportation

Construction of cage of suitable size - The male hippo was fairly a big animal and required a cage of suitable size and strength. The total transporting distance form Kanpur to Junagarh was about 1400 km. Thus the cage along with a heavy animal inside should be in a position to cope with the bumps and jerks on the road. So a cage of 3.60 m (length) X 1.50 m (width) X 1.80 m (height) with angle iron of 60 mm X 60 mm X 6 mm dimensions was chosen for construction of the cage. At one end a sliding-up door was fixed with iron bars of 25 mm thickness. The top of the cage was also constructed with iron bars of 16 mm and were fixed at a spacing of 8.0 cm to allow proper ventilation and drenching of the animal to keep it cool and moist during journey. The front, rear, sides, bottom and the top were covered with wooden planks of the size 0.3 m width X 0.025 m thickness and of appropriate length. The wooden planks placed at the bottom and front end were joined closely but the side planks were spaced to allow free flow of air. Additional reinforcement was placed on the front end and rear end to sustain impact of the animal when it is loaded and if it tries to escape out of the cage. Thus a cage of suitable size and strength was constructed.

Acquaintance of the animal to the cage - To make the animal acquainted with the cage, the cage was placed in the enclosure two months before the expected date of transportation. The entry door (sliding-up door) was pulled up and was tied with a thick plastic rope and the other end of the rope was fixed to the ground with suitably designed nails, so that on the day of transportation the animal could be locked instantly. Feed was served inside the cage. Initially the animal showed reluctance, but gradually the animal was used to the cage and was moving in and out of the cage freely.

Selection of route for transportation - It is a great challenge to transport a fully grown amphibious animal for long distance. Therefore, a comfortable route with minimum jerks and bumps and with facility for water and feed all along the way is of utmost importance. Two probable routes chosen for transportation are as follows :

Route-I - Kanpur >> Jhansi >> Shivpuri >> Guna >> Ujjain >> Ahmedabad >> Junagarh.

Route-II – Kanpur >> Etawah >> Firozabad >> Agra >> Bharatpur >> Mahuwa >> Balaji Crossing >> Dausa >> Jaipur >> Ajmer >> Nathdwara >> Udaipur >> Gandhinagar >> Rajkot >> Junagarh

The total distance covered by route-I was 1393 km and that of route-II was 1500 km. Though the second route was longer by 107 km, route-I has many state highways and few national highways and passes through least populated areas. Thus the expected

jerks and bumps on these roads are more and at the same time in case of emergency during transportation immediate assistance was a remote possibility due to least populated areas along the road. The route II had most of its way with national highway and the golden quadrilateral the national highway number 2. Thus the route-II was chosen for road transportation because of the above mentioned facts such as least jerks and bumps on national highways and the facility for watering and feed availability along the way.

Handpicked personnel for transporting the animal - The arrangements made for transportation of the hippo were satisfactory. But the real challenge was to transport the animal safely to its final destination. The guidelines issued by the Central Zoo Authority for transportation of the animals clearly spell that a veterinarian should accompany the animal during transportation. Thus the first person in the team was a veterinarian. Later a team of staff for assisting the veterinarian during transportation was carefully selected. Any smallest of the mistake would prove detrimental. It would result in the loss of life of a precious animal and at the same time bring bad name to the organization. Hence a careful selection of the personnel to accompany the animal is very much essential. The people should be well acquainted with the habits of the animal under consideration and also be capable to tide over difficult situations. The group should be cohesive, share the responsibility and should be readily accepting the duties assigned to take up the challenges involved. Keeping in view the experience and past history of transporting the animals, Mr. J. P. Awasthi, forester was chosen. Keeper Ramesh Chandra who had a long experience of handling the animals was chosen as third member of the team. Mr. Vinod Kumar, sweeper is an active member of the zoo responsible for maintenance of cleanliness and hygiene of the animal enclosures was chosen as the fourth member of the team. Thus the team members consisted of Dr. U.C Srivastava, Veterinary Officer; Mr. J.P. Awasthi, Forester; Mr. Ramesh Chandra, Keeper and Mr. Vinod Kumar, Sweeper.

Selection of season for transportation - The initial approval of CZA was given in their letter F. No.23-1/2009-CZA (M) dated 06-04-2009. It was decided not to transport the animal during summer as the animal was amphibious in nature and it restricts itself to water for about 16 hours a day. Thus transporting such an animal during summer was not advisable and decided to postpone it till the onset of early winter. But during the end of September and first half of October it was still hot and was not conducive for transporting an animal like hippopotamus. Therefore, an extension of time was sought for transporting the animals. The proposal was accepted by CZA and period was extended in their letter F. No. 23 -1/2009-CZA(M) dated 23-11-2009.

The time of transportation was decided around third week of December, because the nights will be cooler and animal is to be transported longer distance during nights and during day time, the animal will be transported during early hours and late evenings. It was decided that the animal should be rested under shade during the hot hours of the day.

Loading of the animal into the truck - Finally the day of transportation has come. The date of the transportation was 23rd December, 2009. The animal was not given its feed on the usual time which was around 10-30 A.M. It was provided with fruits, protein diet and green fodder at around 2-30 P.M. The animal was given its feed around 4-30 P.M. The animal readily entered the cage for its feed. At the right moment the cage shutter was dropped when the animal was inside the cage. Soon after the shutter was closed, the animal became restless, little violent and pushed its heavy body against the cage walls and shutters. As the cage was designed keeping in view all these eventualities no damage occurred to the cage, but the animal received some bruises in the process. The animal was given the first aid. All the persons involved in the operation were asked to leave the place for a while so that the animal recovers from trauma. The animal got used to the situation and calmed down after some time. At this time the crane did its rest of the job of loading the animal into the truck. The transition of animal from its enclosure to the truck was a slow and steady pace, so that the animal was least disturbed. Once it was loaded into the truck it became restless once again, but calmed down after a while. The journey was started at 11.30 P.M. on 23-12-2009 from Kanpur zoo premises.

Food reserve, veterinary kit and other equipments

Animal Feed: It was essential to carry green fodder and other feed to meet the exigencies. Both chopped and full length jowar strands green fodder, vegetables and fruits were carried as reserve. The animal feed with the following composition was also kept as reserve.

Wheat	30%
Maize	20%
Treacle/Molasses	10%
Small fragments of corn or small ruby containing :- (gram + lentil + horse bean + kidney bean + legume + fragmented legume + grain dust + oil cake + gram husk + pea husk)	40%

Veterinary Kit : During transportation the animal may be subjected to a different environment unusual to its daily routine. This may result in stress and loss of apetite. The fluctuations in the temperature regime might result in dehydration, temperature rise, stomach disorders etc. Further the animal may have to be tranquilized for any unforeseen situation or for treatment. Thus the following important medicines were carried to meet out, any probable incidence.

1.	Antibiotics	Cefrioxone + Tazobactum injection (for parentral use)
		Sulfadiazine + Trimethoprim bolus (for oral use)
2.	Corticosteroids	Prednisilone/Triamcinolone Acetonide and Dexamethasone (injectable)
3.	Behaviour modifier and Anti-emetics	Triflupromazine
4.	Antipyretics / Analgesic and Anti-imflammatory agents	Paracetamol/Nemisulide and Meloxicam;
5.	Antiseptics	Lorexene Cream/Negasunt dusting Powder/ Topicure Spray / Himax Lotion and Betadine lotion.
6.	Miscellaneous	Disposable syringes (50ml/20ml/10ml/5ml and 3ml). Cotton and Bandage Methylated Sprit and Dettol.
7.	Tranquillizing Kit	Disinject Dart Gun, Blow Pipe Xylazine / Ketamin and Yohimbine Injections.

Besides these, for drenching the animal two cans, rope, water trough and rubber tube were kept for pouring water on the animal at regular intervals.

Frequency of water bath required during transportation

Hippopotamus being an amphibious animal, a prime consideration was laid towards the maintenance of humidity to avoid drying of the external body surface. Throughout the journey continuous baths were given to the animal. The major considerations for giving baths were temperature of the atmosphere and availability of

water sources and journey breaks for retiring this heavy animal. Therefore, the following schedule was adopted.

Sl. No.	Date	Place	Time of Bath	Distance covered (km)
1.	23-12-09	Kanpur zoo, U.P	09.00 PM	0 km
2.	24-12-09	Sikandara, U.P.	02.45 AM	90 km
3.	24-12-09	Etawah, U.P.	06.00 AM	85 km.
4.	24-12-09	Agra, U.P.	10.40 AM	140 km
5.	24-12-09	Bharatpur, Rajasthan	12.35 PM	60 km
6.	24-12-09	Mahuwa, Rajasthan	03.00 PM	60 km
7.	24-12-09	Jaipur, Rajasthan	06.40 PM	100 km
8.	24-12-09	Ajmer, Rajasthan	11.30 PM	142 km.
9.	25-12-09	Ajmer, Rajasthan	07.30 AM	Night halt
10.	25-12-09	High way No. NH 79, Rajasthan	11.00 AM	80 km.
11.	25-12-09	High way No. NH79, Rajasthan	01.30 PM	80 km.
12.	25-12-09	High way No. NH 79, Rajasthan	04.15 PM	90 km.
13.	25-12-09	High way No NH 79, Rajasthan	06.45 PM	70 km.
14.	25-12-09	High way No 8, Rajasthan	09.00 PM	70 km.
15.	25-12-09	High way No 8, Rajasthan	11.00 PM.	95 km
16	26-12-09	Gandhinagar, Gujarat	03.00 AM	135 km
17.	26-12-09	Gandhinagar, Gujarat	07.20 AM	Nigh halt
18.	26-12-09	High way No. NH8B, Gujarat	09.45 AM	87 km.
19.	26-12-09	High way No NH 8B, Gujarat	01.00 PM	99 km
20	26-12-09	Rajkot, Gujarat	02.15 PM	Break Journey
21.	26-12-09	Rajkot, Gujarat	04.00 PM	140 km.
22.	26-12-09	Sakkarbaug zoo, Gujarat	07.00 PM	127 km.

Precautions adopted during transportation

1) The driver of the carrier was very careful and cautious about the movements of the animal inside the cage so that the vehicle may not be disbalanced.

2) While applying brakes, the speed of the vehicle was reduced well in advance.

3) Speed of the vehicle was maintained at an optimum speed.

4) Animal was given sufficient rest to retire.

5) Strict monitoring of the animal behaviour and condition was done on every stoppage.

6) Not much emphasis was given to feed the animal during journey but chopped and raw "chari" was given daily. All left over food stuff was discarded next morning and thorough cleaning of the cage was done with D-125 solution. In between the journey period - potato, cauliflower, carrot, guava and banana were given. The banana was relished by the hippopotamus along with the animal feed.

A total distance of 1740 km was covered to reach the destination, because of some diversions on the road. Thus the total road distance was more than the expected distance.

Finally the animal was landed safely into the hippopotamus enclosure of Sakkarbaug zoo, Junagarh at 09.00 PM on 26-12-2009. The marathonic mission was accomplished very successfully.

SUCCESSFUL HAND-REARING OF CHIMPANZEE BABY (*Pan troglodytes*) AT NANDANKANAN ZOOLOGICAL PARK, BHUBANESWAR

S. Mishra, A.K. Mishra, P.K. Roy, R.K. Samantaray, A.K. Das, S.N. Mohapatra and S. Panda

Introduction

Chimpanzees (*Pan troglodytes*), a heavily built non-human primate belongs to the family 'Hominidae' and weighs up to 200 pounds (90.800 kg) and grows up to a height of 3-5.5 feet (0.90 - 1.65 m). Males are generally larger in size than females. They used to live in large forested areas, but they may also inhabit dry savannah and mosaic habitats of grassland, woodland and forest environments. They are omnivorous in nature feeding on fruits, vegetables, insects and other animals at times. It is important to recognize that there is a hierarchical priority among chimpanzees for access to food that must be considered during feeding, foraging activities and access to enrichment foraging devices (Burton and Burton, 1989).

Hand-rearing of abandoned, orphaned or rescued young ones of wild mammals is one of the important and difficult tasks for the zoo care takers. The protocol for hand-rearing of young animals vary with the species involved to be reared, their age at the time of receipt, whether they have received colostrum or not and the general health status of the young (Senthilkumar and Thirumurugan, 2006). Many authors have reported incidents of successful hand-rearing of neonates and juveniles belonging to different groups of mammals and other animals. Studies on captive primates have provided information to zoological societies on how to house and care animals that meet their basic requirements, while providing appropriate environmental and social stimulation (Maple *et al.*, 1995). So, it is important to collect information from the wild that will assist in understanding the dynamics of captive environments and factors that influence the upkeep and rearing of the primates (Kleiman *et al.*, 1991; Lindberg *et al.*, 1997; Stoinski *et al.*, 1997). In zoos, behavioural abnormalities displayed by primates are a common feature (Mallapur and Choudhury, 2003; Mallapur, 2005; Mallapur *et al.*, 2005). Some of the behavioural abnormalities like self-injurious behaviour, bouncing, stereotypic pacing, floating limbs etc. are recorded both in exhibits and laboratories

Nandankanan Zoological Park, Post: Barang, Dist: Cuttack, 754005, Orissa

(Anderson and Chamove, 1985). Watts and Sherrow (2002) documented twenty-one cases of infanticide by males in four chimpanzee populations. Ten of these cases happened within communities and sometimes potential fathers even participated. Other attacks occurred during encounters between communities and the attackers were believed to have been unrelated to the infant victims. This kind of reaction of adult male towards the young male is more prominent in wild as well as in captive conditions (Mallapur, 2005). All the above reasons necessitate for hand-rearing of the helpless new born chimpanzee.

In the present study, some of the parental behaviour as well as the successful hand-rearing procedure of the chimpanzee *(Pan troglodytes)* baby borned at Nandankanan Zoological Park, Bhubaneswar, Orissa (NKZP) is discussed.

Nandankanan Zoological Park case study

Nandankanan Zoological Park houses three chimpanzees consisting of one male and two females. One female named 'Purnima' is the daughter of female chimpanzee 'Pampata' and male chimpanzee 'Zulu'. 'Pampata' and 'Zulu' were brought from Singapore zoo on 16th May 1994 at the age of 3 ½ years and 5 ½ years respectively.

In the early morning of 14th October 2009, the grandmother 'Pampata' was seen holding the just born baby of the other chimpanzee 'Purnima'. Even after 12 long hours, mother 'Purnima' neither showed any maternal instinct nor showed any interest or inclination to collect the baby from 'Pampata' for breast feeding. The new born was visibly looking weak and dull without milk for a prolonged time. Experts from other premier zoos and veterinary institutions were consulted. The non-acceptance of mother and the aggressiveness of the father towards the new born male young of NKZP necessitated this chimpanzee baby to be hand-reared. It was decided to separate the baby from its grandmother for hand-rearing. During the evening hours 'Pampata' was tranquilized successfully and the baby chimpanzee was separated.

Separation of chimpanzee baby

In order to separate the young from the grandmother 'Pampata', it was necessary to drive other adult individuals ('Zulu' and 'Purnima') out of the feeding cubicle. The grandmother was holding the baby limiting the young without proper care. The body weight of 'Pampata' was assessed to be about 60kg. Thus, at about 5 P.M. on 14th October 2009, she was darted using a blow pipe with a mixture of drugs of Ketamine hydrochloride- 300 mg and half ml (0.3 mg) of Atropine sulphate. The dart hit the left forearm region. It took 20 minutes for complete sedation of 'Pampata'. At about 5.20

P.M. the baby chimpanzee was successfully separated from her for hand-rearing. 'Pampata' got fully revived by 6.10 P.M. without any complication.

Housing

After separation of the young, the baby was allowed to be kept in a well ventilated nursery room measuring 2.30 X 2.30 m with cement concrete floor in an off exhibit area of the zoo. The room was cleaned and disinfected daily. There were also arrangements of a wooden cot with mat inside the room. A clean blanket was provided for warmness to the young during the cooler hours. During the sleeping period of the baby, a mosquito net was provided to prevent the mosquito bite. Three dedicated keepers were assigned different works in order to provide the complete care to the young one.

Feeding

Immediately after separation about 20 drops of sterile dextrose solution was given orally and shifted to the nursery room for rearing. As per the manufacturer's instructions, 4.6 g of Nestle's Lactogen-I* (infant formula) was diluted with 30 ml of luke warm water to constitute the feeding solution. This proportion of food constituents had been maintained throughout the rearing period. Ten ml of the freshly prepared milk along with a pinch of glucose was fed at hourly interval with a clean and sterilized dropper. The body weight after the birth and after separation from the grandmother was recorded to be 1655 grams. From the second day, the baby was fed with 30 ml of the freshly prepared milk with the help of a spoon at every two hours. The container was cleaned with boiled water before and after each feed. This quantity of milk preparation was given to the young up to the age of 15 days. Since the milk acceptance increased, 45 ml of prepared milk in the same proportion was given reducing the frequency of feeding to three hours interval. Burfing the baby after each feeding was continued to release the gas, if any. After 15 days the milk was fed with the help of a feeding bottle with silicones nipple. All utensils and feeding bottle used are meticulously cleaned and sterilized by boiling before and after each feeding.

From 31st day onwards, 60 ml of the reconstituted milk was fed at 3 hours interval. By observing the appetite of the baby, the quantity of reconstituted milk was increased to 90 ml per feed with 13.8 grams of Lactogen-I. It is felt that with the increased quantity of the milk, the baby suffered from diarrhoea during 14th week of age resulting in loss of body weight. This was diagnosed as the result of glucose

*Manufactured by-Nestle India Limited, M-5A, Connaught Circus,New Delhi-110001

intolerance. Due to this reason, again the quantity of milk was reduced to 45 ml with Oral Rehydration Salt (ORS) solution. After continuing the same diet pattern the baby had shown remarkable development in the body condition within a week. Again the amount of milk was increased to 90 ml after 170 days of rearing, which was accepted

Table -1: Diet chart and frequency of feeding for the chimpanzee during captive rearing.

Age in days	Quantity of diet given at a time	Frequency of feeding per day
Day 1	about 1.5 g of Lactogen-I + 10 ml of previously boiled water	24
Day 2 - 15	1 scoop (4.6 g) Lactogen-I + 30 ml previously boiled water with a pinch of glucose	12
Day 16 - 30	6.9 g of Lactogen + 45 ml previously boiled water	8
Day 31 - 70	9.2 g of Lactogen + 60 ml previously boiled water	8
Day 71 - 85	13.8 g of lactogen + 90 ml of previously boiled water	8
Day 86 - 170	6.9 g of Lactogen + 45 ml previously boiled water	8
Day 171 - 207	13.8 g of lactogen + 90 ml of previously boiled water	8

readily by the infant. The details of diet schedule, constituents and the frequency of feeding per day were given in Table -1.

Healthcare

Monitoring the health and healthcare is an important aspect of hand-rearing principle. For healing of the navel cord after separating the baby, it was applied with triple dye with the help of sterile cotton buds thrice a day. By applying this, the navel cord was shed after three days and healed up completely. Multivitamin (Hovite drop[1]) was given 3 drops once a day during morning hours with the feed. It has suffered from

[1]Svaidyam Pharmaceuticals & Chemicals (p) Ltd, Thane; [2]Aishwarya Healthcare, Sholan, HP; [3]Kalandi Medicure Pvt. Ltd., Gujarat.

bacterial diarrhoea during 14th week of hand-rearing. As per the bacterial culture antibiotic sensitivity test of the stool, 'Amitax'125 mg[2] (0.5 ml) injection was given intramuscularly twice daily for five days. In addition to that 'Vizylac suspension[3]' 1.0

Table - 2: Growth in grams during the hand-rearing of the chimpanzee baby.

Date	Age in weeks	Weight in grams	Weight gain in grams
14.10.2009	Day1	1655	-
22.10.2009	1st	1755	100
26.10.2009	2nd	1995	240
01.11.2009	3rd	2160	165
09.11.2009	4th	2345	185
16.11.2009	5th	2570	225
23.11.2009	6th	2750	180
30.11.2009	7th	2900	150
07.12.2009	8th	3000	100
14.12.2009	9th	3200	200
21.12.2009	10th	3305	105
28.12.2009	11th	3390	85
04.01.2010	12th	3515	125
11.01.2010	13th	3735	220
18.01.2010	14th	3650	-85*
25.01.2010	15th	3870	220
01.02.2010	16th	3950	80
08.02.2010	17th	4080	130
15.02.2010	18th	4170	90
22.02.2010	19th	4300	130

*Reduced body weight due to sickness and off feed

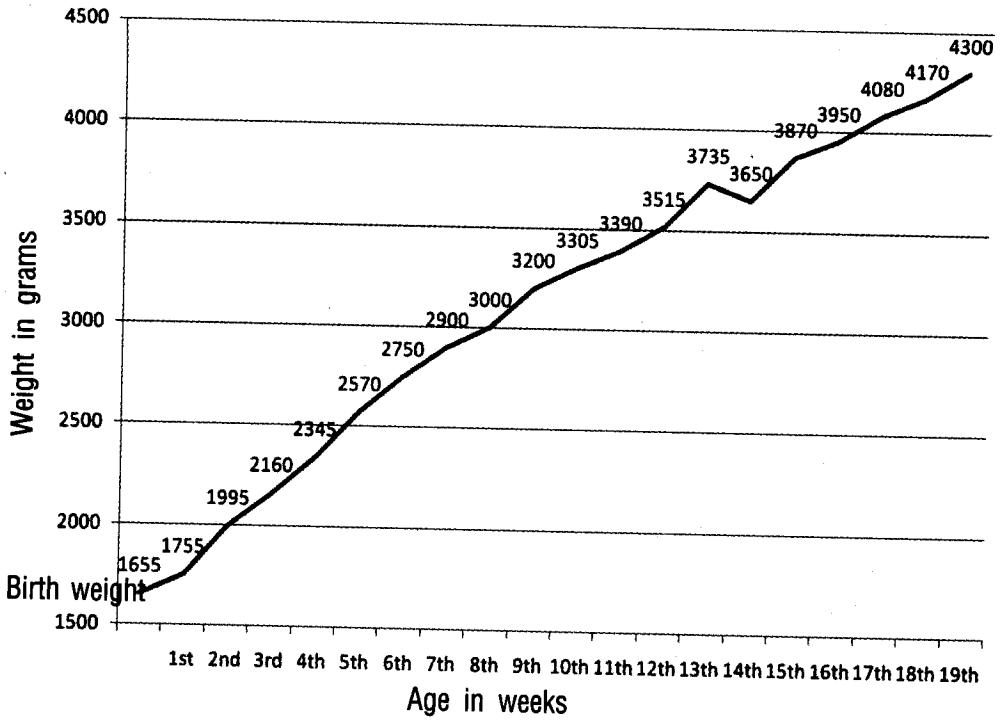


Fig.1: Body weight (in grams) of the chimpanzee baby showing weight loss during 14th week due to diarrhoea and sickness.

ml twice daily along with ORS solution was given. After the treatment, the bacterial diarrhoea was checked. To monitor the proper health status, regular body weight was recorded which is given in the Table - 2 and Fig.1.

Conclusion

- For a successful hand-rearing programme with special reference to non-human primate like chimpanzee, intensive care and continuous monitoring is necessary.
- By supplementing adequate care, hygienic surroundings, regular health check up and providing the appropriate diet in time can be the key for the survival of the chimpanzee baby.
- It is observed that, after providing the liquid food i.e. 13.8 grams of lactogen-I in 90 ml of previously boiled water for eight times per day will lead to frequent urination, which is on an average 19 times per day.

- It is also observed that the defecation rate is twice a day with the above said diet supplement.

But, sometimes diarrhoea occurs due to contamination which may be controlled by maintaining the hygienic condition, avoiding frequent handling by several persons and appropriate treatment, if required. Some of the important events observed from 'Kartik', the male chimpanzee baby is given in Table-3.

Table- 3: Events observed from Kartik (male chimpanzee baby)

Days	Important events observed from Kartik
95 days	Started crawling in belly position
125 days	Trying to sit by extending one leg in forward direction and other in backward condition
140 days	Started sniffing and smelling the unknown objects; taking all objects to mouth and trying to chew as the first teeth have developed in the upper jaw.
153 days	Trying for knuckle walk
154 days	It responded the social interaction with his parents
160 days	Trying to climb on the cot provided at rearing centre

Acknowledgement

We sincerely acknowledge the contributions of Srihari Charan Singh, Kedar Patra and Gangadhar Behera, Animal Keepers of Nandankanan Zoological Park for devoting most of the time for caring the chimpanzee baby.

References

Anderson, J. R. and Chamove, A. S. (1985): Early social experience and the development of self-aggression in monkeys. *Biology of Behaviour 10*: 147 - 157.

Burton, M. and Burton, R. (1989): International Wildlife Encyclopedia, Marshall Cavendish Corporation, Long Island, New York.

Kleiman, D. G. Beck, B. B. Dietz, J. M. and Dietz, L. A. (1991): Costs of re-introduction and criteria for success: accounting and accountability in the Golden Lion Tamarin Conservation Program. *Symposium of the Zoological Society of London 62*: 125 -142.

Lindberg, D. G. laderosa, J. and Gledhill, L. (1997): Steady-state propagation of captive lion-tailed macaques in North American zoos: a conservation strategy. In: Wallis

J (Ed) *Primate Conservation: The Role of Zoological Parks.* American Society of Primatology: Oregon, USA, pp 131 - 149.

Mallapur, A. and Choudhury, B. C. (2003): Behavioural abnormalities in captive non-human primates. *Journal of Applied Animal Welfare Science 6*: 275 - 284.

Mallapur, A. (2005): Managing primates in zoos: Lessons from animal behaviour *Current Science 89*: 1214 - 1219.

Mallapur, A. Waran, N. and Sinha, A. (2005): Factors Influencing the Behaviour & Welfare of Captive Lion-tailed Macaques (*Macaca silenus*) housed in Indian Zoos *Applied Animal Behaviour Science* 91: 337 - 353.

Maple, T. Mcmanamon, R. and Stevens, E. (1995): Defining the good zoo: animal care, maintenance and welfare. In: Norton B G, Hutchins M, Stevens E F, Maple T L (Eds) *Ethics on the Ark.* Smithsonian Institution Press: Washington, USA, pp 219 - 234.

Senthilkumar, K. and Thirumurugan, R. (2006): Hand-rearing of two striped hyena cubs (Hyaena hyaena) at Arignar Anna Zoological Park, Chennai, Indian Zoo Year Book, Vol.-IV, pp. 74 - 86.

Stoinski, T. Beck, B. Bowan, M. and Lehnhardt, J. (1997): The gateway zoo program: a recent initiative in Golden Lion Tamarin reintroduction. In: Wallis J (Ed) *Primate Conservation: The Role of Zoological Parks.* American Society of Primatology: Oregon, USA, pp 113 - 130.

Watts, D. J. M. and Sherrow, H. (2002): New Cases of inter-community infanticide by male chimpanzees at Ngogo, Kibale National Park, Uganda. *Primates*, 43: 263-270.

SUCCESSFUL HAND-REARING OF CHIMPANZEE BABY (*Pan troglodytes*) AT NANDANKANAN ZOOLOGICAL PARK, BHUBANESWAR

S. Mishra, A.K. Mishra, P.K. Roy, R.K. Samantaray, A.K. Das, S.N. Mohapatra and S. Panda

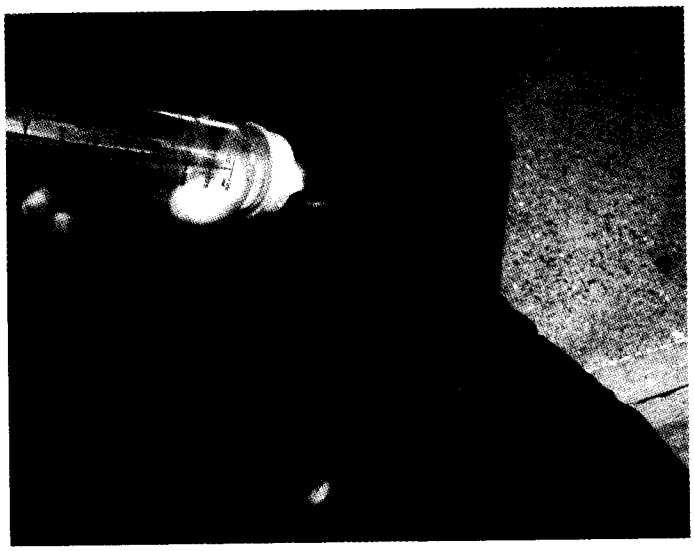


Fig.1: Baby chimpanzee taking lactogen - bottle feeding.

Fig.2: Sleeping inside mosquito net

SUCCESSFUL HAND-REARING OF CHIMPANZEE BABY (*Pan troglodytes*) AT NANDANKANAN ZOOLOGICAL PARK, BHUBANESWAR

S. Mishra, A.K. Mishra, P.K. Roy, R.K. Samantaray, A.K. Das, S.N. Mohapatra and S. Panda

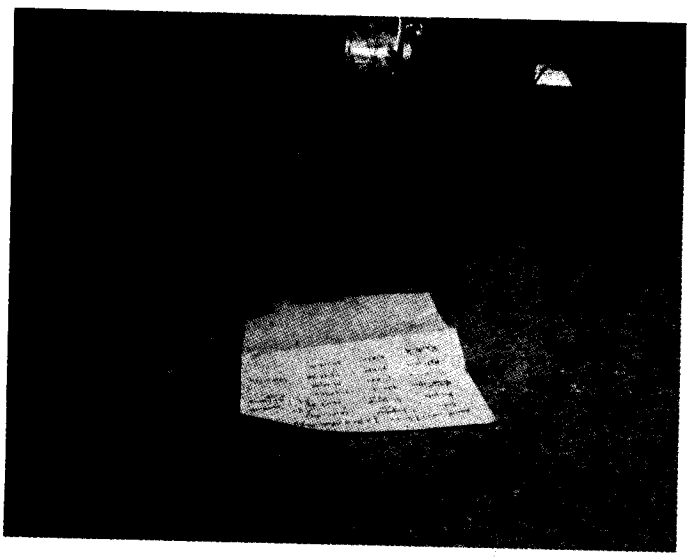


Fig.3: Showing explorative behaviour- examining a printed paper

Fig.4: Social interaction with parents through partition bars

Indian Zoo Year Book, Volume - VI, 2010

FASCIOLA INFECTION IN CAPTIVE ASIAN ELEPHANT : A CLINICAL CASE REPORT

N. K. Nighot[1], R. V. Jadhav[2], Kazveen Umrigar[3] and S.N. Nevase

Introduction

Zoological Parks exhibit wild animals for aesthetic, educational and conservation purposes. Zoo animals living under captivity are susceptible to almost all types of diseases, so much so that parasitic diseases, particularly helminthic infection can frequently be a major problem in zoo animals. Information on parasites of wild animals is meagre due to paucity of systemic investigations; the available data appear rather scanty and are based mostly on findings from autopsies. Parasitic diseases constitute one of the major problems causing mortality even in wild animals in captivity (Rao and Acharjyo, 1984). *Fasciola* infection is one of the most common infections reported in captive Asian elephants in the past (Chakraborty and Islam, 1996, Datta and Bardoloi, 1989). However, no systematic clinico-pathological study has been documented. A case of *Fasciola* infection in one female elephant at Rajiv Gandhi Zoological Park and Wildlife Research Centre, Pune was diagnosed and successfully treated. The details of diagnosis of the infection, the clinico-pathological examinations undertaken and response to the treatment are discussed here.

Clinical signs and symptoms

A female elephant (Merry) aged 12 years, showed symptoms of ventral abdominal oedema on 17.08.08, (Fig. 1 and Fig.2) with pain in the umbilical area and swelling that was cold to touch. At that time, rectal temperature was 92.7^0 F. The animal looked dull and depressed but no constipation or diarrhoea were observed. The umbilical swelling was triangular in shape with the lengths of the three sides being 60 cm, 39 cm and 35 cm respectively. Partial anorexia was also observed.

On clinico-pathological examination of blood, the animal was observed to have anaemia, leucocytosis and elevated levels of SGOT, SGPT and alkaline phosphatase. (Table-1).

1. Veterinary Oficer and Author for Correspondence 2. Dy. Garden Suptt. 3. Ex. Director
Rajiv Gandhi Zoological Park and Wildlife Research Centre, Katraj, Pune-411 046

The coprological examination by floatation and sedimentation method (Soulsby, 2005) revealed the presence of ova of *Fasciola hepatica* and the EPG count was 200. No other parasitic infection could be detected in the faecal sample. Blood smear examination did not show any protozoan infection. The faecal sample of another female elephant (Janaki) housed in the same enclosure was examined and was found negative for *Fasciola* infection. Therefore, it was decided to treat only the first elephant (Merry).

It can be construed that the *Fasciola* infection was responsible for decrease in the total erythrocyte count and haemoglobin concentration, (indicated by the presence of anaemia as a result of blood loss in the liver) (Blood *et al.*, 1989) and hypoproteinemia due to the liver damage as the liver was unable to synthesize the protein (Shastry,1983). The increase in the SGOT, SGPT and Alkaline Phosphatase level may also be attributed to the liver damage due to the migration of the flukes in the liver parenchyma. (Fowler and Miller, 2003 and Soulsby, 2005).

Treatment and discussion

Symptomatic treatment of ventral abdominal oedema was carried out by administering diuretic Furesamide (Inj. Ridema[1]) 30 ml and antibiotic Cefotaxime (Inj. Taxim[2]) 6 gm intramuscular for 3 days from the onset of symptoms.

After confirmatory diagnosis from the examination of the faecal sample on 25.08.08, the animal was treated with the flukicide Oxyclozanide (Bolus Distodine[3]) 15 gm (@ 5mg/kg body weight) orally as per Soulsby (2005). To overcome the hypoproteinemia, essential amino acids were injected intra-venously (Inj. Hermin[4]) 600 ml I/V on alternate days on 3 occasions. Symptomatic treatment with Cefotaxim (Inj. Taxim) and diuretic (Inj. Ridema) was continued to avoid secondary bacterial infection and to reduce the oedema respectively. Along with the above treatment liver protectants like (Inj. Livobex[5]) 60 ml/ animal per day was administered intra muscularly for 3 days and later on oral liver stimulants like Liv 52[6] boli and Nutrolin B[7] tablets were administered to accelerate the healing of the liver.

After treatment the triangular sized ventral abdominal oedema started regressing from the third day onwards.

During the course of treatment blood, sera and faecal samples were sent regularly for examination. The examination reports revealed that the animal showed

---

[1] Inj.Ridema- Samrudh Pharmaceuticals, Thane.
[2] Inj.Taxim- Alkem Laboratories, Mumbai.
[3] Bolus Distodine- Pfizer Ltd.Mumbai.
[4] Inj. Hermin- Alembic, Vadodara.
[5] Inj. Livobex- TTK Healthcare, Chennai.
[6] Liv 52- Himalaya drug Company,Bangalore
[7] Nutrolin B - Okasa Pharma, Sangali.

Table-1 : Blood , Biochemical analysis of Elephant (Merry) and Elephant (Janaki)

Parameter	Unit	Value				
Date of Estimation		21.08.08	02.09.2008	14.10.08	23.12.08	23.12.08
Name of Animal		Merry	Merry	Merry	Merry	Janki
Hb	gm /dl	9.8	12.8	11.5	13.2	14.7
PCV	%	29.8	34.1		24.1	38.9
WBC	X 10^3 /ul	2.02	1.96	4.2	2.21	2.24
RBC	X 10^6 /ul	2.95	3.47	3	2.55	3.66
M.C.V.	cubic microns				94.5	80.2
M.C.H.	picograms				51.7	31.4
M.C.H.C.	g/dl				54.7	37.7
Platelet	X 10^3 /ul	4.75	3.06		2.31	2.76
Diffrential Count						
Neutrophils	%	51	60	20	30	24
Bands				1		
Mature neutrophils				19		
Lymphocytes	%	45	25	28	59	62
Monocytes	%	4	3	36	1	2
Eosinophils	%	0	0	14	10	12
RBC Morphology		Normocytic, normochromic, macrocytes+	Normocytic, normochromic	Microcytic, normochromic	Microcytic, normochromic	Normocytic, normochromic
WBC Morphology		Leucocytosis	Leucocytosis with mild Eosinophilia		Leucocytosis with Lymphocytosis & mild Eosinophilia	Leucocytosis with Lymphocytosis & mild Eosinophilia

Platelet		Adequate	Adequate	Adequate	Adequate	Adequate
Parasite		No	No	No	No	No
Liver Function test						
Serum Bilirubine	mg/dl					
Total		0.65	0.58	0.23	0.69	0.63
Direct		0.45	0.36		0.25	0.3
Indirect		0.2	0.22		0.44	0.33
SGOT	IU/L	36	27	48.1	24	22
SGPT		10	17		15	17
Sr. Alkaline Phosphatase	IU/L	199	210		220	131
Serum proteins						
Total protein	gm%	5.6	6.2	6.75	7.1	6.8
Globuline	gm%	4.2	3.7	4.31	2.4	2.6
Albumine	gm%	1.4	2.5	2.44	4.7	4.2
A:G		03:01.0	0.6:1.0		1.9:1.0	1.6:1.0
Kidney Function Test						
BUN	mgs%	23	41	39.75	29	27
Creatinine	mgs%	2.4	2.4	2.4	1.3	1.4
	Serum Electrolytes					
Na	mmol/L	125.38				
K	mmol/L	5.34				

response to the above treatment and the blood picture also showed improvements in the values which had altered during the infection. These values were compared with the standard values given by Fowler and Miller (2003) and another elephant (Janaki) from the park, as given in the Table-1.

Total recovery was observed on 20th day of treatment with improved blood picture, disappearance of symptoms and a negative report for faecal parasite eggs.

Now, the animal is enjoying good health at the Rajiv Gandhi Zoological Park and Wildlife Research Centre, Pune.

Acknowledgement

The authors would like to thank Dr. Jacob Cheeran and Dr. Ajith Kumar for their invaluable help during the diagnosis and treatment of this case.

References

Blood, D.C., Radostits, O.M. and Hendersan, J.A.(1989): Veterinary Medicine. 7th Ed. The English language book Society and Bailliere Tindall, London.

Chakraborty, A. and Islam, S. (1996): A survey of gastrointestinal parasitic infection in some free living harbivores in the Kaziranga National Park. Zoos' Print. 11(3).3-5.

Datta, G.C. and Bardoloi, G.C. (1989): Prevalence of intestinal helminthic infection in elephant of tiger project of Manas, Assam. Zoos' Print. 4 (3).14-16.

Fowler, M.E. and Miller, R.E. (2003): Zoo and Wild Animal Medicine, 5th Ed. Elsevier"s Health Science Rights, Philadelphia, USA.

Rao, A.T. and Acharjyo, L.N. (1984): Diagnosis and classification of common disease of captive animals at Nandankanan Zoo in Orissa (India). Indian J. Anim. Hlth. 23 (2).147-152.

Soulsby, E.J.L. (2005): Helminths, Arthropods and Protozoa of Domesticated Animals. 7thEd. E.L.B.S. London.

Shastry, G.A. (1983): Veterinary Pathology. 6th Ed. C.B.S. Publication., Delhi.

FASCIOLA INFECTION IN CAPTIVE ASIAN ELEPHANT : A CLINICAL CASE REPORT

N. K. Nighot, R. V. Jadhav,
Kazveen Umrigar and S. N. Nevase

Fig.1 Elephant (Merry) showing ventral abdominal oedema.

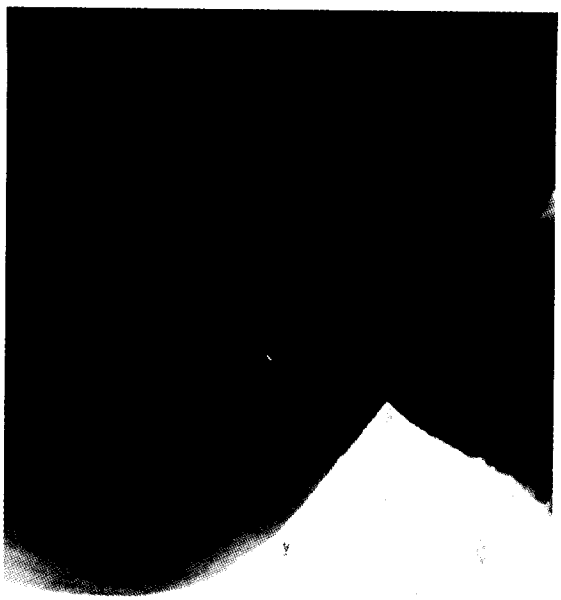


Fig.2. Close view- Elephant (Merry) showing ventral abdominal oedema

CHEMICAL IMMOBOLIZATION OF A CAPTIVE MALE NILGAI (*Boselaphus tragocamelus*) FOR SUCCESSFUL SURGERY

R.K. Samantaray, P.K. Roy, A.K. Das and A.K. Mishra

Introduction

Nandankanan Zoological Park (NKZP) houses 23 nilgais at present, out of which 8 are males and the rest 15 are females. Because of the tendency of the males to fight among themselves for dominancy leading to serious injuries, one adult male is usually housed with a group of females along with their calves in an enclosure. Extending invasive treatment or surgery to a injured/sick nilgai by physical restraint is not possible due to their nervous nature. There are incidences of fatal consequences by dashing with the enclosure chain-link mesh during their frantic run due to the entry of any staff for inspection or for any repair work even in the adjacent enclosures. Earlier experiences of chemical restraint of nilgai at NKZP were not very encouraging e.g. (i) During 2001 an injured nilgai was tranquilized for treatment against injuries by using combination of drugs Ilium Xylazil[1] ((1 ml. contains 100 mg Xylazine hydrochloride) and Ketamil[2] ((1 ml. contains 100 mg Ketamine hydrochloride) where proper sedation was not achieved. The animal remained in standing sedation and dressing of the injury was carried out with much difficulty while the animal struggled during the process. (ii) During 2008, an attempt was made to treat one injured female nilgai from a distance in one particular enclosure. On seeing the tranquilization and treatment team, the whole herd of the adjacent enclosure ran helter-skelter and dashed to the chain-link mesh wall of the enclosure resulting in death of two juvenile nilgais on the spot itself.(iii) In another instance, during 2009 an attempt to tranquilize one female nilgai with drug xylazil and with combination of Xylazil and Ketamil was made with little success. In all these past occasions, necessary treatment could not be rendered as desired because of improper sedation of the animals.

Present study was made to tranquilise a male nilgai using the combination of Immobilon[3] (Each ml contains Etorphine hydrochloride 2.45 mg and Acepromiazine maleate 10 mg) and Xylazil. Nilgai have been chemically restrained and shifted using combination of drugs Xylazine and Ketamine (Kumar, 2006). Also a case of dystocia

Nandankanan Zoological Park,At/P.O.-Barang, Dist: Cuttack,Orissa

1&2.Manufactured by-Troy Laboratories PTY LIMITED, 98 Long Street Smithfield NSW,2164 Australia

3. Manufactured by-Novartis Animal Health UK Ltd. New Cambridge house, Litlington, Nr Royston, Herts, SG8 OSS

in a nilgai has been successfully dealt by anaesthetizing with combination of drugs Xylazine and Ketamine (Kumar and Bhalla, 2007). Immobilization of a sambar, a spotted deer, a gaur, a sika deer and a barking deer have been carried out with the combination of Etorphine and Xylazine for different surgical procedures in zoo animals (Arora *et al.* 1983). Immobilon has also been successfully used to control a marauding wild tusker (Samantaray *et al.* 2007). Musth and its management in Asiatic elephants have been carried out successfully by using immobion (Sarma and Dutta, 1996).

History of injury and initial treatment

One adult male nilgai along with four adult females and a sub-adult male were kept in an open enclosure of NKZP. On 5th February, 2010 morning the males showed aggressive behaviour and started attacking each other .Before they could be separated by the keeper the sub-adult male (approximately 200 kg body weight) was severely injured by the other male. The injured animal was immediately separated by the keeper and driven to a small isolation enclosure (6.0mX4.5m) for treatment. On examination from a distance, deep punctured wounds were noticed at four places on the body. Attempt to spray antiseptic lotion (Dettol lotion), fly repellant lotion (Himax[4]) from outside the enclosure with a 5 litre brass sprayer was partially possible since the animal was running frantically inside the enclosure. Oral antibiotic, 6 nos of Steclin bolus[5] (each bolus containing 500mg Tetracycline hydrochloride), and antinflamatory, 2nos of Melonex[6]bolus (each bolus contains 100mg Meloxicam) medicines were given through ripe banana for a week. This treatment yielded no noticeable improvement rather the wounds got aggravated and maggot infested. With this entire backdrop, a decision was taken for using drug Immobilon to chemically restrain the animal for surgical intervention and treatment.

Tranquilization for treatment and discussion

In the morning of 16.02.2010 a 2ml size metal dart with18" size collared cannula was selected for firing from a Mod-35 N pistol. A mixture of drugs 0.875 ml.of Immobilon and 0.5 ml of Ilium Xylazil was put into the metal syringe and rest gap was filled with distilled water. The charge (Cartouche) meant for 1-5ml metal syringe was used for the dart. Using a blue catridge the prepared dart was fired from a Dist. Inject-30 pistol from a distance of about 6-7 metres at 10.32 hours. The dart hit on the right thigh of the nilgai in mid zone correctly. After 13 minutes the animal started running with short steps with a typical gait like a dancing horse for few minutes and then came

4. Manufactured by-Indian Herbs Research and Supply Co. LTD, Darra Shivpuri,Sahranpur, U.P., India
5. Manufactured by-Acme Pharmaceuticals, Ganpat Vidhyanagar,. Kherva-382711, Mehsana, Gujrat
6. Marketed by Intas Pharmaceutical LTD, Matoda-382210, Dist: Ahmedabad, Gujrat

down to a sitting position and remained in a partially sedated state. Hence a mixture of Ilium Xylazil-0.5 ml Ketamil-0.25 ml and Tropine[7]-0.5 ml (1 ml contains 0.6 mg Atropine sulphate) was loaded to a 3 ml softy syringe and with the help of blow pipe injected I/M into the left thigh. After 5 minutes the animal came to lateral recumbency and was completely sedated. All the 4 major wounds were thoroughly washed by potassium permanganate lotion and flushed with povidine iodine liquid. Skin edges were freshened and made to apposition by stitching with nylon sutures. Long acting antibiotics, 15ml ml of Oxyvet LA[8] (1 ml contains 200mg of Oxytetracycline Hcl), and antiinflamotory,10 ml of Melonex injection (1 ml contains 5mg Meloxicam), were given intramuscularly. During the treatment for maintenance, intravenous infusion of 1 bottle(500ml) of 5% dextrose with 0.9% Normal Saline and 1 bottle (500ml) of Ringer Lactate solution were given. It took 50 minutes to complete the treatment. For revival of the animal first 0.75 ml Reverzine[9](Yohimbine hydrochloride 10mg/ml) I/V was given as anti-dote to drug Xylazine and after ten minutes Revivon[10] 1.2 ml (Diprenorphine hydrochloride 3.26mg/ml) I/V was given as anti-dote to Etorphine hydrochloride and the animal got up and became normal within three minutes and started walking. The revival was uneventful.

After five days it was noticed that bloody discharges was oozing out from one wound of the same animal and it was trying to lick the wound but unable to reach. So on the morning of 20.02.2010 at 10.40 A.M. the same nilgai was tranquilized again for close inspection of the condition of the wound and for extending necessary treatment. Accordingly a mixture of drug Immobilon 0.875 ml, Xylazine hydrochloride 0.75 ml and 1 ml of Atropine sulphate were loaded to a metal syringe barrel of 3 ml size and the dart was fired from a Dist.inject- 30 pistol. This time instead of 0.5 ml Xylazine, 0.75 ml was added to 0.875 ml of Immobilon and the animal was fully sedated within 7 minutes and remained in lateral recumbency.

It was noticed that the injuries at three places are in the healing process but the injury at the brisket region was maggot infested. The maggots were removed and the wound was cleaned and dressed. Since the animal's respiration slowed down drastically, at 11.23 A.M. 0.4 ml of Reverzine was given intravenously as an antidote to Xylazine. At 11.32 A.M. Revivon-0.5 ml (less then half dose) was given intravenously thinking to have slow recovery by the time the intravenous infusion i.e. 500 ml bottle of Ringer

7. Manufactured by- Neon Laboratories LTD, Boisar Road, Palghar(Thane), M.S.
8. Manufactured by- Zydus Animal Health Limited,Plot No-69/1, GIDC, Kansari, Khambhat, Dist: Anand-388630, Gujarat
9. Manufactured by- Parnell Laboratories,(AUST)PTY.LTD.,6/476 GardenersRoad, Alexandria, NSW2015
10. Manufactured by- Novartis Animal Health UK Ltd. New Cambridge house, Litlington, Nr Royston, Herts, SG8 OSS,

Lactate solution would be completed. But after 5 minutes at 11.37 A.M. the animal suddenly recovered and got up. The infusion attachments were immediately removed.

Result

The drug Immobilon in combination with Xylazine hydrochloride was used for chemical immobilization of a captive nilgai for surgical maneuver and treatment. The animal was cured of all wounds within 30 days.

Acknowledgement

Authors are thankful to the Principal Chief Conservator of Forests (Wildlife) and Chief Wildlife Warden, Orissa for extending support and facilities; also to the staff of Nandankanan Zoological Park who have directly or indirectly assisted to carry out the job smoothly.

References

Kumar, A. (2006): Chemical restraint and shifting of a nilgai (*Boselaphus tragocamelus*); *Zoos' Print,* 21(12):7.

Kumar, A. and Bhalla, V.K. (2007): Treatment of certain ailments in zoo animals: *Zoos' Print Journal*, 22(11): 2900-2901.

Samantaray, R.K. Roy, P. K. Das, A. Mishra, A. K. and Pattnaik, A. K. (2007): Successful chemical capture of a marauding wild tusker, its management and rehabilitation in Orissa; *Compendium of International Congress on Advances in zoo and wild animals health and management held at SKUAST, Jammu*, April 26-27, 2007, pp:247-249.

Arora, B. M. Wiesner, H. and Malhotra, A. K. (1983): A note on chemical immobilization of zoo animals with blow pipe. *Indian J. Vet. Surg* .4(2): 78-81.

Sarma, K. K. and Dutta, B. (1996): Musth and its management in Asiatic elephant A discussion based on four clinical cases: *Zoos' Print*, 11(4): 21-22.

VASECTOMY AS A BIRTH CONTROL MEASURE IN PROLIFIC BREEDERS

Powar K. V.[1], Tripati, S.[2] and A. Anjankar[3]

Introduction

Animals belonging to the primates and deer family generally attain early puberty and are prolific breeders. Hence it becomes extremely important to control their breeding in captivity where survival rates are better than that in their natural habitat, Moreover, norms prescribed by the Central Zoo Authority also supports controlled breeding programme. In accordance with these facts, vasectomy was conducted in two Indian rhesus macaques, one bonnet macaque, five spotted deer and one barking deer respectively at Veermata Jijabai Bhosale Udyan-Zoo, Byculla, Mumbai.

The procedure of vasectomy for primates was performed under general anaesthesia using combination of Xylazine and Ketamine @ 1mg/kg and 5 mg/kg body weight respectively, intramuscularly. Anesthesia was induced within 3 minutes.

Similarly for spotted deer the combination of Xylazine and Ketamine was used @ 2 mg/kg body weight and for barking deer the combination was used @ 1.5 mg/kg body weight.

Positioning of macaques for surgical procedure: The surgical site was prepared aseptically and animal was placed in dorsal recumbancy. The scrotal pouch along with the testicle was pulled away from the body to stretch the spermatic cord which was held in position with the thumb and index finger.

Positioning of deer (spotted deer and barking deer) for surgical procedure: The surgical site was prepared aseptically and animal was placed in lateral recumbancy with the hind limb stretched forward for better visualization and handling of the scrotal sac.

Surgical procedure for both macaques and deer: The surgical procedure of vasectomy did not differ in macaques and deer and hence has been described as a common procedure for all these animals.

---

1 Veterinary Officer, 2. Dy. Supdt. (Vety.), 3. Director (Zoo), V.J.B. Udyan-Zoo, Byculla, Mumbai- 400 027

Incision site in macaques: A vertical incision about 1 cm long was given, 3 cm away from the anterior end of the scrotum and 1 cm away from the midline.

Incision site in deer: A vertical incision was made 1 cm away from the midline of the scrotum on either side of the neck of the scrotum.

Surgical procedure : After the incision, blunt dissection was done with the help of forceps to separate the subcutaneous fat and the underlying tunica dartus and tunica vaginalis to expose the underlying pampiniform plexus. The spermatic cord located beneath the plexus was lifted up with the help of forceps and separated from the plexus.

The cord was ligated at two ends with the chromic catgut no. 2.0 and a piece of spermatic cord was cut between the ligated ends. Similar procedure was carried out with the spermatic cord on the other side. Tunics and subcutaneous tissue were ligated with chromic catgut no. 2.0 and skin incision was sutured with nylon in monkeys and catgut or vicryl in deer by making interrupted sutures.

Summary

These cases recovered uneventfully due to smaller incision. Vasectomy was found to make the animals incapable of reproduction without affecting the normal sexual behaviour.

Indian Zoo Year Book, Volume - VI, 2010

COLOUR VARIATION IN COMMON PALM CIVET OR TODDY CAT *(Paradoxurus hermaphroditus)*

L.N. Acharjyo[1] and S. Panda[2]

Introduction

Every mammalian species has a species-specific coat colour pattern which varies depending upon its age, sex and to some extent on its geographical distribution. Ecological conditions also play a role in animal coat colouration, for example, moist environment encourages dark colouration (like the animals of rain forests) while the animals of dry hot environment (like the desert animals) are usually of light colouration (Heran, 1976). There are occasional reports of occurrence of albinistic (e.g. white tiger, white chital, white chinkara, white Indian antelope etc.) and melanistic (e.g. black leopard, black tiger, black jaguar, etc.) specimens in nature and some of them have been successfully exhibited and bred in captivity. Albinism occurs when the pigment disappears completely and then the whole animal is coloured white whereas melanism is caused by an increase in the amount of pigment making the coat colour of the animal very dark and in extreme cases completely black (Heran, 1976).

Apart from these two unusual phenomena, there are many coat colour variations observed among some species of mammals. Colour variation in populations of the grizzled giant squirrel, *Ratufa macroura* in south India (Sharma, 1997), unusual colouration of nilgai, *Boselaphus tragocamelus* of Sariska National Park in Rajasthan (Ranjitsingh, 1987), albinism in a mature nilgai female that bred in Plock zoo and birth of white females of American tapir, *Tapirus terrestris* in Poznan zoo as a result of inbreeding (Smielowski, 1987) have been reported. Unlike the white tigers with white fur marked with chocolate brown to charcoal grey stripes, some of the white tigers born in Cincinnati zoo (USA) are almost completely lacking in stripes, so perhaps the white tiger is affected by a lesser degree of albinism, determined by a recessive gene, (Ross, 1982). This note on body colour variation in common palm civet or toddy cat *(Paradoxurus hermaphroditius)* is based on the observations made at the Nandankanan Zoological Park, Bhubaneswar, Orissa (NKZP).

1. House No. M-71, Housing Board Colony, Baramunda, Bhubaneswar - 751 003
2. Director, Nandankanan Zoological Park, Mayur Bhawan, Janpath, Saheed Nagar, Bhubaneswar - 751 007

Observations and discussion

Four young common palm civets at an estimated age of 20 days were procured from Similipal National Park (proposed) in Mayurbhanj district of Orissa for NKZP on 08.05.1970 (Acharjyo and Tripathy, 1974) and their body coat colours described by them are as follows:

(a) In two females and one male creamish-white throughout the body coat except the face, head, upper parts of the neck and shoulders from the elbow joints or the middle of the external side of the fore-arms upwards and one large or two small patches at the base of the tail, which were black in colour. The hind limbs and fore-limbs below the elbow joints or middle of the fore-arms were creamish white. White patches or spots below and above the eyes were present.

(b) In the other male the body colour was black except at the tip of the tail of 5 cm length which was creamish-white and white spots below and above the eyes were present.

Breeding

One of the females described above under (a) was allowed to remain with the male described above under (b) at NKZP from - 06-10-1970. As a result of their breeding three male young were born in one litter on 03.04.1971. Interestingly the colour pattern of the body coat of all the three young was similar to the body coat of the mother (Fig.1) as described above under (a).

The same female (mother) when mated with one of her male offsprings born here on 03.04.1971 (son) and having the body coat colour as that of mother described above under (a) produced three female young on 18.05.1972 with the following colour patterns.

- One was completely black like normal common palm civet body colour pattern (Fig.2)
- Two others were white throughout except the upper parts of the head region (Fig.3). However, these two died by 23.05.1972.

The VOC Park, Coimbatore was displaying a "pied or semi albino common palm civet" (Fig.4) in their collection. This animal was having a wide white band across the body (Asharf, 1992) more or less similar to the colour pattern described from NKZP. Sharma (2001) states that one out of four adult common palm civets exhibited at

COLOUR VARIATION IN COMMON PALM CIVET OR TODDY CAT *(Paradoxurus hermaphroditus)*

L.N. Acharjyo and S. Panda

Fig.1-Partial albino common palm civet at NKZP

Fig.2-Normal coloured common palm civet

COLOUR VARIATION IN COMMON PALM CIVET OR TODDY CAT
(Paradoxurus hermaphroditus)

L.N. Acharjyo and S. Panda

Fig.3-Common palm civet young with white colour throughout the body except the upper parts of head region at NKZP

Fig.4-"Semi-albino" palm civet at VOC Park, Coimbatore (Ashraf,1992)

Jaipur zoo (Rajasthan) had a white coloured sub-terminal tail ring. Ali *et. al* (1988) described a new species titled *Paradoxurus jorandensis* from Similipal forests (Orissa) mainly based on body colour pattern of a single specimen and state that it is close to *Paradoxurus hermaphroditus*. About the body colouration they state that in this specimen "stripes and spots over body absent but a broad white band encircling the abdomen present". Saha (1995) and Das *et. al* (1993) did not agree with the description of this new species and they state that it is only a partially albinistic specimen of *Paradoxurus hermaphroditus*. Albinism in this species of common palm civet has been widely marked and even one of the young females from Satpara in Chilika lake area has its tail tip white (Saha, 1995).

The skin colour of white tiger is recessive to the normal yellow colour of tiger (Roychoudhury and Sankhala, 1979; Roychoudhury and Acharjyo, 1983). The black colour of black leopard is recessive to the normal spotted colour of leopard (Roychoudhury and Acharjyo, 1984; Malhotra, 1986).

From these limited studies, it is felt that more observations are necessary to understand the genetics of coat colour pattern in common palm civet. The authors are interested to known about the display of common palm civet with abnormal body colour variation in other Indian zoos if any.

References

Acharjyo, L. N. and Tripathy, A. P. (1974): A note on body colour and breeding habits in captivity of common palm civet *(Paradoxurus hermaphroditus)* of Orissa. J. Bombay nat. Hist. Soc, 71 (3): 601 - 603.

Ali, S.M. Chattopadhyay, S. Kankane, P.L. and Gayen, N. C. *(1988):* A new species of palm civet from Orissa. India. Rec. Zool. Surv. India, 85(1): 45 - 48.

Ashraf, N.V.K. (1992): Veverrine rarities in little known Indian zoos, Zoos' Print VII (12): 26 - 27.

Das, P. K. Lal, J. P. and Agrawal, V.C. (1993): Mammalia. State Fauna series 1: Fauna of Orissa, Part-4. Zoological Survey of India, Calcutta (Kolkata) : 143 - 180.

Heran, Ivan. (1976): Animal Colouration. Hamlyn, London, New York, Sydney, Toronto. pp. 46 - 59.

Malhotra, A.K. (1986): Genetics of black panther. Cheetal. 27(3):21-23.

Ranjitsinh, M.K. (1987): Unusual colouration of nilgai *(Boselaphus trogocamelus)*. J. Bombay nat. Hist. Soc. 84 (1) : 203.

Ross, J. (1982): The White tiger enigma. Your Cincinnati Zoo News, Spring, 1982: 10 - 14.

Roychoudhury, A.K. and Sankhala, K.S. (1979): Breeding in white tigers. Proc. Indian Acad. Sci. Vol.88B:311-323.

Roychoudhury, A.K. and Acharjyo, L.N. (1983): Origin of white tigers at Nandankanan Biological Park, Orissa. Indian Journal of Experimental Biology. 21:350-352.

Roychoudhury, A.K. and Acharjyo, L.N. (1984): Genetics of coat colour in the leopard *Panthera pardus.* Indian Journal of Experimental Biology. 22:308-311.

Saha, S.S. (1995): Mammalia. Wetland Ecosystem Series I: Fauna of Chilka lake. Zoological Survey of India, Calcutta (Kolkata): 601 - 610.

Sharma, N. (1997): Colour variation in populations of the grizzled giant squirrel *Ratufa macroura*. J. Bombay nat. Hist. Soc. 94 (3) : 565.

Sharma, S. K. (2001): Toddy cat *Paradoxurus hermaphroditus (Pallas, 1777)* with white-coloured sub-terminal tail ring at Jaipur Zoo, Zoos' Print. XVI (6) : 8.

Smielowski, J. (1987): Albinism in the blue bull or nilgai *Boselaphus tragocamelus (Pallas, 1766):* J. Bombay nat. Hist. Soc. 84 (2): 427-429.

BREEDING SUCCESS OF INDIAN WILD DOG (*Cuon alpinus*) IN CAPTIVITY

A. Manimozhi

Introduction

Listed vulnerable in the IUCN Red Data Book and cited in Appendix I of CITES (Ginsberg and Macdonald, 1990) the Indian wild dog or Dhole (*Cuon alpinus)* is threatened by habitat destruction and decline of prey base. According to Davidar (1972) and Johnsingh (1982) the species has an annual breeding season. While a few useful observations are found in the reports of Gewalt (1978), Cohen (1985) and Sosnovskii (1967), an improved understanding of dhole's reproduction and behaviour is essential for its future conservation.

Although captive breeding of dholes is reported to be difficult (Gewalt, 1978) the Arignar Anna Zoological Park (AAZP) has been breeding these animals successfully (Paulraj *et al.* 1992 and Jaganatha Rao *et al.* 1996). Only little information is available on the reproductive biology of Indian wild dog because of their secretive nature in the wild (Nowak and Paradiso, 1983). A brief history of the breeding biology of this species observed in Arignar Anna Zoological Park, Vandalur, Chennai from 1986 to 2008 is described in this paper.

History of wild dog

During 1985, two males and one female have survived out of eight specimens of wild dog pups obtained from the wild (Mudumalai) at 5 weeks of age and were hand reared for the next 6 months (Gopalakrishnan *et al.* 1988). They ("Gopal", "Krishna" and "Anu") were displayed in a large chain-link mesh enclosure of 8.0 x 4.8 x 2.2 m dimensions. They were separated in the night and housed in individual night shelters, each measuring 2.3 x 2.0 x 2.1 m. One of these wild caught male ("Krishna") died of hepatitis. A female of wild origin named "Aswini" received from Sri Venkateshwara Zoological Park, Tirupati under animal exchange programme was introduced on 28th

A. Manimozhi, Biologist, Arignar Anna Zoological Park, Vandalur, Chennai - 600 048, Tamilnadu.

August 1996. The female ("Aswini") mated with "Sekar" the AAZP born male continuously for three years and died on 5th May 1999. The present population of wild dogs at AAZP descended from the above pair.

Housing and management

The wild dogs were housed in a pen made of chain-link mesh (sand filled) measuring 8.0 x 4.8 x 2.25 m. On each side, two night shelters, each measuring 2.3 x 2.25 x 2.0 m were available. Each night shelter was provided with a den measuring 1.0 m x 1.0 m x 1.0 m. Parallel to this, a cemented kraal of 11.0 x 4.0 x 2.0m and night shelter measuring 3.0 x 3.0 x 2.0 m, one at each end was provided along with a den (1.0 x 1.0 x 1.0 m) in order to accommodate another breeding pair which was constructed in the year 2008. Both kraals connected by a small passage to mix male and female whenever required. Every day each animal was fed with 3 kg of beef in the afternoon except on Tuesdays. The sand filled kraal was attached to a more spacious naturalistic dry moated enclosure (circumference 170m), where the animals were let out for public viewing every day.

The night shelter of each animal was thoroughly washed and allowed to dry. Turmeric powder an indigenous biomaterial was used as antiseptic agent daily. Periodical deworming and vaccination have been carried out.

Observations and Results

Reproductive biology

Period of mating (oestrus) ranged from 14 to 44 days over the 26 mating seasons observed. The longer periods of mating were observed mostly when the female was mating for the first time. During oestrus, both male and female showed increased vocalization, urination and scent marking. This was followed by the mutual inspection of genitalia and vaginal licking by the male. They exhibited the copulatory tie and back to back mating posture that is typical of the canids. The mean oestrus period appeared to be 27.2 days (n=25). The gestation period was calculated as the number of days from the last mating to parturition (Table-1). The 22 years of data indicate the gestation period ranging from 46 to 67 days with an average of 59.32 days.

Table-1. Incidences of births and survival of Indian wild dogs from 1986 to 2008 at AAZP

Sl. No.	Sire & Dam	First mating	Last mating	Whelping date	Gestation period (days)	Litter size	Survived	Survival %	Remarks
1.	Gopal x Anu	01.09.1986	05.10.1986	23.11.1986	49	2:1	Nil	0	Killed by mother
2.	Gopal x Anu	09.09.1987	23.10.1987	23.12.1987	61	2:1	1:1	66 (Suresh & Radha)	
3.	Gopal x Anu	10.08.1988	18.09.1988	24.11.1988	67	3:4	Nil	0	3 pups died at 5 days of age & 4 pups died after 60 days.
4.	Gopal x Anu	26.09.1989	15.10.1989	14.12.1989	60	1:1	1:1	100	Sent to Hyderabad
5.	Gopal x Anu	05.09.1990	25.09.1990	24.12.1990	60	2:1	1:0	33 (Shankar)	Two died (1:1) after 7 days. Shankar died on 05.03.2000
6.	Gopal x Anu	18.08.1992	20.09.1992	24.11.1992	65	2:1	0	0	Two (1:1) died next day and one died after a month
7.	Gopal x Anu	15.10.1993	31.10.1993	03.01.1994	64	4:1	3:0	60	Subraminain (died on 13.12.1996), Sekar (died on

Sl. No.	Sire & Dam	First mating	Last mating	Whelping date	Gestation period (days)	Litter size	Survived	Survival %	Remarks
									18.05.2002) & Rathinam (Died on 14.07.2001)
8.	Suresh x Radha	28.09.1990	05.11.1990	26.12.1990	51	2:1	Nil	0	Mother neglected
9.	Suresh x Radha	12.08.1993	20.09.1993	16.11.1993	57	2:1	Nil	0	Mother neglected
10.	Gopal x Radha	12.08.1991	29.08.1991	02.11.1991	65	1:2	Nil	0	Survived 10 days
11.	Sankar x Radha	12.09.1992	09.10.1992	11.12.1992	63	2:1	Nil	0	Mother neglected
12.	Suresh x Anu	21.08.1991	09.09.1991	15.11.1991	67	0:4	0:2	50	Sheela (died on 08.12.2007) & Shilpa (died on 02.04.1998)
13.	Suresh x Shilpa	05.10.1993	30.10.1993	15.12.1993	46	1:2	Nil	0	Not survived
14.	Sankar x Sheela	08.09.1994	09.10.1994	04.12.1994	56	2:3	Nil	0	Not survived
15.	Gopal x Shilpa	15.09.1994	15.10.1994	11.12.1994	57	2:1	Nil	0	Mother neglected

Sl. No.	Sire & Dam	First mating	Last mating	Whelping date	Gestation period (days)	Litter size	Survived	Survival %	Remarks
16.	Sekar x Aswini	20.09.1996	01.10.1996	30.11.1996	60	0:0:7	0:1		
17.	Sekar x Aswini	22.09.1998	10.10.1998	09.12.1998	60	2:2	1:2	75.00	1:1 Given to Guindy, Female Viji died on 17.11.2004
18.	Sekar x Aswini	13.09.1999	29.09.1999	02.12.1999	64	3:5	2:2	50.00	Brabu (died on 20.01.2000) Mohan (died on 03.02.2005) Valli (died on 03.02.2005) Vasanthi sent to Hyderabad on 11.09.2007
19	Mohan x Viji	02.10.2003	28.10.2003	28.12.2003	61	4:4	2:2	50	Praveen, Paulraj, Gomathi & Dhiviya
20	Praveen x Gomathi	01.10.2005	29.10.2005	31.12.2005	63	1:4	1:4	100	1:2 died on 29.04.06, 2 female died on 05.07.06
21.	Praveen x Gomathi	-	-	19.08.2006	-	5:6	1:0	9.01	Sivasankar died on 11.09.2007

Sl. No.	Sire & Dam	First mating	Last mating	Whelping date	Gestation period (days)	Litter size	Survived	Survival %	Remarks
22.	Praveen x Vasantha	03.09.2006	29.09.2006	22.11.2006	54	2:1	1:0	33.33	Bharathi died few months later.
23.	Paulraj x Dhiviya	29.10.2007	15.11.2007	03.01.2007	49	3:2	Nil	0	All died in a week time
24	Paulraj x Dhiviya	22.08.2007	13.09.2007	14.11.2007	62	2:2	2:2	100	Did well
25	Praveen x Gomati	14.09.2008	06.11.2008	06.01.2008	61	2:4	2:2	66.67	Did well
26.	Paulraj x Dhiviya	18.08.2008	19.10.2008	19.12.2008	61	1:4	1:4	100	All doing well
				Mean gestation (n=25)	59.32 days	53:59:7 =119	19:23 =42		

Mating and birth season

The observations on breeding for 22 years at AAZP indicate that the mating is confined to only 3 months of the year i.e., August, September and October, rarely extending to November. Highest number of mating was observed during the month of September. Correspondingly all the births were observed only during the months of November, December and January with the months November and December contributing 88.46 % of births (Table-2).

The litter size varied from 2 to 11 with an average of 4.58 (n=26). The 22 years data also indicate that the sex ratio at birth was slightly in favour of the females 1.00:1.11 (n=26).

Survival rate of pups

"Anu" has bred regularly once in a year for eight years. When the data for the 22 years for all the pairs was taken into consideration, the percentage of pups survived was only 38.53 (17.43% for males and 21.10% for females). 61.47% of pups were neglected/killed by the mother during various stages of development.

Sexual maturity

The captive born female pups attained sexual maturity at different ages. The youngest female to attain sexual maturity was after 1 year 3 months and 20 days from the date of birth. The maximum age to attain sexual maturity was 3 years and 6 days. However, the mean (n=6) age of attaining sexual maturity was 2 year 5 months and 24 days (Table-3) for females.

In male wild dog pups, the shortest and longest age of sexual maturity observed were 1 year 9 months and 3 days and 3 years 10 months and 2 days respectively. The mean age of males attaining sexual maturity was 2 years 9 months and 13 days (Table-4).

Inter-parturition interval

The whelping intervals for the female "Shilpa" was observed to be the lowest of 10 months and 6 days. The highest inter-partiturition interval observed in "Gomathi" was 1 year 4 months 17 days. The mean inter-whelping (n=13) interval was 11 months 24 days.(Table-5).

Table-2 . Mating and whelping seasons in Indian wild dog (*Cuon alpinus*) at AAZP

Sl. No.	Name of the animal	Number of Matings				Total	Number of Whelpings			Total
		August	September	October	November		November	December	January	
1.	Anu	3	5	4	-	12	4	3	1	8
2.	Radha	2	4	1	1	8	2	2	0	4
3.	Sheela	-	1	-	-	1	-	1	-	1
4.	Shilpa	-	1	1		2	2	2	-	4
5.	Viji	-	-	1	-	1	-	1	-	1
6.	Gomathi	-	1	1	1	3		1	1	2
7.	Dhiviya	1	2	1	-	4	1	1	1	3
8.	Aswini	-	3	2	-	5	1	2	-	3
	Total	**6**	**17**	**11**	**2**	**36**	**10**	**13**	**3**	**26**

Table-3. Age of sexual maturity of female Indian wild dogs *(Cuon alpinus)* at AAZP

Sl. No.	Name of the animal	Date of birth	First estrous/ mating observed	Sexual maturity
1.	Shilpa	15.11.1991	05.03/1993	1 year 3 months 20 days
2.	Sheela	15.11.1991	08.09.1994	2 years 9 months 23 days
3.	Radha	23.12.1987	29.09.1990	2 years 9 months 7 days
4.	Gomathi	28.12.2003	31.12.2005	2 years, 0 month, 3 days
5.	Sheela	28.12.2003	22.12.2006	2 years, 11 months, 24 days
6.	Dhiviya	28.12.2003	03.01.2007	3 years, 0 month 6 days.
			Mean (n=6)	2 years, 5 months 24 days.

Table-4. Age of sexual maturity of male Indian wild dogs *(Cuon alpinus)* at AAZP

Sl. No.	Name of the animal	Date of birth	First estrous/ mating observed	Sexual maturity
1.	Sankar	24.11.1990	12.09.1992	1 year 9 months 19 days
2.	Suresh	23.12.1987	28.09.1990	2 years 9 months 5 days
3.	Sekar	03.01.1994	20.09.1996	2 years 8 months 20 days.
4.	Mohan	02.12.1999	02.10.2003	3 years, 10 months 0 days
5.	Paulraj	28.12.2003	29.10.2007	3 years, 10 months 2 days.
6.	Praveen	28.12.2003	01.10.2005	1 years, 9 months, 3 days.
			Mean (n=6)	2 years 9 months 13 days.

Table-5. Inter-parturition intervals in Indian wild dog *(Cuon alpinus)* at AAZP

Sl. No.	Name of the animal	Date last parturition	Date of subsequent parturition	Inter-parturition interval
1.	Anu	23.11.1986	23.12.1987	1 year, 1 month 0 day
2.	Anu	23.12.1987	24.11.1988	0 year 11 months 1 day
3.	Anu	24.12.1988	14.12.1989	0 year 11 months 19 days
4.	Anu	14.12.1989	24.11.1990	0 year 11 months 10 days.
5.	Anu	24.11.1990	15.11.1991	0 year 11 months 20 days.
6.	Anu	15.11.1991	24.11.1992	1 year 0 month 9 days.
7	Anu	24.11.1992	03.01.1994	1 year 1 month 8 days.
8.	Shilpa	26.12.1990	02.11.1991	0 year 10 months 6 days
9.	Radha	02.11.1991	11.12.1992	1 year 1 month 9 days
10	Radha	11.12.1992	16.11.1993	0 year 11 months 6 days.
11.	Gomathi	31.12.2005	19.08.2006	0 year 7 months 18 days.
12.	Gomathi	19.08.2006	06.01.2008	1 year 4 months 17 days.
13.	Dhiviya	03.01.2007	14.11.2007	0 year, 10 months 11 days.
			Mean (n=13)	0 year 11 months 24 days

Discussion

The period of oestrus, length of oestrus, reproductive behaviour as well as optimum time for successful mating is prerequisite for establishment of controlled breeding programme of any species. The breeding behaviour of dholes in captivity has been well documented by Gewalt (1978), Cohen (1985), Sonovskii (1967), Paulraj *et al.* (1992) and Jaganatha Rao et al. (1996). The findings indicated that breeding habits of dholes do not change as a result of captivity.

The results of the study also indicate that the Indian dholes reproduce seasonally, with the onset of oestrus occurring between August to October (Manimozhi et al. 2001). Although Prater (1965) states that dholes in the wild have no fixed breeding season, Jhonsingh (1982) gives September to December as the time of mating.

Similarly the litter size in the wild is reported to be around 8 (Jhonsingh, 1982). The present study indicates the average litter size as 4.58 (n=26) ranged between 2 to 11 pups. Data on 25 litters of dholes born at AAZP from 1986 to 2008 indicate a gestation period of 46 to 67 days with an average of 59.32 days.

The mating behaviour, parturition and parental care observed is very similar to that described by Paulraj et al. (1996).

Conclusion

The following tips were learned from 22 years of experience and these tips aided for successful breeding of this species at AAZP.

- Keep compatible male and female wild dogs together prior to breeding season.
- During breeding season, no other persons are allowed in the breeding cage other than the keeper and the person who is familiarized with the concerned animals to minimize the disturbance.
- The first and last mating is to be meticulously recorded in order to prepare whelping den.
- A week before parturition, whelping den is provided with bedding material.
- After parturition, no one is allowed to enter the back yard where she gives birth. The whelped mother should be kept away from its inmates.
- The concerned keeper is advised not to go very often near the whelping den for any purpose to minimize disturbance.
- Periodical change of bedding material is necessary in order to avoid wetting of pups with their urine in the den.
- Avoid sending new keeper to look after day-to-day maintenance of wild dog in the absence of concerned keeper.
- Twice feeding is required to the mother after she delivers pups. The one feed in the morning (9.00 to 10.AM and another one at 4.0 to 5.00 PM. Every day, in the morning chicken of about 1.5 kg was provided. This will help to avoid cannibalism as well as neglect of pups.
- When the pups started eating the regurgitated food of the mother, the room provided with the den and its floor is to be kept neat and clean.

- Handling of pups is avoided as much as possible. If needed, the concerned keeper may be advised to handle the pups for physical examination in the presence of veterinarians/biologists.
- Supplements are to be provided along with beef/chicken while feeding the mother in consultation with the zoo veterinarian.
- The growth and development of the pups are to be monitored daily.
- Don't let out the mother and pups in the yard after consumption of feed (beef/ chicken). The mother usually regurgitates on the sandy floor and allows the pups to feed. This may lead to diarrhoea in pups which is not easy to bring back the pups to their normal health.
- When the pups start taking regurgitated meat/beef (31st day), small pieces of raw/cooked chicken may be introduced.
- The pups are allowed to move in a spacious cemented closed kraal attached to the den.
- The pups are weaned at the age of 6 to 7 months to promote further breeding by the mother.
- The mother may be introduced with a suitable male.
- Avoid giving meat with bone for pups. This may lead to choking in the throat.
- Trypanosomiasis is a blood protozoan disease which is very common among wild dogs. Similarly leptospirosis is another disease of this species. Periodical prophylactic measures are to be carried out regularly.

Acknowledgement

The author is thankful to Thiru R. Sundararaju, I.F.S., Principal Chief Conservator of Forests and Chief Wildlife Warden, Tamilnadu Forest Department and Thiru P. L. Ananthasamy, I.F.S, Chief Conservator of Forests and Director, Arignar Anna Zoological Park for their constant support and encouragement.

References

Cohen, J.A. (1985): A note on the behaviour of captive dholes (*Cuon alpinus*) J. Bombay. nat. Hist. Soc. 82:183-186.

Davidar, E.R.C. (1972): Dhole or Indian wild dog (*Cuon alpinus*) mating. J. Bombay.nat.Hist.Soc. 70:373-374.

Gewalt, W. (1978): Some remarks on keeping and breeding the red dog dhole (*Cuon alpinus*) at Duisberg zoo. Int.Zoo.Yb 18:173-176.

Ginsberg and Macdonald, (1990): Foxes, wolves, jackal and dogs. IUCN/SSC Canid Specialist Group.

Gopalkrishnan, A.V. Thiruthalinathan. R. and Paulraj, S. (1988): Food and feeding regimen of hand reared dhole pups (*Cuon alpinus*). Animal Keepers' Forum 15:165-166.

Johnsingh, A.J.T. (1982): Reproductive and social behaviour of the dhole (*Cuon alpinus*) Canidae, Journal of the Zoological Society of London, 198:433-463.

Jaganatha Rao, M. Manimozhi, A. and Asaithambi, P. (1996): Reproductive biology and breeding history of Indian wild dog (*Cuon alpinus*) at Arignar Anna Zoological Park. Zoos' Print, 11 (9) :3-6.

Manimozhi, A. Sekar, M. and Krishnakumar. N. (2006): Birth seasons of mammals at Arignar Anna Zoological Park, Chennai, Indian Zoo Year Book. Vol. IV : 99 - 111.

Nowk, R. M. and Paradiso, J.L. (1983): Carnivora : Canidae Genus *Cuon* Hodgson, 1838, pp 961-962. in Walkers' Mammals of the world Vol.II, 4th Edition. The Hopkins University Press, Baltimore.

Paulraj, S. Sundararajan, Manimozhi, A. and Sally, Walker. (1992): Reproduction of the Indian wild dog *(Cuon alpinus) Zoo Biology 11: 235-241.*

Prater, S. H. (1965): The Book of Indian animals. Bombay Natural History Society, Mumbai.

Sosnovskii, I.P. (1967): Breeding the Red dog or dhole (*Cuon alpinus)* at Moscow zoo. Int. Zoo Yb 7:120-122.

CAN THE ACTIVITY LEVEL OF ELDERLY ANDEAN BEARS *(Tremarctos ornatus)* BE INCREASED IN CAPTIVITY?*

S. Panda[1] and B.K. Gogoi[2]

Introduction

The Andean bear *(Tremarctos ornatus)* is the only species of bear found in South America in a narrow strip running from the western Venezuela through the Andes in Columbia, Ecuador, Peru, Bolivia and ending in northern Argentina. The Andean bear is the only surviving member of the short-faced bear sub-family, which thrived until about 10,000 years ago. There are whitish or cream 'spectacles' encircling the eyes of the bear and hence the Andean bears are also called 'Spectacled bears'. Each individual bear has its own distinctive set or 'fingerprint' of distinct spectacle marking on its head, throat or chest. The species is highly endemic to South America. The Andean bear is adjusted to most biome types ranging from lowland tropical forests to meadows or above the altitudinal tree growth limit.

Andean bears are mostly omnivorous; feed mostly fruits and succulent plants. Tree and ground nests are used for resting. They are good climbers. The species is a good seed disperser, passing on seeds of laurels (valued hardwoods) and other plants through its dropping and hence is a 'key stone' species in Andes mountain eco-system. The species has many special adaptations such as (a) spectacle markings to aid in individual recognition, (b) long curved claws for digging into the soil or into insect mounds for food and (c) large nose and excellent sense of smell to locate food.

Today, the species has fragmented distribution in the inter-tropical section of Andes Corditlera mountain system. Habitat loss, poaching due to inadequate protection even inside protected areas, retaliatory killings while depredating crops or cattle, increased mining, agriculture and oil exploration activities coupled with habitat fragmentation are the threats to the unique bear species living in South America.

Andean bear has been listed in Appendix-I of CITES. This species of bear is listed as vulnerable on the World Conservation Union's (IUCN) Red List of Threatened

[1] Director, Nandankanan Zoological Park, Mayur Bhawan, Janpath, Saheed Nagar, Bhubaneswar - 751 007
[2] Veterinary Officer, Assam State Zoo cum Botanical Garden, R.G. Baruah Road, Guwahati-781005, Assam.
* This study was undertaken at Durrell zoo, Jersey as a part of ESR course, 2010 during July, 2010.

Animals. They are also protected through national ligislations in each range country. However, there are many loopholes in these laws by which the bears can be killed or removed from the wild. Many biologists predicted that by the year 2030, the species will meet the IUCN criteria for endangered species, if such situations continue to operate in these distribution ranges. This paper is based on the studies undertaken at Durrell zoo, Jersey required as a part of the training programme of the authors during July, 2010.

Study site and study period

The behavioural study of the two elderly bears housed in the bear enclosure in Durrell zoo, Jersey was undertaken. The male bear named 'Wolfie' was brought from a German zoo and the female named 'Barbara' was procured from a zoo in U.S.A. They were born in captivity and produced 6 cubs in 3 occasions in Durrell zoo.

The two Andean bears (one male and a female), aged about 24 years have been kept in a spacious enclosure along with three other species namely (1) one female Asiatic small clawed otter (*Aonyx cinereus*) (about 12 years old), (2) seven black and gold howler monkeys (*Alouatta caraya*) and (3) seven (5 females, 2 males) ring-tailed coati (*Nasua nasua*).

The Asian small clawed otter is a species from south-east Asia while the howler monkeys and coatis are South American species. The monkeys and coatis used the trees available inside the enclosure while the otter very often used the water moat. The Andean bears mostly used the foot paths and rarely used the tunnels. The enrichments available inside the enclosure are mostly adequate. Some of the enrichments in the form of climbing trunks/trees, wobble tree for climbing, herbs, natural substrate, ropes, water moat and tunnel are found to be excellent. The enclosure is well protected all around by electric fencing. Flowing water has been an added attraction in the enclosure. There are two dens for resting of the Andean bears.

The present study has been carried out in the Durrell zoo from the 16th July to 27th July 2010.

Objectives of the study

The present study on Andean bears housed in Durrell zoo, Jersey was carried out with the following objectives:

1) To study the present activity level of the bears.

2) To assess whether the activity level of the elderly bears can be increased in captivity.

3) To suggest ways and means to increase the activity level of Andean bears.

Methods

To undertake the study, the following methods were used:

Direct observation: Regular observations were made during the day time and recorded during the study period with reference to the different behavioural patterns of the two elderly Andean bears and an ethogram was developed. The interaction of the bears with other animals housed in the same enclosure was also documented through direct observation.

Interaction with keeper: Interaction with the keeper provided valuable past information on the elderly bears. The experience of the keeper has been used in the present study and has been duly incorporated in the report.

Perusal of existing records: The records maintained by the keepers for daily maintenance, food chart, treatment schedule etc. have been perused.

Review of existing literature: The information available in the form of published reports, books etc. have been referred to ascertain the natural behaviour of the species and the conservation status.

Observations

Ethogram: The behavioural activities of the Andean bears were recorded during the study period and are represented in the form of an Ethogram

Behaviour activity	Definition
1. Locomotion	Walking, running
2. Grooming	Showing affection/cleaning an individual
3. Climbing	Go up/arboreal habit
4. Resting	Lay out in the Sun/den
5. Vocalisation	Calling to draw attention due to stress/mating/ for communication
6. Rubbing	Scratching the body

7. Food and feeding	Eating food/foraging
8. Sleeping	Lying down with closed eyes in relaxed state
9. Interaction with other species	Giving company, snatching/stealing food
10. Bathing	taking bath/entering water moat
11. Aggression	Chasing/screaming/hitting
12. Approach	Movement towards the intended individual.
13. Playing	Play/make fun/enjoy

Activity budget: The species in the wild is said to be nocturnal, but observation during the study period showed that the two bears showed diurnal behaviour. The animals were active during the day time, they preferred to take rest and sleep in the den (feed chamber). They spent more time inside the enclosure during sunny days as compared to rainy days. In sunny days, they spent more than 70% of their time inside the enclosure. Only 30% of their time spent in the den either for feeding or sleeping.

Locomotion: It was observed during the study period that the bears usually spent about 41% of their time in walking in fixed paths exhibiting a stereotypic behaviour.

Grooming: About 6% of their time was spent for grooming. The male usually grooms the female bear for mating. He suckles the female and tried 4-5 occasions to mount, but the female avoided mating due to the fact that she was not in oestrous condition. During this period, the male always follows the female bear during walking. In normal conditions, the female follows the male bear while walking inside the enclosure.

Climbing: Climbing is a natural habit of Andean bears in the wild, but in captivity, it was observed that hardly they prefer to climb the structures or the wobble tree provided as enrichments inside the enclosure. It was recorded that about 5 minutes time were being devoted by the elderly bears for climbing the existing lower wooden frames and tunnel. This may be due to old age problems coupled with degeneration of joints in the elderly bears in the zoo.

Resting: About 5% of the day time was found to be used by the animals for resting. They preferred the den or a part of the enclosure beneath the rocks to lie down and relax. Usually both the animals were found to be in close proximity.

Volcalisation: Very rarely one can hear the vocalization of the Andean bear in the zoo. They usually made sounds during grooming and pre-mating behaviour; screamed

when the food was snatched by the stray sea gull or the otter. But, one can observe the aggression towards the otter and sea gull when they tried to snatch food materials from the bears. In one occasion, the otter was able to snatch bread from the male bear and he showed aggressive behaviour to scare away the sea gull and the otter. The male bear was found to be more dominant and aggressive. In one occasion only, the male showed aggressive behaviour towards his partner when he failed to mate her. The animals were found to be friendlier with the keeper responding to her call.

Rubbing: Occasionally the animals use the standing and wooden frames to rub their body parts to relax themselves, in one occasion the male bear was seen using a tree for this purpose.

Food and feeding: The diet chart of the Andean bears is quite interesting. Food items of various types are being provided to the animals to meet the biological requirements of the species. The animals are being fed four times a day i.e 8.30 A.M., 12.30 P.M. (lunch), 2 P.M. and 4.00 P.M. (dinner). The food chart described here refers to the supply of diet to both the bears per day. About 8% of time is devoted to this activity.

At 8.30 A.M., every day, the animals are provided with various fruits (pine apple-1, grape-1 kg, pomegranate (2nos), also vegetables like carrot (2 to 3 nos) in a day. They usually prefer the grapes and carrot to apple. During lunch and dinner, various major food items like apple (36 nos), pears (36 nos), carrot (2 nos) sweet corn (2 nos), banana (2 nos), melon (1/2), grapes (1 kg) etc. are being provided inside the enclosure along with bread (400 gm) mixed with olive oil and cod-liver oil. The keeper supplied the food items inside the enclosure adjoining to the visitor centre and therefore, the animals were exhibiting conditioning behaviour during feeding. The less favoured food items during the lunch and dinner are banana and melon. In addition to the above food items, the animals are being provided with eggs (8 nos) on Mondays and Thursday. Tomatoes (4) and plums(2) are also given to the bears on Fridays.

The animals are fed with meal worms (caterpillar weighing about 200gm) twice in a week in addition to leaf eating pellets (200 gm) and primate pellets (200gm) at 2 P.M. The primate pellets contain the ingredients of wheat, maize, hiprosoya, sugar, minerals, vitamins, soya oil etc. The dry fruits (raisins, apricot, sultarner etc. 200gm) are being given to the elderly bears once/twice in a week.

In addition to the above food items, the leaves/foliage of the plants namely-Hazel (*Corylus avellana*), Hornbean *(carpinus betutus)* Hawthorn (*Crataegus monogyny*), False acacia (*Robinia pseudoacacia*), Chinese bramble (Rubus tricolor), Bramble (Rubus

fruiticosus), European beech (Fagus sylvatica), Common ash (Fraximus excelsior), Common lime (Tilia europaea), Sweet chestnut (Castanea sativa), Crack willow(Salix fragilis), Curley willow (Salix caprea) and white willow (Salix alba) are being provided to the Andean bears housed in the zoo. It was also observed that out of the above foliage species, the Andean bears prefer the foliages from Hazel, Curley willow and white willow.

Experience with coconut feeding : The bear in Jersey zoo never experienced eating coconut. In some of the zoos in India, coconuts are being provided to the bears. Having that experience, on 21st July, the bears were given two coconuts for the first time by the keeper inside the enclosure area. Initially, the two Andean bears did not know what to do with the coconuts. But 6-10 minutes later, the male bear could be able to bite the coconut and he eventually succeeded in breaking the hard shell. After a while the female bear joined her male partner. The animals enjoyed eating the coconuts and it was an enjoyable experience for both the animals and also for the keeper.

Sleeping: The animals usually go to sleep at around 5.30 P.M. everyday. They prefer the den for sleeping. It has also been observed that both the bears like to sleep very closely to each other. During the sleeping, they close their eyes and lie on the ground stretching their limbs in relaxed state. About 35% of the time is spent by the captive Andean bears in sleeping.

Interaction with other species: The bears had frequent interactions with the Asian small-clawed otter but did not have any interactions with the other two species (howler monkey and ring-tailed coati) housed in the same enclosure as they maintain arboreal life. The bears had interactions with a sea gull during the feeding time. The wild ranging sea gull comes during the feeding time especially during 4.00 P.M. to steal food (especially bread) from the bears. Many a times, the bird could not succeed in stealing the food. The otter many a times accompany the bears and has been a constant companion in the enclosure for last many years. It was observed that the otter spend more than 2-3 hours everyday (in different occasions) with the bears. During the feeding time, when the bears are fed before the otter, the latter tries to snatch food especially the bread from the bears. In one occasion, the otter could snatch the bread from the male bear due to aggressive behabiour towards the otter.

It was observed that out of 13 times, nine times, the otter ran away from the bears and only four times, the otter could stay during the feeding time. The bears scare away the otter either by vocalization or by snoring. The bears were found to have very good appetite. It seems that the animals are apparently in good health.

Bathing : On sunny days during 3.30 to 4.30 P.M. the male bear occasionally enters the moat for bathing. He remains in the water for about 5-10 minutes and the female was not seen taking bath during our study period.

Discussion

The feed chart of the Andean bears in the zoo is quite exhaustive. Peyton (1980) has recorded 83 feed items in the wild ranging from insects, rodents, corn, berries, bamboo hearts, cactus, fruits etc. The food items of the bears can be supplemented with coconut (with shell), jiggery, whole sugarcane to give them a new taste of food besides keeping them active. Renner *et al.* (2002) suggested various climbing structures for enhancing the behavioural diversity. In the present case, enrichment for climbing has been provided, but low climbing structures may be introduced for increased activity level. In the present study the Andean bears showed diurnal behaviour showing more activeness during the day time which confirms the findings of Paisley and Garshells (2005). They have observed the activity patterns of the two radio-collard Andean bears in the wild while conducting their studies in the Apolobanba Range of Bolivia, and they documented that both the bears were active during the period from sun rise to sun set and slept during the night time.

Castellanos *et al.* (2010) had analyzed eleven serum biochemical and haematological parameters of Anean bears in Ecuador which provides the baseline information for diagnosis of disease and assessment of nutrition in the captive conditions. Examination of blood samples of the elderly bears will help the zoo management to effectively deal with the old age problems of the animals. Bourne *et al.* (2010) have described in detail about various veterinary issues relating to bears. They have also indicated that the bears are susceptible to joint diseases. The captive bear in the Durrell zoo seems to suffer from this disease and the zoo-vet has therefore, prescribed the analgesic and anti-inflammatory drug Metacam (Meloxicam 15mg/ml) given in the bread. But regular use of this kind of drug is harmful because of its serious side-effects. Feeding of 8 number of eggs per week to each of these elderly bears should be reviewed because of it's high harmful cholesterol level.

Kolter (2005) while describing the potential contribution of zoos to bear conservation underlined the importance of enclosure enrichments and he suggested some possible ways to reduce the stereotype behaviour of the Andean bears in captivity, it is suggested to widely scatter the food items so that the animals will be stimulated to perform natural behaviour for prolonged period of time.

It has been observed that the husbandry practices and the health conditions of the elderly Andean bears are being maintained in the zoo up to greater extent. The enclosure is naturalistic and provides a lot of opportunities for the animals to explore and to live in a condition very close to wild.

Conclusion

The elderly Andean bears housed in Durrell zoo have been observed to be active and have been using the enrichments except the climbing frames/structures. The species although prefer to climb trees in its natural habitat, the elderly bears are not keen to use the climbing frames within the enclosure, may be due to degenerative joint ailment in the old age. The introduction of a low height climbing structure and a platform within the enclosure may induce increased activity.

Although the species is said to be nocturnal, both the Andean bears studied were found to be diurnal. They are generally active during the period after sunrise (08.00 hours) and before sun set (20.00 hours). They were found to be active 80% of the time during the day time and they were walking during most of the period of the observation.

Bears are opportunistic feeders and forage for about half of their time. The Andean bears in Durrell zoo spend most of their time in the portion of the enclosure towards visitor centre and have not been using the other spaces available in the enclosure. By widely scattering small food items and by hiding large ones, the captive bears can be successfully stimulated to perform natural behaviour for prolonged period of time to decrease the percentage of stereotypic behaviour.

The aspect of health management is an important intervention in the maintenance of the elderly bears. The present dietary chart needs to be reviewed. Additional food items such as coconut and sugarcane may be supplemented to encourage the animals to adopt for increased activity level.

Acknowledgement

We would like to express our sincere thanks to Dr. Jill Key, International Training Centre, Durrell Wildlife Conservation Trust, Jersey and Mr. Richard Switzer, Programme Manager, Hawaii Endangered Bird Conservation Prograqmme for their support and encouragement throughout the project work. Our special thanks are due to Ms Susie Parkin, zoo keeper and other staff of Durrell zoo, Jersey for their help and providing valuable information during the study.

References

Bourne, D. C., J.M. Crackness and H.J. Bacon (2010): Veterinary issues related to bears (Ursidae). International Zoo year Book. Vol.44(1).pp.16-32.

Castellanos, A., A. Leonard, D. Jackson and R. Castellanos (2010): Haematological and serum biochemical values of Andean bear sin Ecuador. Ursus. Vol.21(1).

Kolter, L. (2005): Potential contributions of Zoos to Bear Conservation. Bears.

Paisley, S. and D. L. Garshells (2005): Activity Patterns and time budgets of Andean bears in the Apolobamba range of Bolivia. Journal of Zoology, Vol.258(1), pp.25-34.

Peyton, B. (1980): Ecology, Distribution and Food Habits of Specteled Bears in Peru. Journal of Mammalogy. Vol. 61(4).

Renner, M.J. and J.P. Lussier (2002): Environmental enrichment for the captive spectacled bear *(Tremarctos ornatus)*. Pharmacology Biochemistry and behavior. Vol. 73(1) pp.279-283.

EARLY PREGNANCY DIAGNOSIS IN CAPTIVE CHIMPANZEES *(Pan troglodytes)* OF NANDANKANAN ZOOLOGICAL PARK, BHUBANESWAR

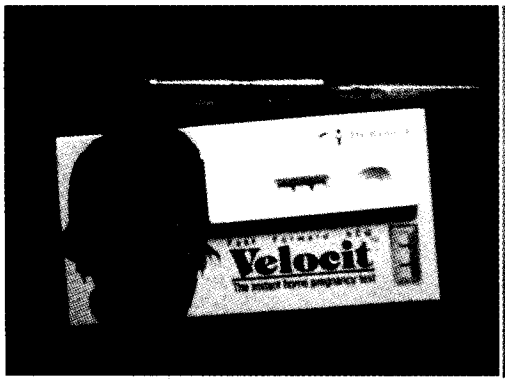
P.K. Roy[1], A.K. Das[1], R.K. Samantaray[1], A.K. Mishra[2] and S.N. Mohapatra[3]

Introduction

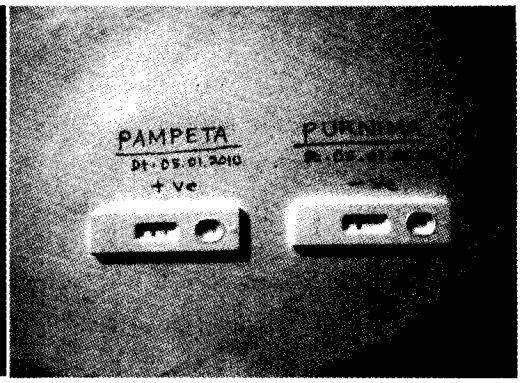
Conservation breeding programme is one of the prime objectives of modern zoo management. In this context, new approach with regard to the veterinary care of the endangered species has become an important mandate especially in the field of optimum care of pregnant mother, safe delivery of the new born and effective neonatal care. In this case pregnancy diagnosis and the expected date of delivery of captive animals have turned out to be the key factors in scientific management practices in the zoos. A pair of captive born chimpanzees of Singapore zoo named "Zulu"(born on 12.10.88 - male) and "Pampata" (born on 5.11.90 - female) were brought to Nandankanan Zoological Park (NKZP) on 16.05.94 in exchange of 2 pairs of gharials (*Gavialis gangeticus*) and a pair of sloth bears (*Melursus ursinus*). From this pair of exotic apes, who are the major attraction of the zoo visitors, NKZP has successfully achieved the objective of captive breeding in this species by optimum management practices and health care. "Pampata" has given birth four times out of which two female offsprings, one born on 09.01.2001 named "Purnima" and the other born on 13.07.2010 (unnamed) at NKZP are alive now. Other two babies have died in the neonatal stage. In the mean time "Purnima" has attained puberty and has conceived twice being sired by "Zulu". Its first pregnancy was a miscarriage but in the second pregnancy it delivered a healthy male ("Kartik") on 14.10.2009.In this context constant monitoring of the reproductive status of the above two females ("Pampata" and "Purnima") has helped to establish the successful breeding programme of this species in captivity.

Previously the pregnancy diagnosis was used to be done on the basis of date of last menstrual period (LMP), date of mating, followed by absence of next cycle,

1- Zoo Veterinarians, 2- Asst. Director, 3- Deputy Director, Nandankanan Zoological Park, Post : Barang, Dist: Cuttack-754 005, Orissa



Positive urine sample of chimpanzee in instant home Pregnancy testing kit indicating double band



Comparative study of positive and negative samples

Results and Discussion

The results of pregnancy test is given in the Table. The non-invasive characteristic of urinary hormone monitoring provides a stress-free approach to the accurate evaluation of great ape reproductive status. Detection of pregnancy in gorilla using urinary hormone kit is quick and easy as reported by Czekala *et al.* (1988).But orang-utan chorionic gonadotropin is less closely related to human CG than gorilla and chimpanzee CG (Chen and Hodges, 1976). Perusal of the table reveals that the urine of pregnant chimpanzee reacts positively whereas that of a non- pregnant chimpanzee showed negative result with instant home test kit of human. The pregnancy of two female chimpanzees could be diagnosed successfully as early as 7-8 weeks of LMP (Sl.No.1 and 10 of the table). The female chimpanzee "Purnima" was diagnosed as pregnant when tested at 7 weeks and 12 weeks of LMP. But the animal aborted on 09.10.2008 and it when tested on 31.10.08 at 3 weeks after abortion, it was found negative(non pregnant). The same female "Purnima" in her second pregnancy was found positive at 15 weeks of LMP and found negative at 22 weeks of LMP though pregnant. In case of the second female "Pampata" the result of the tests showed positive at 8 and 9 weeks of LMP but was negative at 20 weeks of LMP though pregnant. Although both the female chimpanzees "Purnima" and "Pampata" found positive in early pregnancy (Sl.No. 1 and 10) but showed negative result after 20 -22 weeks of gestation (Sl.No. 12 and 5)though pregnant. This observation is more or less in accordance with the

finding of Bruner (1951) who detected the presence of gonadotropin at 25th day in chimpanzee and reaches peak around 42nd day and then disappears between 100th and 130th days of gestation. Further in "Purnima", the urine sample became negative after 2 weeks of miscarriage in its first pregnancy (spontaneous abortion) (Sl.No 3) since CG concentration drops rapidly following a miscarriage.

The usefulness of human test kit for diagnosis of pregnancy in chimpanzee was determined in this study. The availability of above reliable non-invasive method for monitoring reproductive function in female chimpanzee offers a new opportunity for successful management of captive breeding in this species.

References

Bruner, A. Joyce (1951): Distribution of chorionic gonadotropin in mother and foetus of various stages of pregnancy. The journal of clinical endocrinology. Vol 2, No 4,360-374.

Chen, H.C. and Hodges, G.D. (1976): Primate chorionic gonadotropin : antigenic similarities to the unique carboxyl- terminal peptide of the hCG subunit. Journal of Clinical endocrionology and Metabolism. 43: 1414-1417.

Czekala, N.M., J.F. Roser, R.B. Mortensen, T. Reichard and B.L. Lasley (1988): Urinary hormone analysis as a diagnostic tool to evaluate the ovarian function of female gorillas (*Gorilla gorilla*).*J. Reprod. Fert.* 82:225-261.

Joslin, J.O. (1999): Other primates excluding great apes in Fowler ME, Miller RE, editors : Zoo and Wild Animal Medicine, *ed.* 5, Philadelphia, 1999, WB Saunders, pp.380.

Loomis, M.R. (1999): Great Apes in Flower ME, Miller RE, editors : Zoo amd Wild Animal Medicine, *ed.* 5, Philadelphia, 1999, WB Saunders, pp. 381.

A REPORT ON TWINNING ABNORMALITY IN RETICULATED PYTHON *(Python reticulatus)* RECORDED AT ARIGNAR ANNA ZOOLOGICAL PARK, CHENNAI

A. Manimozhi

Introduction

The reticulated python *(Python reticulatus)* is one of the several species of reptiles that has successfully bred at Arignar Anna Zoological Park, Chennai (AAZP). This species is the world's longest snake and is distributed in Myanmar, Malaysia, Indonesia and Thailand. Within the Indian subcontinent, it is found in the border areas of north-eastern India and Nicobar Islands (Smith, 1943). There are many reports on management, captive breeding, gestation, clutch size, incubation, feeding, skin sloughing and growth rates of *Python* species (Acharjyo and Misra, 1976, Kalaiarasan and Rathinasabapathy, 1991, Kalaiarasan, 1990, Kalaiarasan and Rathinasabapathy, 1995). The first report on twinning in *Python molurus bivittatus* was reported by Bob Clark and Tim Tytle (1983) The second report on twinning in *Python molurus molurus* was reported by Manimozhi *et al.* (2006). The present study reports on twinning abnormality in *Python reticulatus* for the first time in this species and this is the third report on twinning of *Python* species in captivity.

The pythons are housed in a specially built enclosure measuring 3.06 x 2.75 x 3.00 x 4.14 m. The three sides of the enclosure are concrete wall and the side of the viewers' gallery is covered with 8 mm thick glass of 2.39 x 1.34 m size and above this viewing glass, perforated aluminium sheet (2.36 x 0.47 m size) is provided for ventilation. Similarly in the back side perforated aluminium sheet (1.50 x 0.41 m size) is provided and the service door has perforated iron sheet of 0.86 x 0.77 m size for cross ventilation. A kidney shaped cement trough of 1.48 m diameter and 0.22 m height is provided inside the enclosure at ground level for provision of water for the snakes. Dried leaves, few logs, rocky stones, sand (10 cm) are provided as landscape of the enclosure to facilitate early skin sloughing Biweekly a 2 kg live chicken is provided as food for each snake. The enclosure houses an adult male and females including the incubating female python.

Biologist, Arignar Anna Zoological Park, Vandalur, Chennai - 600 048, Tamilnadu

Observations

The incubating female reticulated python was continuously monitored and the hatchlings were measured and weighed. Mating could not be observed in the present study, however, on 26th May 2006 muscular contractions of the body were noticed in the gravid female reticulated python which was found in a corner of the enclosure laying eggs in the leaf litter. The clutch of eggs was left as it is for natural incubation. On 17th July the female abandoned the clutch of eggs and not resumed incubation till the hatchlings emerged. It was found that the clutch consisted of 36 eggs.

On 1st August 2006 the first python baby emerged from the egg and died soon after hatching. On the morning of 2nd August, 7 eggs were seen with cracks and newly hatched python heads appeared through the openings. Later they were assisted to come out of the eggs. The rest 28 eggs were removed and examined on the same day after breaking the eggs gently. Out of 28 eggs, 16 eggs were infertile and the rest 12 fertile eggs contained well developed dead babies. One of the 12 fertile eggs contained twin dead python babies. The calculated incubation period was 67 days.

The seven newly hatched python babies were released into a plastic tray of 90 x 30 x 30 cm size with newspaper sheet at the bottom. The python babies were neither active nor agile. One of the babies had the lowest weight of 46 grams and another baby showed abnormality on the back of the anal end.

On 2nd August 2006 itself the dead twins were measured and weighed. The length and weight of each of them were 51 cm and 34 gm respectively excluding the yolk. The length of the seven live hatchlings varied from 67 - 77 cm with a mean of 69.57 cm and they weighed 46 - 164 gm with a mean of 107 gm. The python baby with the lowest body weight died on 3rd August 2006. The baby pythons were fed with small size rats and mice after their first sloughing.

Interestingly, the lengths and weights of both the twin dead baby pythons were exactly the same suggesting that they were identical twins. The sex of the twins could not be identified. This appears to be the first report of twins observed in this species in captivity.

Our earlier two studies revealed that while incubating, the female python never abandoned the clutch. In the present study it was observed that on the 53rd day, the

female abandoned the clutch and has not resumed back. Pythons brood their eggs and remain coiled round them till they hatch (Smith, 1943). In present study, the clutch size was 36 eggs with hatching percentage of 18.44.

In the year 2004 the same female laid 20 eggs out of which 9 babies hatched successfully after an incubation period of 72 days. The hatching percentage was 45. In the year 2003 the same female laid 15 eggs and 9 babies hatched out after an incubation period of 80 days. The hatching percentage was 60. The incubation period varies from 56 to 87 days as per the few available records (Smith, 1943, Gans, 1978, Daniel, 1983, Kaliarasan, 1990). In the present study the hatching success was low and the period of incubation noted was also low.

Acknowledgement

The author is thankful to Thiru R. Sundararajuv, I.F.S., Principal Chief Conservator of Forests and Chief Wildlife Warden, Tamilnadu, Thiru P. L. Ananthasamy, I.F.S., Chief Conservator of Forests and Director, Arignar Anna Zoological Park, Tamilnadu Forest Department, for their constant support and encouragement. I also thank K. Senthil Kumar, Vety. Asst. Surgeon for his help during hatching.

Literature cited

Acharjyo, L. N. and Misra, R. (1976) : Aspects of reproduction and growth of the Indian Python, *Python molurus molurus* in captivity. British Journal of Herpetology. 5: 562 - 565.

Bob Clark and Tim Tytle (1983) : A note on twinning *Python molurus bivittatus* (Burmese Python) Morphology. Herp. Rev. 14 (4) : 124.

Daniel, J.C. (1983) : The book of Indian Reptiles. Bombay Natural History Society, Mumbai, pp. 71 - 73.

Gans, C. (1978) : Reptiles of the world Bantam Book Inc. New York.

Kalaiarasan, V. (1990) : Captive breeding of the reticulated python *(Python reticulatus).* Cobra 1 : 9 - 11.

Kalaiarasan, V. and B. Rathinasabapathy. (1991) : Breeding of the Indian Python (*Python molurus*) Cobra, 3 : 10 - 11.

Kalaiarasan, V. and B. Rathinasabapathy (1995) : observation on sloughing in reticulated python (*Python reticulatus*). Animal Keepers' Forum. 22 (6); 223 - 225.

Manimozhi, A :, Baskar, N. and Sekar, M. (2006) : Twinning in *Python molurus molurus* in captivity. Hamadryad. 30 (1&2) : 204 - 205.

Smith, M.A. (1943) : The Fauna of British India, Ceylon and Burma including the whole region of Indo - Chinese subregion. Reptile and Amphibia - 3. Serpents. Taylor and Francis Ltd. London.

OBSERVATIONS ON PATTERN OF BIRTHS AMONG SOME SPECIES OF WILD RUMINANTS IN CAPTIVITY

L.N. Acharjyo[1], S. Panda[2] and S.K. Patnaik[3]

Introduction

Despite the maintenance and breeding of a number of species of wild ruminants in various Indian zoos since last several decades, limited published information on different aspects of reproduction among these animals is available for ready reference by zoo professionals. The Nandankanan Zoological Park, Bhubaneswar (NKZP) is maintaining the details of all births of all species exhibited in the park such as date of birth, number born in each litter and sex of each and every new born young including the species involved in this study in the zoo records since its establishment on 29th December, 1960. This paper is intended to present the results of the study on pattern of zoo births such as birth months, litter size and sex ratio at birth observed among nine species of wild ruminants (5 species of deer, 3 species of antelopes and one species of gazelle) at NKZP from its inception to 30th June, 1992 (31 years and 6 months) to supplement and enrich the existing informations on this subject from Indian zoos.

Observations and discussion

1. **SAMBAR *(Cervus unicolor)*:** The 129 births were recorded in all the months except May with maximum of 33 births during October and minimum of 3 births each during March and April (Table-1). Only one pair of twins was recorded (Table-2). There were 63 males and 67 females among 130 fawns born in 129 litters, the sex ratio at birth being 94 males: 100 females (Tabel-3).

Forty one sambar fawns of Arignar Anna Zoological Park , Chennai (AAZP) were born in all the months except February (Manimojhi, Sekar and Krishnakumar, 2006). Twelve births of this species at Delhi Zoological Park (DZP) were recorded during

1. House No. M-71, Housing Board Colony, Baramunda, Bhubaneswar -751003
2. Director, Nandankanan Zoological Park, Mayur Bhawan, Janpath, Saheed Nagar, Bhubaneswar -751007
3. Plot No.-81 Fishery Lane, P.O. Budheswari Colony, Bhubaneswar-751006

January-4, April-1, October -2, November-4 and December-1 and the litter size was always one (Sankhala and Desai, 1969). Eighteen births of Ahmedabad zoo observed during June 1990 - October, 1999 were produced in all the months except January and March and at Kanpur zoo (1977-89) 36 births were recorded in all months of the year except in March and July (Arora, 2002). Schaller (1972) states that a single fawn per litter is the rule. From his study at Kanha National Park, he further states that sambar hinds outnumbered the stags by a ratio of about 3:1 and the reason for this great disproportion of the sexes is unknown, but it may be due to selective predation on the males, both as fawns and adults and perhaps to an unequal sex ratio at birth.

2. THAMIN OR BROW-ANTLERED DEER OR SANGAI *(Cervus eldi eldi)*: Six births were recorded as follows: September - 1, October-4 and November - 1 (Table-1). The litter size was always one (Table-2) and there were 3 males and 3 females, the sex ratio being 100 males:100 females (Table -3).

Fifteen births of AAZP were noted during February - 1, September - 1, October - 1, November - 7 and December - 5 (Manimojhi, Sekar and Krishnakumar, 2006). Peak birth season occurs during October and November and 85.5% of 36 births of this species at DZP took place during these two months; the litter size was always one and never twins (Desai and Malhotra, 1978). During the period from 1970 to 1979, 35 births of this deer at Alipore zoo, Kolkata were distributed as follows: September, - 2, October - 13, November-12 and December - 8 (Das, 1988). Further, he stated that the litter size was always one and there were 19 males and 16 females, the sex ratio (number of males to 100 females) being 118.8:100.0.

3. CHITAL OR SPOTTED DEER *(Axis axis)*: The 481 births recorded during the period of observation were distributed throughout the twelve months of the year with maximum of 98 births during February and minimum of 12 births during October (Table-1). An analysis of data also suggests that there is a definite concentration of births during the 3-month period from January to March (240 out of 481 births). Litter size of all the 481 births was always one and never twins (Table -2). The sex ratio at birth was 109.11 males: 100 females (Table-3).

According to Manimojhi, Sekar and Krishnakumar (2006) the litter size was always one and out of 70 births recorded at AAZP, the number of births varied from 2 to 11 on every month but 24 births were recorded during the 3- month period from

January to March. Desai and Sankhala (1969) state that at DZP, 37 litters were born in all the twelve months of the year and there were two twin births. The 81 births of Thrissur zoo recorded during 1998 - 2000 and 37 births recorded at Deer Park, I.V.R.I, Bareilly (U.P) during 1987 - 95 were distributed throughout the twelve months of the year (Arora, 2002).He further states that usually single fawn is born in a litter. Schaller (1972) states that there were no twins in the 25 births of Calcutta (Kolkata) zoo and 97 births of the Bombay (Mumbai) zoo. He further states that there were 10 males and 13 females among 25 new born fawns in the Calcutta (Kolkata) zoo but figures from such a small sample have little relevance.

4. HOG-DEER *(Axis porcinus)*: Out of 52 births observed, the number of births varied from 3 to 7 on all the months of the year (Table-1). Only one fawn was born per litter with no twins (Table-2). There were 25 males and 27 females, the sex ratio (number of males to 100 females) being 92.6: 100.0 (Table - 3).

Twenty nine single births were observed at AAZP in all the months except October (Manimojhi, Sekar and Krishnakumar, 2006). Arora (2002) reported that the 34 births of Lucknow zoo observed during 1989 - 2000 were noted in all the months of the year whereas the 23 births of Kanpur zoo recorded during 1977 - 87 were noted in all the months except February, June, November and December. One fawn per litter is the rule and the sex ratio of adult hog-deer was about equal or favoured the does only slightly (Schaller, 1972). The hog-deer at DZP has given birth to fawns at any time of the year and there were two twins in 23 litters (Sankhala and Desai, 1969).

5. MUNTJAC OR BARKING DEER *(Muntiacus muntjak)*: The births of 112 litters were observed in all the twelve months of the year with minimum of 6 litters during January and maximum of 13 litters during December (Table-1). Only one pair of twins was noted (Table-2). There were 58 males and 55 females, the sex ratio (number of males to 100 females) being 105.0:100.0.

Manimojhi, Sekar and Krishnakumar (2006) state that the twelve births of AAZP were recorded in February (4), April (2), May (1), June (1), September (2), October (1) and November (1). The 21 births of barking deer at DZP were observed in all the months of the year except in May and December and only one fawn was born at a time and never twins (Sankhala and Desai, 1969). The 34 births of Lucknow zoo (April 1998 - March 2000) were noted in all the months of the year whereas at Kanpur zoo.

8 fawns (1982-99) were born during January, February, March, May, June, August and October. Usually one young but rarely twin births occur (Arora, 2002). There were 33 males and 29 females among 62 new born fawns observed at NKZP upto December 1975 (Acharjyo and Mohapatra, 1977) indicating uneven sex ratio at birth favouring males.

6. NILGAI OR BLUE BULL *(Boselaphus tragocamelus)*: The 16 births of nilgai were observed during January - 1, February - 4, March - 2, April-1, September-2, October - 3, November -2 and December-1 (Table-1) with two peak periods, one from February - April (7 births) and the other from September - November (7 births). There were ten litters with single young and six litters with twin young with an average litter size of 1.38 (Table-2). The sex ratio at birth (number of males to 100 females was 144.44:100.00 indicating the males have outnumbered the females at birth (Table-3).

According to Sankhala and Desai (1969) seventy nilgai young were born in 45 litters at DZP (February - 4, March - 7, April - 8, May - 1, August - 2, September - 12, October - 6, November - 1 and December - 4) with two peak periods of birth, one from February - April (19 births) and the second from August - October (20 births). The litter size of 20 births was only one young and the rest 25 litters had twin births.

Fourteen births of AAZP were recorded in January (1), March (1), August (2), September (7) and October (3) and three of the 14 births were twins (Manimojhi, Sekar and Krishnakumar, 2006). From their limited observation of 14 nilgai new born young of Nandankanan Zoological Park recorded upto December, 1975. Acharjyo and Mohapatra (1977) state that there were 10 males and 4 females suggesting unequal sex ratio with the males outnumbering the females at birth. The same trend has been observed in this study also.

7. BLACKBUCK OR INDIAN ANTELOPE *(Antilope cervicapra)*: The 258 births of this species in the park were recorded in all the months of the year with a peak period of births from January - April (Table-1). The litter size was always one and never twins (Table-2). There were 134 males and 124 females indicating that the males have outnumbered the females at birth (Table-3).

Eighty nine births of blackbucks of AAZP were observed in all the months of the year with one birth in January and 26 births in August (Manimojhi, Sekar and

Krishnakumar, 2006). The 17 blackbuck births of DZP were observed in all the months of the year except February, May and November. There were two twin births and the rest 15 single births (Sankhala and Desai, 1969). Arora (2002) from his pooled data on 185 births of this species noted in ten Indian zoos recorded during different periods, states that births occur in all the months of the year with peak period in March and September. The sex ratio at birth of males to 100 females observed among 39 new born specimens at Nandankanan Zoological Park upto December, 1975 was 116.7:100.0 (Acharjyo and Mohapatra, 1977).

8. FOUR-HORNED ANTELOPE OR CHOWSINGHA *(Tetracerus quadricornis)*: The 22 births were recorded during January - 8, February - 3, March-2, April-1, August-3, September - 3, October -1 and November - 1 with two peak periods, one from January to March (13) and the other from August to September (6) (Table-1). Six births were with single young and the rest 16 births were with twins (Table -2). There were 23 males and 15 females, the ratio of males to 100 females was 153 .33: 100.00 (Table-3). At birth the males have outnumbered the females.

Sankhala and Desai (1969) from their observation at DZP state that 15 young were born in 10 litters (January-4, February - 1, March - 1 and October - 4) and there were five twin births and 5 litters were with single young only. The sex ratio of 11 young (4 males and 7 females) produced in six litters at Nandankanan Zoological Park upto March 1974 was 1 male: 1.75 females (Acharjyo and Misra, 1975).

9. CHINKARA OR INDIAN GAZELLE *(Gazella gazella)*: Twelve births of this species were observed in January, February, March, April, May, July, August and October, always with one or two births in each month (Table-1). The litter size was always one (Table-2). There were 9 males and 3 females; the sex ratio at birth was 3 males: 1 female (Table-3).

The four births with always a single young in each litter were recorded at DZP in April, June, July and August (Sankhala and Desai, 1969). According to Arora (2002) the animal inventory records of Kanpur zoo showed births mainly in the months of June, September and November whereas births of this species at Ahmedabad zoo occurred once in January, May, November and December and twice in April between 1990 - 1993.

Table-1 : Monthwise distribution of zoo births among wild ruminants at Nandankanan Zoological Park, Bhubaneswar (from 29-12-1960 to 30-06-1992)

Sl. No.	Species of wild ruminant	J	F	M	A	M	J	J	A	S	O	N	D	Total litters	Remarks
1.	Sambar (*Cervus unicolor*)	4	10	3	3	NIL	6	4	13	27	33	14	12	129	
2.	Thamin or Brow-antlered deer or Sangai *(Cervus eldi eldi)*	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	1	4	1	NIL	6	
3.	Chital or Spotted deer *(Axis axis)*	80	98	62	38	52	27	24	18	22	12	16	32	481	
4.	Hog-deer (*Axis porcinus*)	5	5	5	4	3	3	4	3	4	4	5	7	52	
5.	Muntjac or Barking deer (*Muntiacus muntjak*)	6	9	9	12	10	9	12	8	10	7	7	13	112	
6.	Nilgai or Blue bull *(Boselaphus tragocamelus)*	1	4	2	1	NIL	NIL	NIL	NIL	2	3	2	1	16	
7.	Blackbuck or Indian antelope (*Antilope cervicapara)*	20	40	39	22	14	7	17	23	30	24	13	9	258	
8.	Four-horned antelope or Chowsingha*(Tetracerus quadricornis)*	8	3	2	1	NIL	NIL	NIL	3	3	1	1	NIL	22	
9.	Chinkara or Indian gazelle (*Gazella gazella)*	2	2	1	1	2	NIL	1	2	NIL	1	NIL	NIL	12	

N.B. : J, F, M, A, M, J, J, A, S, O, N and D stands for January, February, March, April, May, June, July, August, September, October, November and December respectively.

Table - 2: Litter size of zoo births among wild ruminants at Nandankanan Zoological Park, Bhubaneswar (from 29.12.1960 to 30.06.1992).

Sl. No.	Species of wild ruminant	Number of births recorded (Total number of young born)	Litter size (Number of births)	Remarks
1	Sambar	129(130)	1(128) 2 (1)	Only one pair of twins was born in 129 litters.
2	Thamin or Brow - antlered deer or Sanga	6(6)	1 (6)	Always only one young was born in a litter.
3	Chital or Spotted deer	481(481)	1 (481)	Litter size was always one and never twins.
4	Hog - deer	52(52)	1 (52)	Litter size was always one and never twins.
5	Muntjac or Barking deer	112(113)	1 (111) 2 (1)	Only one pair of twins was noted in 112 births.
6	Nilgai or Blue bull	16(22)	1 (10) 2 (6)	Average litter size was 1.38.
7	Blackbuck or Indian antelope	258(258)	1 (258)	Always only one young was born in a litter and never twins.
8	Four-horned antelope or Chowsingha	22(38)	1 (6) 2(16)	Average litter size was 1.73.
9	Chinkara or Indian gazelle	12(12)	1 (12)	Always only one young was born in a litter and never twins.

Table-3 : Sex ratio at birth among wild ruminants at Nandankanan Zoological Park, Bhubaneswar (from 29-121960 to 30-06-1992)

Sl. No.	Species of wild ruminant	Total number of young born	Males	Females	Sex ratio at birth (Number of males to 100 females)
1	Sambar	130	63	67	94.00:100.00
2	Thamin or Brow - antlered deer or Sangai	6	3	3	100.00:100.00
3	Chital or Spotted deer	481	251	230	109.10:100.00
4	Hog - deer	52	25	27	92.60: 100.00
5	Muntjac or Barking deer	113	58	55	105.00:100.00
6	Nilgai or Blue bull	22	13	9	144.44:100.00
7	Blackbuck or Indian antelope	258	134	124	108.60 :100.00
8	Four-horned antelope or Chowsingha	38	23	15	153.33 : 100.00
9	Chinkara or Indian gazelle	12	9	3	300.00:100.00

References

Acharjyo, L.N. and Misra, R. (1975): A note on the breeding habits of four-horned antelope *(Tetracerus quadricornis)* in captivity. J. Bombay nat. Hist. Soc. 72 (2):529-530.

Acharjyo, L.N. and Mohapatra, S. (1977) : Sex ratio at birth in some captive wild mammals. J. Bombay nat. Hist. Soc.74(1) : 167-169.

Arora, B. M. (2002) : Reproduction in wild mammalia and conservation. Association of Indian Zoo and Wildlife Veterinarians, Bareilly (U.P.) pp. 6-54.

Das, A. K. (1988): Some observations on the Manipur Brow-antlered deer (*Cervus eldi eldi*) in Calcutta Zoo from 1970 - 1977. Zoo Zen. Vol.III (8 & 9) : 67 - 75.

Desai, J. H. and Malhotra, A. K. (1978): The Manipur Brow-antlered deer, *Cervus eldi eldi* : its status and breeding in captivity. International Zoo Yearbook, 18 : 235-236.

Manimojhi, A., Sekar, M. and Krishnakumar, N. (2006): Birth seasons of mammals of Arignar Anna Zoological Park, Chennai. Indian Zoo Year Book, IV:99-111.

Sankhala, K.S. and Desai, J.H. (1969) : Reproductive pattern of some Indian mammals. Cheetal.12(1) :114-129.

Schaller, G. B. (1972) : The deer and the tiger- A study of wildlife in India. The University of Chicago press, Chicago and London.

CAPTIVE BREEDING IN FOUR-HORNED ANTELOPE *(Tetracerus quadricornis)* IN GULAB BAGH ZOO, UDAIPUR, RAJASTHAN

Rahul Bhatnagar*, Pradeep Pradhan and Satish Kumar Sharma*****

Introduction

Four species of antelopes namely, nilgai *(Boselaphus tragocamelus)*, blackbuck *(Antilope cervicapra)*, Indian gazelle *(Gazella bennettii)* and four-horned antelope or chowsingha *(Tetracerus quadricornis)* are confined to Rajasthan State. Of these, the four-horned antelope is the smallest and is mainly distributed in dense forests of the Aravallis from southern tip in Phulwari-ki-Nal Wildlife Sanctuary (Sharma, 2007)to the northern tip in Sariska Tiger Reserve area; Vindhyan forests and forests of Malwa plateau which are situated east of the Aravallis. It is absent in Thar area, located west of Aravallis, Mt. Abu Kumbhalgarh and Todgarh - Raoli Wildlife Sanctuaries and Jaswantgarh, forest range of Jalore district, make the western most distribution limit of *Tetracerus quadricornis* in Rajasthan.

Four-horned antelope or chowsingha locally known as "Bhedal" in southern Rajasthan and "Ghantali" in northern part of the state is a well known species of Rajasthan. Before independence, they were quite abundant but post independence, wanton hunting took a heavy toll of this species. Since these antelopes are fond of water (Menon, 2003, Prater, 1980) hunting almost always took place at or near water holes/bodies.

Tigers, sambars, spotted deer and four-horned antelopes are uniformly distributed in Rajasthan, Sambar and spotted deer being bigger sized herbivorous animals, form main prey base of tigers. Even a panther can over power young sambar and adult spotted deer. As long as sambars and spotted deer were plenty in number four-horned antelopes were relatively less focused prey of tigers and panthers. But as soon as sambars and spotted deer disappeared from a larger part of the state due to various reasons, four-horned antelopes became eventual prey animals of big cats. On being stalked and preyed, the population of these wonderful animals started diminishing in its distribution range. Habitat loss and disappearance of surface water sources accentuated the tough situation. Now, status of four-horned antelope is somewhat jeopardized in most of its distribution range in the state.

* Dy. Chief Wildlife Warden, Udaipur (Rajasthan) - 313001, e-mail:rahulbudr@yahoo.co.in
** Veterinary Officer, Gulab Bagh Zoo, Udaipur
*** Range Forest Officer, Sajjangarh Biological Park, Udaipur (Rajasthan)-313001, e-mail : sksharma56@gmail.com

Its number is decreasing in other parts of the country too. Therefore, and appropriately so it is listed in Schedule I of Wildlife (Protection) Act, 1972 from conservation point of view.

Gulab Bagh zoo, Udaipur is a small zoo and only zoo in the state where four-horned antelopes are kept for display. Few years back two young (one male and one female) of this species were rescued from Sitamata Wildlife Sanctuary and housed in the zoo. After maturity they started breeding in the zoo.

We would like to shore our special experience of successful rearing of a motherless young for the benefit of zoo keepers elsewhere.

Breeding season of the year 2008 - 2009

Two males and four female four-horned antelopes were kept in a small enclosure in the year 2008. On November 1, 2008 during an infighting between two adult males a pregnant female got injured accidentally by the horns of the dominant male. She received serious injury in her udder and died the some day. To avoid further infighting, all the remaining animals were shifted to a bigger enclosure having many compartments.

Later after shifting, a female gave birth to two young on January 18,2009 (one male and one female) in the new enclosure, On February, 1, 2009 the newly born male young died due to some unknown reason. A month later, the mother also died leaving behind the female young orphaned.

The care-taker was given instruction to start bottle feeding to the baby animal. The zoo veterinarian was regularly looking after its health. Although the young one was feeding from the bottle, its health especially the mental condition was not good - may be due to lack of mother's care. After discussion with the care-taker and zoo veterinarian, a she goat in milk was selected from a herd available in a nearby village having the following features to act as a foster mother.

- Dull red-brown body colour as close as its mother's colour.
- Short height so that the young animal could reach the udder easily.
- Thin tipped teats so that the orphaned young could suckle easily.

The she goat on arrival at the zoo was bleating as it was alone. However, with adequate care the goat got acclimatized to the new environment within 4 - 5 days. The bleating became less pronounced. The orphaned young was left in the company of the goat in a separate small enclosure. A black thread was put around its neck for quick identification (Fig-1). Sharp tips of horns of the goat were rasped off for safety reasons. Initially two care-takers were put in charge of the feeding of the young animal, one man used to restrain the goat to stand in still position while the second man was to help the young suckle (Fig-2). After one month not much human support was necessary and the young one was able to suckle of her own. Besides milk, green fodder was also given to it for better growth and has run into an uneventful second year life. She was quite normal and healthy.

Breeding season of the year 2009 - 10

On January 17, 2010 another female littered two young ones (one male and one female) in the zoo. It was her first birth. Since visitors' path was close to the enclosure, the female was feeling uneasy and if any one stopped near the enclosure, she became very restless. To avoid being directly sighted, a tin sheet of one metre height was erected along the path close to the chain-link mesh fence of the enclosure (Fig-3). This provided mental peace to the lactating mother and it felt less provoked despite to and fro movements of the visitors on the visitors' path.

Chilling nights were another problem. Hence a hut like nursery having side walls stuffed with dry grasses was prepared in the farthest corner of the enclosure to provide necessary insulation and warmth (Fig-4). Top of the hut was closed. A layer of dry soft grass i.e *Eremopogon foveolatus* was spread on the floor as litter to provide comfort to the infant. An opening was provided for entry and exit of the animals. Water in a trough was placed near the nursery and green fodder was also kept close to it. This arrangement was done to minimize the movement and exposure of the mother and her young ones. During the breeding season no casualty occurred and number of four-horned antelopes increased in the zoo.

Chowsingha or four-horned antelope is a fast breeder and generally two is the normal litter size. Breeding of animals in semi-wild condition can be used for restocking the forest areas. Beside chowsingha, Indian hare *(Lepus nigricollis)* is also a suitable animal for restoring the broken food chain in the forest areas of the state. It can be reared inside predator proof wire-meshed big size cages in sanctuaries simulating semi-wild conditions. By releasing captive reared population of hare in the wild, pressure of leopard on chowsingha as a prey animal, can be minimized. Thus dwindling population of chowsingha can be arrested in the wild in Rajasthan.

ACKNIWLEDGEMENT

The authors are extremely grateful to the zoo staff for providing help during the present study.

REFERENCES

Menon, V. (2003) : A field guide to Indian mammals. D. K. Publishers (India) Pvt. Limited, New Delhi.

Prater, S. H. (1980): The book of Indian animals. Bombay Natural History Society, Mumbai.

Sharma, S. K. (2007): Study of biodiversity and ethnobiology of Phulwari Wildlife Sanctuary, Udaipur (Rajasthan) Ph. D. Thesis, MLSU, Udaipur.

CAPTIVE BREEDING IN FOUR-HORNED ANTELOPE *(Tetracerus quadricornis)* IN GULAB BAGH ZOO, UDAIPUR, RAJASTHAN

Rahul Bhatnagar, Pradeep Pradhan
and Satish Kumar Sharma

Fig. 1: A four-horned antelope young with a black thread round its neck for quick identification

Fig. 2: Two persons helping the four-horned antelope young to suckle a she goat in milk

CAPTIVE BREEDING IN FOUR-HORNED ANTELOPE *(Tetracerus quadricornis)* IN GULAB BAGH ZOO, UDAIPUR, RAJASTHAN

Rahul Bhatnagar, Pradeep Pradhan and Satish Kumar Sharma

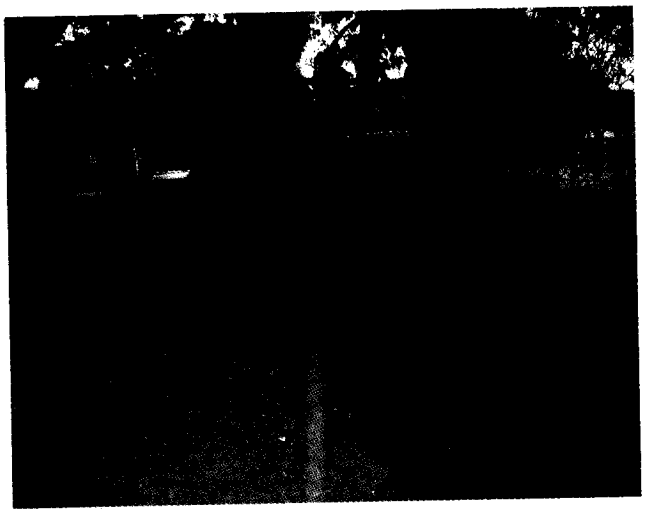


Fig. 3: Tin sheet erected along the path to avoid direct sight of visitors by the animals

Fig. 4: Side walls stuffed with dry grasess to provide warmth to four-horned antelopes

OUTBREAK OF FOOT-AND-MOUTH DISEASE IN NEHRU ZOOLOGICAL PARK, HYDERABAD - A CASE STUDY

M. A Hakeem*, M. Navin Kumar and P. Srinivas*****

Introduction

Foot-and-mouth disease, (FMD) or hoof-and-mouth disease *(Aphtae epizooticae)* is a highly contagious and sometimes fatal viral disease of cloven-hoofed animals, including domestic animals such as cattle, water buffalo, sheep, goats and pigs, as well as antelope, bison and other wild bovids and deer. This disease is caused by foot-and-mouth disease virus. There are seven serotypes: O,A, C, SAT-1, SAT-2, SAT-3, and Asia-1. These serotypes show some regionality, and the 'O' serotype is most common.

Nehru Zoological Park (NZP), Hyderabad has got a wide variety of Indian herbivores in its collection and presented to the visitors in large moated enclosures wherein few species are displayed in a row in a location named as "Hoof and Horned area". The species displayed are Indian gaur, hog-deer, sambar, nilgai, blackbuck. four-horned antelope, barking deer, mouse-deer and giraffe (exotic). All of them are in sufficient numbers.

The nilgai (*Boselaphus tragocamelus)* is an antelope and is one of the most commonly seen wild animal of central and northern India, Pakistan mainly along the border with India and in Nepal. The mature males appear ox-like and are also known as blue bulls. The nilgai is the biggest Asian antelope.

Deaths in nilgai

Between 29.11.09 to 03.12.09 death of eight nilgais (including male, female and young) was reported in nilgai enclosure at Nehru Zoological Park, Hyderabad.

Clinical history of nilgai

On 29.11.2009 one of the sub-adult female nilgai was reported dull and off feed. Close observation revealed salivation with abnormal temperature. The animal was treated with anti-inflammatory drugs and antibiotics but subsequently it died in the

* Assistant Director, ** Consultant (Vety.), *** Veterinary Assistant Surgeon, Nehru Zoological Park, Hyderabad - 500064, Andhra Pradesh

night. On 30.11.2009 by evening two more nilgais were found dull with mild lameness of hind limbs, jerking of the limbs and licking of the foot but they were consuming feed along with other nilgais.

On 01.12.2009 two nilgais were found dead in the enclosure. Post-mortem was conducted. On 02.12.2009 three more animals died suddenly without showing any clinical signs of foot-and-mouth disease. Meanwhile two more nilgais were seen dull (may be they were under incubation) and found dead on the intervening night of 2nd and 3rd December 2009.

Post - mortem findings

The Post-mortem team consisted of pathologist from Veterinary College, Rajendranagar, Hyderabad; pathologist from Veterinary Biological Research Institute (VBRI), Shantinagar, Hyderabad; scientists from Laboratory for the Conservation of Endangered Species (LaCONES) and Centre for Cellular and Molecular Biology (CCMB) Attapur, Hyderabad and zoo veterinarians of NZP, Hyderabad. The post-mortem findings were as follows :

- All the eight animals showed highly congested lungs and frothy fluid in respiratory tract.
- Pinpoint hemorrhages observed in kidney.
- Severe congestion of mesentery in most of the animals.
- In one animal hepatomegaly and splenomegaly were observed.
- In one nilgai there were foot lesions (aberrations at coronet region, vesicles at interdigital space).
- In another animal there were vesicles on the tongue.

However, samples were collected from dead animals along with the serum from one ailing animal for further investigation.

Prophylaxis

As per suggestions of the expert team, all precautionary measures were taken to control the spread of the disease like disinfection by spreading bleaching powder and lime soda in entire area of all the enclosures of herbivores in the zoo.

The experts recommended to drench total area (where herbivores are kept) with caustic soda, which is very effective in restricting the spread of the virus.

An oral antibiotic in feed and homoeo drug (Variolinum 2000 was added both in water and feed for two weeks to all the herbivores.

As wild boars are susceptible to foot-and-mouth disease, their enclosure was also disinfected thoroughly. They were also provided with potassium permanganate lotion foot dips.

The entrances of the zoo were provided with foot baths for vehicles and visitors. The animal keepers were posted on make shift basis on particular species.

Treatment

1. The affected animals were isolated from the group and kept in holding crawls for treatment and feeding.
2. The affected nilgais and sambars were treated with antibiotics, anti inflammatory and supportive therapy drugs.
3. Apart from allopathic drugs they were also treated with homoeo drugs like Mercsol 200, Letrun mur 200, Reus tox 200 given along with water and feed.
4. Ad-lib quantity of feed and fodder provided to all the sick and healthy animals. To the affected animals coriander leaves, "Methi" leaves and bananas were given.

How the virus might have come to the zoo

The FMD can be transmitted in many ways - aerosol spread, fodder, motor vehicles, uncooked food scraps of infected animals etc. Some of the probable causes of this FMD outbreak are -

I. The zoo is located in the old city of Hyderabad (where a lot of Muslim population resides). During the festival season of Bakrid (Dt:28.11.2009) lots of livestock from adjoining states like Karnataka, Maharashtra, Madhya Pradesh and Tamilnadu are brought to the city for sale and slaughter.

II. The zoo has got its own resources of fodder but inadequate to meet the requirement and so fodder is purchased from outside.

III. Zoo personnel possessing livestock and

IV. Visitors exposed to endemic area.

Conclusion

Experts from Veterinary College, VBRI and LaCONES conducted post-mortem and laboratory tests and confirmed the presence of foot-and-mouth disease virus with "O" serotype strain. In domestic animals morbidity is high and mortality is low, whereas in the present instance (wild animals-nilgais) mortality was high.

There was no incidence of this disease since 1986. However, it occurred in 1986 in the same species with high mortality.

Again in 2009 nilgai species was affected with FMD causing heavy mortality. But in few sambar deer (which is adjacent to nilgai enclosure) foot lesions were seen but no mortality. Surprisingly no other species of herbivores were affected though they were in very close proximity.

The management and staff of the zoo promptly reacted and restricted the spread of the virus. However, as per the recommendation of the experts from VBRI, vaccination was conducted in different herbivores with Raksha - Ovac Trivalent vaccine which contains Trivalent FMD inactivated antigens against O, A and Asia - 1 strains.

The spread of the virus was controlled and no untoward infection was reported further.

Acknowledgement

The management of Nehru Zoological Park, Hyderabad is thankful for the support and prompt advice given by :

- Dr. S. Krishnama Chary, Deputy Director (AH) and Dr. M. Vanisree, Asst. Director (AH), F. M. D Laboratory, VBRI, Hyderabad, Dr.Ratnakumari, Deputy Director (AH) and Dr. Mukeeth, Asst. Director (AH), Disease Surveillance, VBRI, Hyderabad.
- Dr. Y. Anjaneyulu, Associate Professor, Department of Pathology, College of Veterinary Science, Rajendranagar, Hyderabad.
- Dr. Laxmikanthan and Dr. Rahul Pawar, Research Scientists, LaCONES who assisted in post-mortem and disease diagnosis.
- Sri Hitesh Malhotra, I.F.S, PCCF (Wildlife)/Chief Wildlife Warden, A.P Forest Department, Hyderabad for his kind support and guidance.

- Sri A. V. Joseph, I.F.S., Additional PCCF (Admin.), A.P. Forest Department for giving valuable advice out of his experience with his long association as a Zoo Manager.

- Sri K. Bhoopal Reddy, I.F.S, Director/CCF, Zoo Parks, A.P., Hyderabad for kind support and concern in initiating all necessary steps in controlling the dangerous FMD disease.

- Sri S. Sri Saravanan, I.F.S, Curator, Nehru Zoological Park, Hyderabad for his round the clock vigilance and concern.

- Sri K. Shekar Reddy, ACF, Nehru Zoological Park, Hyderabad who has monitored the overall operations.

- Sri S. Ramesh, Asst. Curator - 1, Nehru Zoological Park, Hyderabad for monitoring the tasks given by Veterinary and Management Teams.

- Sri Manohar Chand and Sri E. Vivekananda Rao, Veterinary Assistants for their active participation in the Veterinary team.

NOCTURNAL BEHAVIOUR OF INDIAN PANGOLIN (*Manis crassicaudata* Gray) IN CAPTIVITY

Satyanarayan Mishra and S. Panda

Introduction

Population of four species of Asian pangolins (Botha and Gaudin, 2007; Lim and Ng, 2008) including Indian pangolin (*Manis crassicaudata*) is thought to have declined significantly in many areas due to hunting and trade (Broad *et al.*, 1988). However, little is known about the status and activity pattern of Indian pangolin throughout its range (Burton and Pearson, 1987). Pangolins are nocturnal and are adapted to have a highly specialized diet of ants and termites (Lekagul and McNeely, 1988; Heath, 1995; Prater, 2005; Lim and Ng, 2008; Pattnaik, 2008). Few studies on ecology and behaviour of *Manis pentadactyla* (Shi, 1985; Heath and Vanderlip, 1988 and Wu *et al.*, 2003), *Manis javanica* (Samiadi *et al.*, 2008; Lim, 2008, Vijayan *et al.*, 2008) and *Manis culionensis* (Lim and Ng, 2008; Gaubert and Antunes, 2005) has been undertaken. All these pangolins inhabit different latitudes and habitats, and thus probably have different ecological niche (Lim and Ng, 2008) which directly affect the behaviour of the animal. Few works have been conducted including that of Lim and Ng (2008), many of them concentrated on the general behaviour. The present study highlights the nocturnal behaviour of Indian pangolin in captivity.

Study Area

Nandankanan Zoological Park, one of the premier zoos in the country, is situated amidst natural forest along the banks of Kanjia Lake in the state of Orissa. It is situated between 20° 23' 08" to 20° 24' 10" N latitude and 85° 48' 09" to 85° 48' 13" E longitude which covers an area of 3.62 sq km (Anonymous, 2009). To facilitate *ex-situ* conservation inside Nandankanan Zoological Park, Bhubaneswar (NKZP) a Pangolin Conservation Breeding Centre (PCBC), funded by Central Zoo Authority (CZA), was constructed for Indian pangolin in an off exhibit area of the park.

Nandankanan Zoological Park, Post: Barang, Dist: Cuttack, 754005, Orissa

Materials and Methods

Housing

Six pangolins were housed separately in specially constructed enclosures of 3.0 m X 4.0 m X 3.5 m dimension at PCBC. Each enclosure was provided with one meter deep red laterite soil mixed with small stones to enhance the natural instinct of burrowing behaviour of these animals. At the base of the soil, a six centimeter thick reinforced concrete floor base with 5 X 5 cm chain-link mesh was provided to prohibit the escape of these burrowing animals. All the pangolins have been micro-chipped with a Passive Integrated Transponder (PIT) for their individual identity (Table-1). The activities of the pangolins inside the enclosures were observed by infrared sensitive fixed CCTV cameras with infrared sources which enable to capture the video in dark night. The CCTV cameras were linked with a high storage capacity computer installed with Digital Video Recording (DVR) software to store all the recorded videos for further analysis.

Table-1: Source and ID of captive Indian pangolins at Pangolin Conservation Breeding Centre, Nandankanan Zoological Park, Bhubaneswar.

Enclosure No.	Source	PIT ID	Sex
Cell 1	Rescued, Berhampur, Orissa	0006A2A395	Female
Cell 2	Rescued, Cuttack, Orissa	98102057708	Male
Cell 3	Rescued, Bhanjanagar, Orissa	0006A2AA6F	Female
Cell 4	Zoo born, Nandankanan Zoological Park, Bhubaneswar	98102057484	Female
Cell 5	Rescued, Badamba, Orissa	0006A283F9	Female
Cell 6	Exchange Programme, Bhopal zoo	0006A2ACA3	Female

Feeding and Hygiene

Pangolins have a very specialized food habit of feeding on ants and termites. At PCBC, each adult pangolin is provided with 600 grams of red weaver ants (*Oecophylla smaragdina*) per day per individual. The food is provided every day just before sun set on a feeding trough made of cement concrete. The feed supply time was kept in late afternoon in order to avoid the putrefaction of the feed as this nocturnal animal comes out from its burrow only after dusk. The leftover food particles, faecal matters are regularly cleaned daily in the morning. A shallow water trough with clean water is provided inside the enclosures for drinking purpose.

Data recording

Data was collected in different seasons (mainly Summer and Winter season) for a period of one year from April 2009 to March 2010. Behaviour of each individual was recorded from the captured video by CCTV cameras fitted with the computer. As they are strictly nocturnal in nature, the behaviour data was recorded from 18:30 hour to 01:00 hour, observed only for 6 ½ hours. The behaviour of the animal was broadly classified in to five categories, i.e. walking, digging, feeding, drinking and climbing (Table-2). All the behaviours were recorded in a 10 minutes time series data sheet. When the animal is not visible and inside the burrow it was mentioned as invisible.

Table-2: Different behaviour scores exhibited by the Indian pangolins (Daily average activity in minutes ± Standard Deviation)

ID of Pangolins	Walking	Digging	Feeding	Drinking	Climbing
0006A2A395	13.16 ± 2.54	2.63 ± 3.24	8.15 ± 0.94	1.0 ± 0.26	0.53
98102057708	205.00 ±8.13	53.10 ±4.41	25.00 ±2.12	74.2 ±4.14	35.00 ±2.01
0006A2AA6F	73.1 ±8.5	4.62 ± 1.00	54.6 ±5.17	0	8.46 ±1.53
98102057484	98.68±7.87	19.70 ±4.88	49.50 ±3.58	15.3 ±2.84	4.47 ±1.17
0006A283F9	140.00 ± 9.10	19.00 ±3.30	71.80 ±4.36	13.00 ±1.90	7.89 ±1.36
0006A2ACA3	166.00 ±11.00	17.60 ±2.23	61.30 ±4.68	3.95 ±0.71	3.42 ±1.21

Data analysis

Data was computed in a data sheet for each individual. Each ten minutes time series was considered as a unit time and number of activities exhibited by the individual was recorded. The average time (in minutes) for each behaviour was calculated for six animals for each day (only for 6 ½ hours during the night). The standard deviation of the duration of each activity was calculated for each animal with respect to their behaviour.

Results and discussion

Many studies revealed that there is significant change in behaviour of animals in the wild and under captive conditions. A confined condition leads to many stereotypic behaviours expressed by the animals. In the above study, only major activities like walking, digging, feeding, drinking and climbing were taken into account. The dusk i.e. time of sunset, is playing a major role in initiating the activities of the pangolins. It was

recorded that during summer, the pangolins used to come out of their burrows at about 19:00 hours or later whereas in winter (during December and January) they used to come out as early as 16:45 hours. It is noteworthy to record that the activity pattern recorded for each individual is very specific to their own.

Walking: Pangolins exhibiting walking behaviour is a predominant behaviour in captivity. However, individuals housed in different enclosures exhibit different patterns of walking behaviour. When walking, the tail of the pangolin usually does not touch the ground and only touches when performing other activities like feeding and digging. The pangolin housed in cell- 6 (ID: 0006A2ACA3) exhibited repetitive circular motion around itself whereas the pangolins in cell no.- 3 (ID: 0006A2AA6F) had shown repetitive movement along the border of the cell through the feeding trough which is different from the pangolin housed in cell no.- 5. The pangolin of cell no. 5 (ID: 0006A283F9) exhibited a typical pattern of movement of '8' inside the enclosure. It was also recorded that the duration of walking behaviour varied from individuals to individuals. The walking behaviour exhibited by the pangolin of cell no.-2 in captivity recorded for the maximum period of 205.00 ±8.13 minutes (ID: 98102057708) and minimum duration was exhibited by the pangolin of cell no.-1 (ID: 0006A2A395) for a period of 13.16 ± 2.54 minutes. Thus, from the study it was found that the pangolins spent on an average of 155.99 minutes (n=6) in walking per day in captivity.

Digging: Pangolins have a specialized adaptation for fossorial life. They dig burrows with the help of their strong curved claws in the forelegs and the hind legs help throwing soils from the burrows. In the specially designed cells, 1.0 m laterite soil was provided for the pangolins to exhibit their natural instinct of digging. It was noticed that the male pangolin (ID: 98102057708) housed in cell no.- 2 showed maximum average duration (53.10 ±4.41 minutes) of digging behaviour while the average duration of digging behaviour of pangolin of cell no 1 (ID: 0006A2A395) recorded was 2.63 ± 3.24 minutes. The average duration of time spent for digging by the pangolins in captivity was 19.37 minutes (n=6). During the summer, a typical digging behaviour of male pangolin housed in cell no 2 was noticed. This animal after digging, frequently entered the water trough kept inside the enclosure. This peculiar behaviour of digging and then entering in to the water trough may be for regulating the body temperature of the animal.

Feeding: The pangolins at NKZP were provided with their natural food i.e. different developmental stages of red weaver ant (*Oecophylla smaragdina*) in dead condition. As per the physiological need and on the basis of the body weight of the pangolins,

on an average 600 grams of the feed per adult individual per day was given. The feed was provided on the feeding plate in a particular time before the sunset; however, the feeding time is very individual specific. The individual in cell no.- 2 used to come earlier to the feeding plate as compared to other pangolins whereas, the pangolin in cell - 5 used to come out of the burrow at about 19:00 hours to the feeding plate. As far as duration of feeding behaviour is concerned, the pangolin of cell no.- 5 was spending maximum time (71.80 ±4.36 minutes) near the feeding plate while least time (8.15 ± 0.94 minutes) was being spent by the pangolin of cell no.- 1 with an average of 45.05 minutes (n=6) duration for feeding in captivity.

Drinking: Although pangolins drink water as and when required, they may live without water for a longer period (Prater, 2005). Pangolin drinks water by flickering its tongue in water very quickly in an in and out motion. In the above study it was recorded that the pangolin of cell no.- 3 did not drink water during the study period. But the pangolins of cell no.- 2 had spent maximum time in drinking (74.2 ±4.14 minutes) followed by the pangolin of cell no.- 4 (15.3 ±2.84 minutes), cell no.- 5 (13.00 ±1.90 minutes), cell no.- 6 (3.95 ±0.71 minutes) and the pangolin of cell no.- 1 (1.0 ± 0.26 minutes). Thus, water requirement of the pangolins varies from individual to individual. An average time of 17.90 minutes (n=6) was spent by pangolins for drinking per day in captivity.

Climbing: The special feeding habits of the pangolins necessitate them to have arboreal adaptation. They are very good climbers. In the above study it was also recorded that the pangolins exhibited climbing behaviour on the dead tree branches provided inside the enclosure. All the six individuals performed more or less similar climbing behaviour. Besides, climbing on artificial mounds and chain-link mesh wall was also noticed. The male pangolin of cell no.- 2 was associated with maximum average duration (35.00 ±2.01 minutes) of climbing behaviour and the least duration (0.53 minutes) of climbing behaviour was recorded for the pangolin of cell no.- 1. It was recorded that the pangolins in captivity spent on an average 9.96 minutes (n=6) in climbing the dry tree trunk and mounds provided in the enclosure.

Conclusion

From the above study, it is concluded that the pangolins spend most of their time in walking inside the enclosure under simulated conditions of surroundings. The activity starts from the dusk and continues up to the mid night. Although pangolin is a strictly nocturnal animal, the most active time period for the pangolins in general is about one hour after the dusk and continues till 22:00 hours at night under captive

condition. The pattern of their activities varies from individual to individual. The activity pattern was depending upon the season, climatic condition, level of disturbance and the physiological condition of the individual. The activity score reduces drastically during the time of sickness and pregnancy.

Acknowledgements

The authors are thankful to Central Zoo Authority for giving permission and providing financial support for conducting the study. The cooperation of State Forest Department, Government of Orissa is also duly acknowledged for providing necessary support for the establishment of the Indian Pangolin Conservation Centre at Nandankanan Zoological Park. The authors extend their sincere thanks to the veterinary officers and other staff members of the park for extending their support during the study period.

References

Anonymous (2009): Annual Report, Nandankanan Zoological Park, Orissa, India, pp.3.

Botha, J. and Gaudin, T. (2007): An early Pliocene Pangolin (Mammalia: Pholidota) from Langebaanweg, South Africa, Journal of Vertebrate Paleontology, 27 (2): 484 - 491.

Broad, S., Lusmoore, R. and Jenkins, M. (1988): Significant trade in wildlife: a review of selected species in CITES Appendix II, p.51 in Vol. I, Mammals, International Union for Conservation of Nature, Gland, Switzerland, pp. 183.

Burton, J.A. and Pearson, B. (1987): The Collins guide to the rare mammals of the world, The Stephen Green Press, Lexington, Massachusetts, pp. 810.

Gaubert, P. and Antunes, A. (2005): Assessing the taxonomic status of the Palawan pangolin *Manis culionensis* (Pholidota) using discrete morphological characters, Journal of Mammalogy, 86(6): 1068 - 1074.

Heath, M.E. (1995): Manis crassicaudata, *Mammalian Species*, 513: 1 - 4.

Heath, M.E. and Vanderlip, S.L. (1988): Biology, Husbandry and veterinary care of captive Chinese Pangolins (*Manis pentadactyla*), *Zoo Biology*, 7: 293 - 312.

Lekagul, B. and McNeely, J.A. (1998): Mammals of Thailand, Association for the Conservation of Wildlife, Bangkok.

Lim, N.T.L. (2008): Ecological Research and Conservation of Sunda Pangolin *Manis javanica* in Singapore, Proceedings of the workshop on Trade and Conservation of Pangolins native to South and Southeast Asia, 30th June to 2nd July 2008, Singapore Zoo, pp. 90 - 93.

Lim, N.T.L. and Ng, P.K.L. (2008): Home range, activity cycle and natal den usage of a female Sunda pangolin *Manis javanica* (Mammalia: Pholidota) in Singapore, *Endang Species Res*, 4: 233-240.

Pattnaik, A.K. (2008): Enclosure design and enrichment key to the successful conservation breeding of Indian Pangolin (*Manis crassicaudata*) in captivity, Indian Zoo Year Book, Vol. V: 91 - 102.

Prater, H.S. (2005): The book of Indian Animals, 3rd Edn., 12th Reprint, Bombay Natural History Society, Mumbai, Oxford University Press, New Delhi, pp. 301 - 303.

Samiadi, G., Darnaedi, D. and Arief, A.J. (2008): Sunda Pangolin *Manis javanica* in Indonesia: Status and Problems, Proceedings of the workshop on Trade and Conservation of Pangolins native to South and Southeast Asia, 30th June to 2nd July 2008, Singapore Zoo, pp. 12 - 17.

Shi, Y.Q. (1985): Feeding habits on Chinese Pangolin (*Manis pentadactyla*), *Chin. Wildl.* 6: 11 - 13.

Vijayan, M., Yeong, C. and Ling, D. (2008): Captive Management of Malayan Pangolin *Manis javanica* in the Night Safari, Proceedings of the workshop on Trade and Conservation of Pangolins native to South and Southeast Asia, 30th June to 2nd July 2008, Singapore Zoo, pp. 119 - 131.

Wu, S.B., Liu, N.F., Ma, G.Z., Xu, Z.R. and Chen, H. (2003): Habitat selection by Chinese Pangolin (*Manis pentadactyla*) in winter in Dawuling Natural Reserve, *Mammalia*, 67: 493 - 501.

NOCTURNAL BEHAVIOUR OF INDIAN PANGOLIN (*Manis crassicaudata* Gray) IN CAPTIVITY

Satyanarayan Mishra
and S. Panda

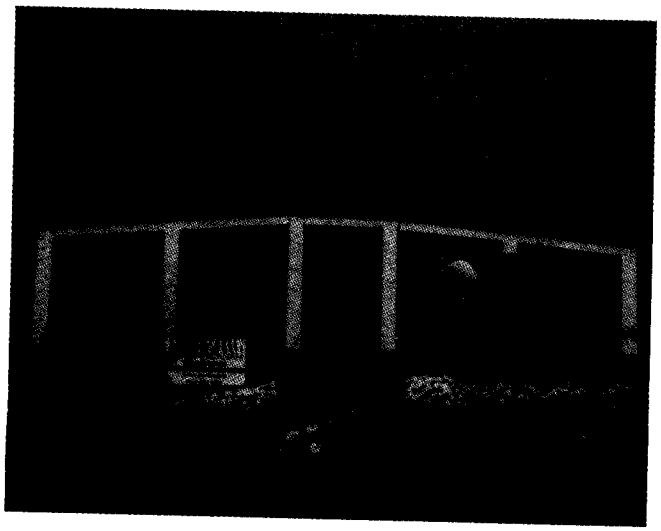
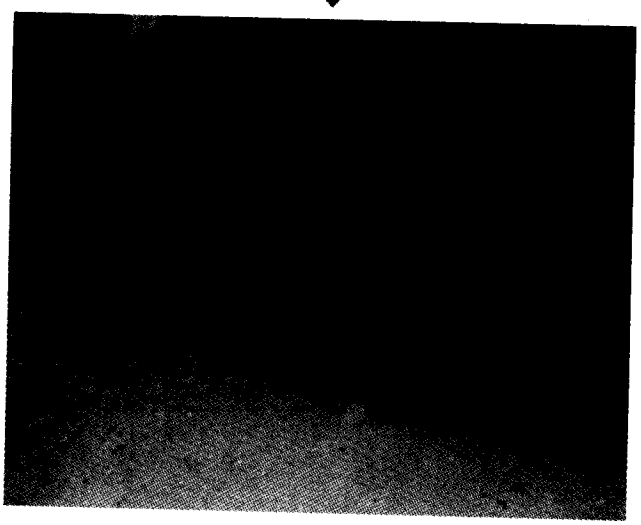


Fig.1: Indian Pangolin Conservation Breeding Centre, Nandankanan Zoological Park, Bhubaneswar

Fig.2: Exhibiting digging behaviour by the pangolin (ID 0006A2AA6F)



Satyanarayan Mishra
and S. Panda

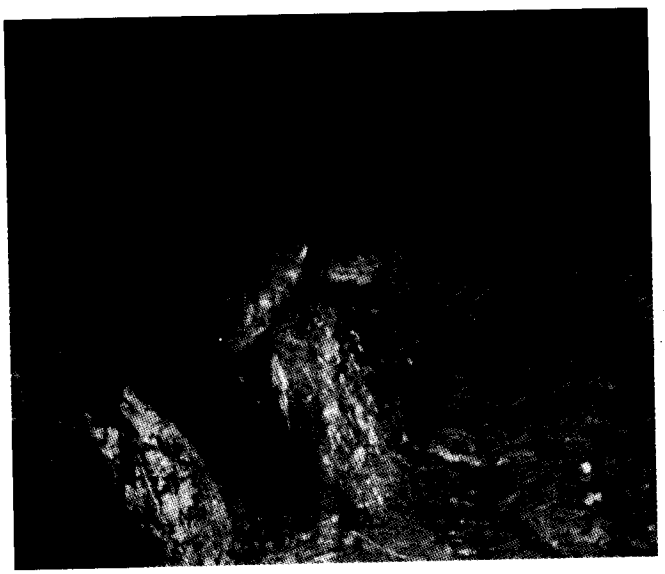


Fig.3: Climbing on dry tree by the pangolin (ID 98102057708)

Fig.4: Pangolin (ID 0006A283F9) drinking water

ENCLOSURE ENRICHMENT OF GHARIAL *(Gavialis gangeticus)* HATCHLINGS IN CAPTIVITY

Dharminder Singh[1] and Nirmaljit Singh[2]

Introduction

The gharial *(Gavialis gangeticus)* belongs to the Order - Crocodilia and Family - Gavialidae. This species is the only surviving member of Family Gavialidae, a long and narrow snouted fish eating crocodilian. It is listed as "Endangered" species in 1990 IUCN Red List of Threatened Animals. It is included in Schedule-1 of Indian Wildlife (Protection) Act, 1972.

The gharial is believed to be the second longest of all living crocodilians after the salt-water crocodile. The adult males may reach around 6-7 m in length. The gharial has a characteristic elongated narrow snout which ends in a bulbous tip. The adult male gharial has a large pot-like cartilaginous mass on the tip of the snout which appears like a "ghara" and hence the name "gharial". The elongated jaws are lined with large number of slender interlocking razor shaped teeth adopted to its fish diet.

The gharial distribution is confined to Indus, Ganges, Brahmaputra and Mahanadi river systems in Indian subcontinent and the Irrawaddy and Arakan river systems in Myanmar (Daniel, 1983). The gharials are currently known to occur in Bangladesh, India, Nepal and Pakistan and formerly occurred in Bhutan (Groombridge, 1982)

This note discusses in brief about the breeding of gharial and enclosure enrichment for successful rearing of gharial hatchlings at M. C. Zoological Park, Chhatbir, Punjab.

Breeding

An adult pair of gharials were kept in an open enclosure with a pond filled with water for breeding. Mating of this pair of gharials was observed on 5th and 6th April 2008. Though egg-laying could not be observed, three gharial hatchlings came out of the sandy exhibit area on 3rd July 2008. After watching the nest site for a few days, the remaining eggs were manually removed from the sandy pit and four more gharial hatchlings were assisted to come out of the cracked eggs on 7th July 2008. All these seven hatchlings remained with the parent gharials in the pond till they were shifted to an enclosure specially designed for rearing of gharials on 15th July, 2008.

1 Director, 2. Senior Veterinary Officer, M.C. Zoological Park, Chhatbir, Dist : Mohali, Punjab

Enclosure for gharial hatchlings

A specially designed enclosure with dimensions of 6.15 m In length, 4.70m in width and 2.00m in height with a pool in the centre was built in advance for rearing and handling of gharial hatchlings. The pool filled with fresh water measured 5.00 m in length, 3.90 m in width and 0.43 m in depth. Enrichment of this enclosure was carried out with the prime objective of improving captive environment of gharial hatchings to enhance their well-being and survival.

Enrichment of enclosure for gharial hatchlings

Keeping in view the natural habitat, biology and behaviour of the gharials, three different enrichments of the hatchlings' enclosure were designed in such a manner so as to support the adaptability of gharial babies with the enclosure environment for better rearing and growth. The details are as follows:

a) The entire enclosure was covered on all the three sides with a transparent plastic sheet (2mm thick). This sheet was water proof and heat absorbent. The front door on the entry side was half covered with the sheet. The rest portion was left open to allow air circulation Prime objective of covering the enclosure was thermoregulation. All sides were covered so as to minimize heat loss from the enclosure and maintain an ambient temperature and environment suitable for survival and growth of gharial hatchlings. Two thermometers were hung, one inside the enclosure and another at the entrance of the enclosure so that regular monitoring of the temperature could be done.

b) Another enrichment of enclosure was designed to maintain optimum temperature. A specially designed brooder shaped iron cover structure with provision of four bulbs (200 watts each) was installed at two different corners of the enclosure. These structures were hung from the roof with an iron wire and kept at a height of 0.45m from the floor. Purpose of bulbs was to provide heat and maintain ideal temperature for growth and exhibition of their natural behaviour. Heat generated by bulbs added warmth to sandy exhibit and hatchlings had a wonderful time wandering about. This enrichment was of great utility and significance as the hatchlings mostly during the day time (for a period of 6-8 hours) remained under these structures. This whole system was supported by a generator set in case of emergency so that temperature is maintained during 24 hours in the event of electricity failure. It may be mentioned here that the institution falls under a rural electricity supply feeder and the electric supply fails frequently.

c) Two wooden logs 1.20m long and 0.30 m wide were kept in the open sandy exhibit area adjoining the above structures. Hatchlings liked this noval approach and rested for hours together on wooden logs.

The entire enclosure was such that movements of gharial hatchlings on sandy area could be easily identified. Specific wavy pattern of movement of hatchlings was observed as they moved through sandy exhibit area and entered the pond to take their fish diet.

These enrichments of the gharial hatchling enclosure stimulated natural behaviour of gharials, their healthy growth, survival and adaptability to surroundings in a perfect manner.

Feeding

Small fish fingerlings (approximately 1000 in number) were released into the pool of the enclosure. Hatchlings relished the diet and as the growth of gharials progressed, the size of fish fingerlings was increased. Fish was replaced in the pool after an interval of 10 days.

Primary health care

Primary health care of gharial hatchlings involved basic two strategies:

- Cleaning and disinfection with potassium permanganate lotion at frequent intervals.
- Regular dose of multivitamins i.e Vimeral containing: Vitamin A-12,000 IU, Vitamin D-6000 IU, Vitamin E-48 mg, Vitamin B12-20 mcg, were fed to fishes which were their diet for better growth of hatchlings.

Growth

The details of growth in length observed from the 15th day to 180th day are given in the Table.

Table

Age	Length
15th day	13 inches (32.5 cm)
30th day	14 inches (35.0cm)
60th day	16 inches (40.0cm)
90th day	19 inches (47.5 cm)
120th day	22 inches (55.0cm)
150th day	24 inches(60.0cm)
180th day	28 inches (70.0cm)

Conclusion

By adopting the above enrichments of gharial hatchlings' enclosure the prime objective of increasing their behavioural repertoire has been achieved. Positive utilization of the whole enclosure space and enhancement of the ability of young gharials to cope with these novelty has been safely met. This enrichment has played a vital role in maximizing good animal welfare both in terms of health (increasing activities, optimum growth) and physiological well being of the gharial hatchlings.

References

Daniel, J. C. (1983): The Book of Indian Reptiles, Bombay Natural History Society, Mimbai. pp.15-16.

Groombridge, Brain (1982) : The IUCN Amphibia - Reptilia Red Data Book, Part-I. International Union for Conservation of Nature and Natural Resources (IUCN), Gland Switzerland pp.405-413.

POIKILOCYTOSIS AND ANISOCYTOSIS IN CAPTIVE SPOTTED DEER OF NANDANKANAN ZOOLOGICAL PARK, BHUBANESWAR

G.N. Bhujabal[1], P.K. Mohanty[2], S. Panda[3] and P.K. Roy[4]

Abstract

This study aims at the investigation on the red blood cell (RBC) polymorphism of the spotted deer *Axis axis.* For this study, venous blood of two spotted deer was collected after chemical restraint of the animals and thin peripheral blood smears were prepared and analyzed. Crescent or sickle cell RBCs along with varied degrees of poikilocytosis and anisocytosis were recorded. The polymorphic forms of RBCs such as circular biconcave, crescent or sickle, holly leaf, tear drop and match stick were observed. The mean dry cell diameter of the normal RBCs is 4.53µm ranging from 3.5µm to5.5 µm. The haemoglobin concentration of the animals is 12.6gm/dl and14gm/dl which is slightly less than the reference values. It is interesting to note that no symptomatic disorders were found in spite of these polymorphic red cells.

Key words

Axis axis, RBCs, poikilocytosis, anisocytosis, crescent or sickle, *holly leaf, tear* drop, match stick, dry red cell diameter, microcyte, macrocyte.

Introduction

Axis axis is commonly called as spotted deer or chital. It is the most common deer species of Indian forests and belongs to the Order-Artiodactyla, Family-Cervidae of Class-Mammalia. Red blood cell polymorphism in cervids was first reported by Gulliver in 1875. Since then, it was reported by many authors in different species of deer worldwide. Reports on haematological studies including red blood cell polymorphism on different deer species are on record.

Naik et al.(1964) reported microcytic red blood cells in *Axis axis* with 1-50% crescent or sickle cells in saline preparation and 100% sickling in metabisulphite preparation with haemoglobin 16-17gm/dl. Shrivastava *et al.* (1995) observed haematological parameters of dry ground barasingha (*Cervus duvauceli branderi*).

1. and 2. P.G. Department of Zoology, Utkal University, Vani Vihar, Bhubaneswar-751 004, Orissa. mailtobhujabal@sify.com / gbhujabal.bhujabal@gmail.com 3 and 4. Nandankanan Zoological Park, Bhubaneswar, Orissa.

Victor *et al.* (1999) studied basic haematological values in some wild ruminants in captivity. Nimitsuntiwong *et al.* (2000) reported the haematological values on captive Eld's-brow antelered deer (*Cervus eldi thamin*) in Thailand.

Mohri and Aslani (2000) studied the haematology of fallow deer (*Dama mesopotamica*) in both physical and chemical capture method. Tomkins and Jonsson (2005) reported the haematological values of young male rusa deer (*Cervus timorensis*).Vengust *et al.* (2006) investigated the haematological values of fallow deer (*Dama dama*). Gupta *et al.* (2007) studied the haematological values of chital (*Axis axis*) and barking deer (*Muntiacus muntjak*) in semi-captive conditions. Topal *et al.* (2010) investigated the effect of capture method on haematological and serum biochemical values of red deer (*Cervus elaphus*).

Since haematological reports on *Axis axis* is inadequate in India including Orissa, the present study is aimed at the analysis of the red cell polymorphism of *Axis axis.*

Materials and Methods

Venous blood was collected from the saphenous vein of two male spotted deer aged about 7 years of Nandankanan Zoological Park, Bhubaneswar, Orissa, India. The blood samples were collected and processed immediately after tranquilization, while the animals were under treatment for foot injury. Thin blood smears were prepared after collecting the blood. The smears were air dried and stained with Leishman's stain for 10 minutes. After air drying, the smears were observed under low, high and oil immersion objectives of a microscope. Varied degrees of poikilocytosis and anisocytosis have been observed, analyzed and recorded.

Results and Discussion

The normal shape of the mammalian RBC is circular and biconcave. The various shapes of RBCs, observed in the smears are crescent or sickle and tear drop (Fig. 1), holly leaf shape (Fig. 2)and match stick (Fig. 3) along with the normal circular and biconcave cells. The population of polymorphic red blood cells are found in the order, normal red blood cells>crescent or sickle cells>match sticks cells>holly leaf cells>tear drop cells (Table-1). These polymorphic forms are found directly from the peripheral blood smear without saline or metabisulphite preparation.

The average size of the circular biconcave red blood cells is calculated 4.53µm within the range 3.5µm to5.5 µm. The microcytes are 2.5- 3µm and macrocytes are 7-9µm (Fig. 4) in size in diameter. The size of the match stick cells is 7.85µm on an

average (Table-2). The sickled red cells are resistant to rouleaux formation and the normal red cells have a less tendency towards it. Hardly, two or three cells together form rouleaux, towards the thick area of the smear (Fig. 5). Irregular shaped RBCs have been observed to be common in the smear (Fig. 6).

The sickling phenomenon is a taxonomical characteristic in Family Cervidae with few exceptions like muntjac deer and rein deer (Feldman *et al.*, 2000). The authors also stated that sickling occurs due to variant types of haemoglobins in different red cells of cervids. For example, haemoglobin type II alone or in combination with I, III and IVb produces match stick red cells subsequent to sickling. Haemoglobin IVa produces burr cells and red cells having haemoglobin type V and VII never produce sickle cells. The red cells circulate in vivo as normal, but gets sickled when becomes stagnant or dry shortly after phlebotomy due to oxygenation. Varying degrees of sickling is found in different species of cervids. In *Axis axis,* it is 40 % including the polymorphic red blood cells without the treatment of saline and metabisulphite. The red blood cells other than the crescent or sickle cells are also associated with mild degrees of anisocytosis. The polymorphism in red cells of deer is an interesting laboratory observation, but produces apparently no deleterious effect on the animals. Red blood cells containing haemoglobin IVa assume burr shape as stated above. These burr cells are not observed from the blood smears of these two male *Axis axis.* Therefore, it needs further investigations with large sample size to establish the absence of haemoglobin IVa as a species specific character of *Axis axis.*

Table-1 : Percentage of polymorphic red blood cells (RBC)

Sl No	Types of RBCs	Percentage
1	Normal	60
2	Crescent	20
3	Match stick	10
4	Holly leaf	09
5	Tear drop	01

Table-2 : Morphometry of red blood cells(RBC)

Sl No	Types of RBCs	Size(range) (µm)	Mean (µm)
1	Normocytes	3.5-5.5	4.53
2	Microcytes	2.5-3.0	2.63
3	Macrocytes	7.0-9.0	8.10
4	Match stick	6.0-8.5	7.85

POIKILOCYTOSIS AND ANISOCYTOSIS IN CAPTIVE SPOTTED DEER OF NANDANKANAN ZOOLOGICAL PARK, BHUBANESWAR

G.N. Bhujabal, P.K. Mohanty, S. Panda and P.K.Roy

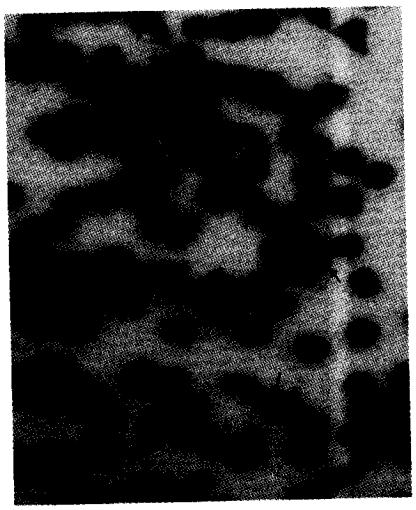


Fig. 1 Crescent or sickle and tear drop RBC

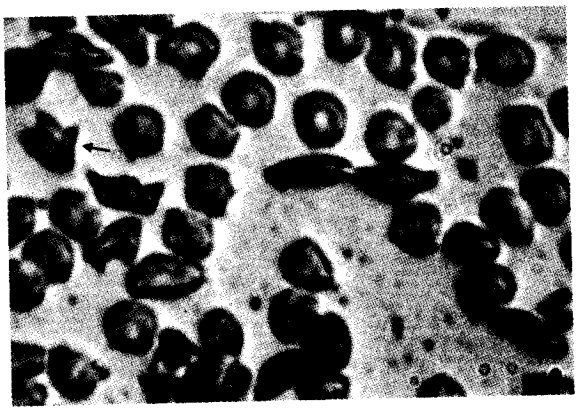


Fig. 2 Holly leaf RBC

Fig. 3 Match stick RBC

POIKILOCYTOSIS AND ANISOCYTOSIS IN CAPTIVE SPOTTED DEER OF NANDANKANAN ZOOLOGICAL PARK, BHUBANESWAR

G.N. Bhujabal, P.K. Mohanty, S. Panda and P.K.Roy

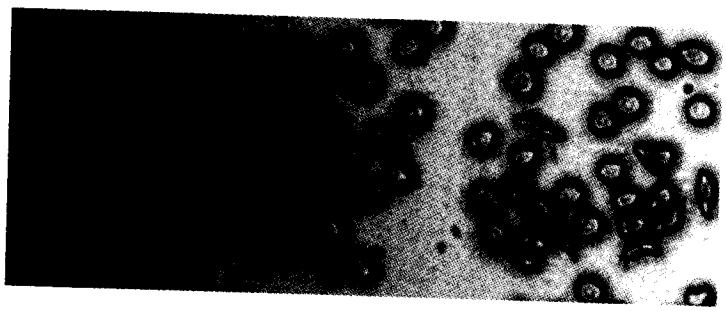


Fig. 4 Microcytes (block arrow) and macrocytes (thin arrow)

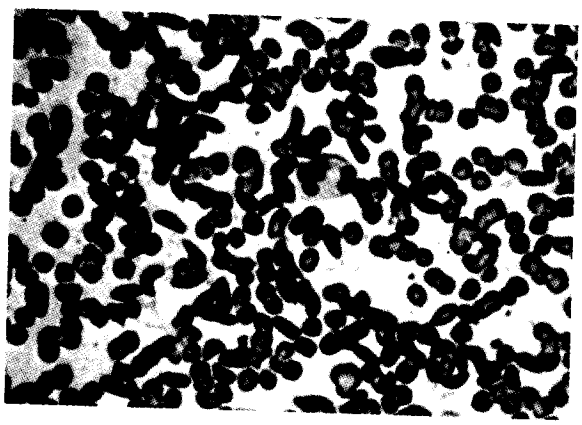


Fig.5 Rouleaux formation

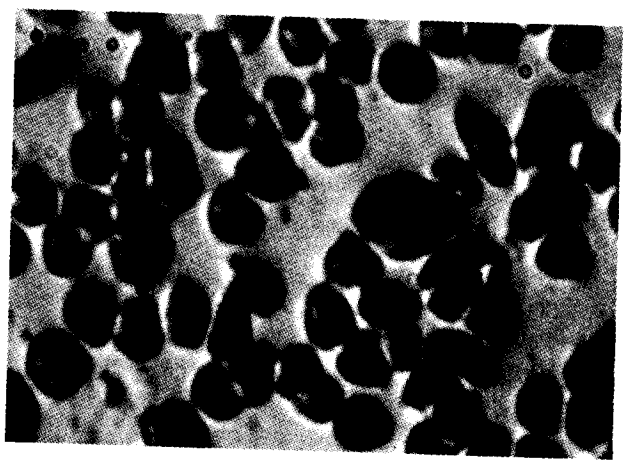


Fig. 6 Irregular RBC

Acknowledgements

The authors owe their thanks to the Head, P.G.Department of Zoology, Utkal University, Vani Vihar, Bhubaneswar-751 004 for permitting to undertake the investigations in the Cytogenetics laboratory of Utkal University. Thanks are also due to Dy. Inspector General of Forests (Wildlife), Ministry of Environment and Forest, Government of India and PCCF Wildlife & Chief Wildlife Warden, Government of Orissa for their kind permission to undertake this study. Sri S.N. Mohapatra,I.F.S., Dy. Director, Dr. Alok Kumar Das and Dr. Sarat Kumar Sahu, Veterinary Officers, Nandankanan Zoological Park, Bhubaneswar are highly acknowledged for technical support.

References

Feldman, B.F.; Zoseph, G.Z.; Nemi, C.J. and Schalm, O.W.(2000): Schalm's Veterinary Haematology, 1179-1183.

Gupta, A.R.; Patra,R.C.; Saini, M. and Swarup, D. (2007): Haematology and serum biochemistry of chital(*Axis axis*) and barking deer (*Muntiacus muntjak*) reared in semi-captivity. Veterinary Research Communications, 31(7):801-808.

Mohri,M. and Aslani, M.R.(2000): Haematology of Persian fallow deer-*Dama mesopotamica*. Comparative Haematology International, 17(2) 29-34.

Naik,S.N.; Bhatia, H.M.; Baxi, A.J. and Naik,P.V. (1964): Haematological study of Indian spotted deer(Axis deer). Journal of Experimental Zoology, 155(2):231-235.

Nimitsuntiwong,W; Homswat,U.; Boonprakob,U.; Kaewmokul,S and Schmi, A. (2000): Haematological and plasma biochemical values in captive Eld's-brow antlered deer (*Cervus eldi thamin*). Journal of Veterinary Medical Science, 62(1):93-95.

Shrivastava,A.B. and Gopal,R. (1995): An observation on haematological parameters of dry ground Barasingha.(*Cervus Duvauceli branderi*). Zoos' Print, 10 (6): 12-14.

Tomkins, N.W. and Jonsson J. (2005): Haematological values of young male rusa deer (*Cervus timorensis*). Australian Veterinary Journal, 83(8):496-498.

Topal, A.; Gul,N.Y. and Yani, K. (2010): Effect of capture method on haematological and serum biochemical values of red deer (*Cervus elaphus*) in Turkey. Journal of Animal and Veterinary Advances, 9(8):1227-1231.

Vengust, G.; Zele, D.; Kobal, S. and Bidovec, A. (2006): Haematological and biochemical values of farmed fallow deer (*Dama dama*) after using different methods of capture. Veterinarski Arhiv,76 (Suppl.):189-197.

Victor, I.; Peinado, J.F.C. and Palomeque, J.(1999): Basic haematological values in some wild ruminants in captivity. Comparative Biochemistry and Physiology-Part-A: Molecular and Integrative Physiology, 124(2):199-203.

LIST OF RECOGNISED INDIAN ZOOS WITH THEIR ADDRESSES

ANDAMAN & NICOBAR ISLANDS

1.	**Name of Zoo**	**Biological Park, Chidiyatapu/Haddo, Andaman & Nicobar Islands**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Deputy Conservator of Forests, Wildlife Division - 1Van Sadan, Haddo, Port Blair - 744 102, Andaman & Nicobar Islands, UT of Andaman & Nicobar Islands
C.	Telephone No.	03192-232816/233549, Fax - 03192-233549
E.	E-mail ID	cwlw@cal3.vsnl.net.in

ANDHRA PRADESH

1.	**Name of Zoo**	**Indira Gandhi Zoological Park, Visakhapatnam, Andhra Pradesh**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Curator, India Gandhi Zoological Park, Visakhapatnam - 530 040, Andhra Pradesh.
C.	Telephone No.	0891-2010500, Fax - 0891-2552081
E.	E-mail ID	zoo_vzg@efs.gov.in
2.	**Name of Zoo**	**Sri Venkateswara Zoological Park, Tirupati, Andhra Pradesh**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Curator, Sri Venkateswara Zoological Park, Pudipatla Post, Tirupati - 517 505, Andhra Pradesh.
C.	Telephone No.	0877-2249235, Fax - 0877-2248029
E.	E-mail ID	trupatizoo@yahoo.co.in
F.	Web site	www.svzoo.org
3.	**Name of Zoo**	**Nehru Zoological Park, Hyderabad, Andhra Pradesh**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Director Nehru Zoological Park, Bahadur Pura, Hyderabad - 500 064, Andhra Pradesh.
C.	Telephone No.	040-24477355, Fax - 040-24473253
E.	E-mail ID	hydzoo@rediffmail.com

4.	**Name of Zoo**	**Pillalamarri Deer Park, Mahabubnagar (Andhra Pradesh).**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer, Mahaboob Nagar Forest Division, Mahaboob Nagar - 509 001, Andhra Pradesh.
C.	Telephone No.	08542-242237, Fax - 08542-250110
5.	**Name of Zoo**	**Deer Park, Chittoor, Andhra Pradesh**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer, Chittor (East) Deer Park, Chittor (Andhra Pradesh) Chittoor East (Wildlife) Division, Chittoor, Andhra Pradesh.
C.	Telephone No.	08572-236341
6.	**Name of Zoo**	**Deer Park, NFCL, Kakinada (Andhra Pradesh)**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Deputy General Manager (P&A) Deer Park, NFCL, Kakinada (Andhra Pradesh) Nagarjuna Fertilizers and Chemicals Limited, Nagarjuna Road, Kakinada - 533 003, Andhra Pradesh.
C.	Telephone No.	0884-2360390
D.	Fax No.	0884-2362084/2365020/ 2360041
7.	**Name of Zoo**	**Deer Park, Satyam Technology Centre, Village Bhadurpally, Ranga Reddy District (Andhra Pradesh)**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Location Manger, Deer Park, Satyam Technology Centre, Bahadurpally Village, Qutubullapur Mandal, R.R. District, Hyderabad - 500 043, Andhra Pradesh.
C.	Telephone No.	040-23097505, Fax - 040-23097515
8.	**Name of Zoo**	**GVK Power Plant Deer Park, Jegurupadu, (East Godavary Distt.) Andhra Pradesh**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Manager (Project Development) Deer Park, GVK Power Plant, 235 MW CCPP, Jegurupadu, East Godavari District, Andhra Pradesh - 533 126.
C.	Telephone No.	0883-2453179/948
D.	Fax No.	0883-2453180

9.	**Name of Zoo**	**Himayath Sagar, Mini Zoo (Ranga Reddy District) Andhra Pradesh**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Curator, Himayat Sagar Mini Zoo, Himayat Sagar Village, Rejender Nagar Mandal, Ranga Reddy District, Andhra Pradesh.
C.	Telephone No.	040-24016845, Fax - 040-27902665
D.	E-mail ID	som@gvk.com
F.	Web site	www.gvk.com
10.	**Name of Zoo**	**Deer Park, Jawahar Lake Tourist Complex, Shamirpet, Hyderabad (Andhra Pradesh).**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer, Deer Park, Jawahar Lake Tourist Complex, Wildlife Mangement Division, Hyderabad (Andhra Pradesh).
11.	**Name of Zoo**	**Van Vigyan Kendra, Warangal (Andhra Pradesh).**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer(WLM) Warangal Van Vigyan Kendra, Wildlife Management Division, Warangal, Andhra Pradesh.
C.	Telephone No.	08712-2431546/2524256
12.	**Name of Zoo**	**Deer Park, Kandaleru, Nellore (Andhra Pradesh).**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Deputy Conservator of Forests (TGP) Nellore Deer Park, Kandaleru, Compensatory Afforestation Project, (Telugu Ganga Project), Division Nellore, Andhra Pradesh.
13.	**Name of Zoo**	**Deer Park, Kesoram Cement, Basant nagar (Karim Nagar Distt.), Andhra Pradesh**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Asst. G.M. (Civil)Deer Park, Kesoram Cement, Prop: Kesoram Industries Ltd., Basantnagar - 505 187, District Karimnagar, Andhra Pradesh.
C.	Telephone No.	08728-228141 Fax - 08728-228160
E.	E-mail ID	kaa_kesoram3@sancharnet.in

14. Name of Zoo	**Vishakha Society for Prevention of Cruelty to Animals Rescue Centre, Marikavalasa (Visakhapatnam), Andhra Pradesh**
A. Category of Zoo	Rescue Centre
B. Contact Details	Hon. President, Visakha Society for Prevention of Cruelty to Animals 26-15-200, Main Road, Visakhapatnam - 530 001, Andhra Pradesh
C. Telephone No.	0891-3296217/ 3295522
15. Name of Zoo	**Sanghi Deer Park, Sanghi Nagar, Andhra Pradesh**
A. Category of Zoo	Mini Zoo
B. Contact Details	Manager, Sanghi Plantation Limited, Sanghi Nagar, Hayathnagar, R. R. District - 501 511 (Andhra Pradesh)
C. Telephone No.	08415-242232, 9391912159
16. Name of Zoo	**Karim Nagar Deer Park, Karim Nagar, Andhra Pradesh**
A. Category of Zoo	Mini Zoo
B. Contact Details	Divisional Forest Officer, Karimnagar (West) Divisional Forest Officer, Karimnagr West, Andhra Pradesh
17. Name of Zoo	**Karuna Society for Animals and Nature, Beedupalli, Rayalaseema, Andhra Pradesh**
A. Category of Zoo	Rescue Centre/ Mini Zoo
B. Contact Details	Secretary 2/138/C, Karuna Vilayam, Behind S. T. Quarters Praenthi Nilayam (PO), Anantpur District, Andhra Pradesh
C. Telephone No.	08555-287214
E. E-mail ID	karunasociety@gmail.com
F. Web site	www.karunasociety.org
18. Name of Zoo	**Kinnerasani Deer Park, Kinnersani (Andhra Pradesh).**
A. Category of Zoo	Mini Zoo
B. Contact Details	Divisional Forest Officer Wildlife Management Division Kinnerasani Wildlife Sanctuary, Paloncha, Distt. Khammam (Andhra Pradesh)
C. Telephone No.	08744-254125 (Tele fax)
19. Name of Zoo	**Deer Park, Tirumala Hills, Andhra Pradesh**
A. Category of Zoo	Deer Park/ Mini Zoo
B. Contact Details	Divisional Forest Officer, Tirumala Tirupati Devasthanams, Distt. Chittoor (Andhra Pradesh)

C.	Telephone No.	0877-2263870 (Tele fax)

ARUNACHAL PRADESH

1.	**Name of Zoo**	**Centre for Bear Rehabilitation and Conservation (CBRC) Pakke, Arunachal Pradesh**
A.	Category of Zoo	Rescue Centre/ Mini Zoo
B.	Contact Details	Divisional Forest Officer, Pakke Tiger Reserve, Seijosa, East Kameng District, Arunachal Pradesh
C.	Telephone No.	03778-222229, Fax - 03778-222230
2.	**Name of Zoo**	**Biological Park, Itanagar, Arunachal Pradesh**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Director Biological Park, P.O. - Naharlagun, Itanagar - 791 110,Arunachal Pradesh.
C.	Telephone No.	0360-2203533/2203534, Fax - 0360-2244416
3.	**Name of Zoo**	**Mini Zoo, Roing, Arunachal Pradesh**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer Mehao Wildlife Sanctuary Division, Roing - 792 110, District - Lower Dibang Valley, (Arunachal Pradesh).
C.	Telephone/FAX No.	03803-222408
4.	**Name of Zoo**	**Mini Zoo, Miao, Arunachal Pradesh**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer Kamlang Wildlife Sanctuary Division, Miao - 792 122, District - Changlang, Arunachal Pradesh.
C.	Telephone/FAX No.	03807-222 222
5.	**Name of Zoo**	**Wildlife Centre, Tawang, Arunachal Pradesh**
A.	Category of Zoo	Conservation Breeding Centre
B.	Contact Details	Divisional Forest Officer, Tawang, Arunachal Pradesh
C.	Telephone No.	03794-222041 (Tele fax), 222241 (Res.)

ASSAM

1.	**Name of Zoo**	**Assam State Zoo, Guwahati, Assam**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Divisional Forest Officer Assam State Zoo Division, R.G. Baruah Road, Guwahati - 781 005,Assam.

C.	Telephone No.	0361-2201363
E.	E-mail ID	assamstatezoo@yahoo.com
2.	**Name of Zoo**	**Centre for Wildlife Rehabilitation and Conservation (CWRC), Borjuri, Assam**
A.	Category of Zoo	Rescue Centre/ Mini Zoo
B.	Contact Details	Director, Kaziranga National Park, Bokakhat - 785 612, Distt. - Golaghat, Assam.
C.	Telephone No.	03776-269563/ 269564, Fax - 03776-269688
E.	E-mail ID	cwrcmvs@yahoo.co.in / mailto:dfobsp@rediffmail.com
F.	Web site	Wildlifetrust of India.org.in
3.	**Name of Zoo**	**Pigmy Hog Conservation Programme, Basistha (Guwahati), Assam**
A.	Category of Zoo	Conservation Breeding Centre
B.	Contact Details	Project Director PHCP, Indira Nagar, Basistha, Guwahati - 781 029 , Assam
C.	Telephone No.	0361-2231312, 09435016247
D.	E-mail ID	pygmyhog@gmail.com
4.	**Name of Zoo**	**Bijni Deer Park, Bongaigaon, Assam**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer, Kokrajhar O/O Divisional Forest Officer, Social Forestry Division, Kokrajhar, Assam
C.	Telephone No.	03661-270210 Fax - 03661-270694
5.	**Name of Zoo**	**Rhino Circus**
A.	Category of Zoo	Circus
B.	Contact Details	Managing Director ,Rhino Circus, Ward No. 14, Khelmati North Lakhimpur Town, Distt. Lakhimpur - 787 001, Assam.
C.	Telephone No.	09474136739/ 990872924
6.	**Name of Zoo**	**Moonlight Circus**
A.	Category of Zoo	Circus
B.	Contact Details	Manager, Moonlight Circus,P.O. Khelmati, Ward No. 14,North Lakhimpur,Pin - 787 001, Distt. Lakhimpurt,Assam.
C.	Telephone No.	09435085924/ 03752-2244829

BIHAR

1.	**Name of Zoo**	**Sanjay Gandhi Biological Park, Patna, Bihar**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Director Sanjay Gandhi Biological Park, Patna - 800 001, Bihar.
C.	Telephone No.	0612-2223455 (O) Fax - 0612-2223455

CHHATTISGARH

1.	**Name of Zoo**	**Kanan Pendari Zoological Garden, Bilaspur, Chhattisgarh**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Divisional Forest Officer Bilaspur Forest Division, Bilaspur - 495 001 (Chhattisgarh)
C.	Telephone No.	07752-226082
E.	E-mail ID	dfobsp@rediffmail.com
2.	**Name of Zoo**	**Maitri Baug Zoo, Bhilai, Chhatisgarh**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Senior Manager (Horticulture) Steel Authority of India Limited, Bhilai Steel Plant,Bhilai - 490 001, Distt. Durg, Chhattisgarh.
C.	Telephone No.	0788-2898480/ 2223491, Fax - 0788-2221181/ 2222890
E.	E-mail ID	sailbsb@sancharnet.in
F.	Web site	www.sail.co.in
3.	**Name of Zoo**	**Nandan Van Zoo, Raipur**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Divisional Forest Officer, Raipur Forest Division, Raja Talab, Raipur, Chhatisgarh
C.	Telephone/FAX No.	0771-2427640
E.	E-mail ID	dfo_raipur@redifmail.com
4.	**Name of Zoo**	**Wild buffalo Conservation Breeding Centre, Kuturu (Distt. Bijapur), Chhatisgarh**
A.	Category of Zoo	Conservation Breeding Centre
B.	Contact Details	Director, Indravai Tiger Reserve, PO: Jagdalpur, Bustar, Chhatisgarh - 494 001

DADRA & NAGAR HAVELI

1.	**Name of Zoo**	**Vasona Tiger Safari, Silvassa, Dadra & Nagar Haveli**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Assistant Conservator of Forests (Wildlife) Van Bhawan, At & P.O. Silvassa - 396 230,(Dadra & Nager Haveli), U.T. of Dadra & Nager Haveli
C.	Telephone/FAX No.	0260-2643048
E.	E-mail ID	dnh_forestwl@rediffmail.com

DELHI

1	**Name of Zoo**	**National Zoological Park, New Delhi**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Director National Zoological Park, Near Purana Quila, Mathura Road, New Delhi - 110 003.
C.	Telephone No.	011-24359825, Fax - 011-24352408
D.	E-mail ID	delhizoo@vsnl.net
F.	Web site	www.delhizoo.org
2.	**Name of Zoo**	**A. N. Jha Deer Park, Hauz Khas, New Delhi**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Deputy Director (Horticulture), Horticulture Division No. IV, Delhi Development Authority, Division No. 4, Sheikh Sarai, Phase -I, New Delhi - 110 017
C.	Telephone No.	011-23378078, FAX- 011-24624017
D.	Web site	www.dda.org.in
3.	**Name of Zoo**	**Gemini Circus**
A.	Category of Zoo	Circus
B.	Contact Details	Gemini Circus, C-508, UNESCO Apartments,Plot No. 55, Patparganj, New Delhi - 110 092.
C.	Telephone No.	09971031874

GOA

1.	**Name of Zoo**	**Bondla Zoo, Goa, Panaji**
A.	Category of Zoo	Small

B.	Contact Details	Deputy Conservator of Forests (Wildlife and Ecotourism), 4th Floor, Junta House,Panaji - 403 001,Goa
C.	Telephone/FAX No.	0832-2229701
E.	E-mail ID	goawildlife@yahoo.co.in / mailto:sundervan@ceeindia.org
F.	Web site	www.goaforest.com

GUJARAT

1.	**Name of Zoo**	**Kamla Nehru Zoological Park, Ahmedabad, Gujarat**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Zoo Superintendent, Kamla Nehru Zoological Garden, Kankaria, Ahmedabad - 380 008, Gujarat.
C.	Telephone No.	079-25463415/ 25463818/ 32984115, Fax - 079-25350926
E.	E-mail ID	ahmedabadzoo@icenet.net
F.	Web site	www.ahmedabadzoo.com
2.	**Name of Zoo**	**Sakkarbaug Zoo, Junagarh, Gujarat**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Zoo Officer Sakkarbaug Zoo, Outside of Majevadi Gate, Rajkot Road, Junagarh - 362 003, Gujarat
C.	Telephone No.	0285-2660235, Fax - 0285-2632900
3.	**Name of Zoo**	**Dr. Shyama Prasad Mukherjee Zoological Garden, Surat, Gujarat**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Zoo Superintendent Offie of Superintendent of Zoo & Aquarium, Surat Municipal Corporation, Muglisara, Surat - 395 003 (Gujarat)
C.	Telephone No.	0261-2423751/ 2422285-87/0091-9376844856 (Mo.)
D.	Fax No.	0261-2422110/ 2451935
E.	E-mail ID	mctigersmc@hotmail.com/ mehtadrprafull@yahoo.co.in
F.	Web site	www.suratmunicipal.org/ www.smc.gov.in
4.	**Name of Zoo**	**Shree Sayajibaug Zoo, Vadodara, Gujarat**
A.	Category of Zoo	Medium Zoo
B.	Contact Details	Curator, Sayajibaug Zoo, Municipal Corporación, Vadodara - 390 018, Guajarat.
C.	Telephone No.	0265-2784079, Fax - 0265-2433060

D.	Fax No.	01262-211231 & 01262-212191
7.	**Name of Zoo**	**Wildlife Rescue Centre, Gopalpur Khera, (Distt. Gurgaon), Haryana**
A.	Category of Zoo	Rescue Centre
B.	Contact Details	Chairman Wildlife S.O.S. (R), D-210, Defence Colony, New Delhi - 110 024.
C.	Telephone No.	011-24621939
8.	**Name of Zoo**	**Vulture Conservation Breeding Centre, Pinjore, Haryana**
A.	Category of Zoo	Rescue Centre/ Conservation Breeding Centre
B.	Contact Details	In charge Vulture Conservation Breeding Centre, B-3, Forest Complex, Pinjore - 134 102, Haryana.
C.	Telephone No.	01733-232924, Fax - 01733 - 264426
E.	E-mail ID	jatayuprakash@sify.com
9.	**Name of Zoo**	**Chinkara Breeding Centre, Kairu, Bhiwani, Haryana**
A.	Category of Zoo	Conservation Breeding Centre/ Mini Zoo
B.	Contact Details	Divisional Wildlife Officer Rohtak Zoo, Chankyapuri, H.No. 69, Near Railway Crossing, Shila Bye Pass Road, Rohtak, Haryana.
C.	Telephone No.	01262-211231 (O)
D.	Fax No.	01262-211231 & 01262-212191
10.	**Name of Zoo**	**Pheasants Breeding Centre, Morni (Panchkula), Haryana**
A.	Category of Zoo	Conservation Breeding Centre/ Mini Zoo
B.	Contact Details	Deputy Chief Wildlife Warden, Van Bhawan, Plot No. C-18, Sector 6, Panchkula (Haryana)

HIMACHAL PRADESH

1.	**Name of Zoo**	**Himalayan Nature Park, Kufri, Shimla, Himachal Pradesh**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Divisional Forest Officer, Zoos and Rescue Centre, Mist Chamber,Khallini, Shimla - 171 002 (Himachal Pradesh).
C.	Telephone No.	0177-2623993(O) Fax - 0177-26239930177-2648249 (Zoo)
2.	**Name of Zoo**	**Sarahan Pheasantry, Sarahan (Shimla), Himachal Pradesh**
A.	Category of Zoo	Mini Zoo

B.	Contact Details	Divisional Forest Officer, Wildlife Division Sarahan, Vill. P.O. Sarahan - 172 102, Tahsil - Rampur, Bushahr, Distt. Shimla, Himachal Pradesh
C.	Telephone No.	01782-274232, Fax - 01782-274544
3.	**Name of Zoo**	**Dhauladhar Nature Park, Gopalpur, Himachal Pradesh**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Divisional Forest Officer (Wildlife), Hamirpur, HP Wildlife Division, Hamirpur - 177 001 (H.P.)
C.	Telephone/FAX No.	01972-222319
E.	E-mail ID	dfpwlham-hp@nic.in
4.	**Name of Zoo**	**Renuka Mini Zoo, Renukaji, Himachal Pradesh**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer, Wildlife Division, Shimla (HP), Wildlife Division, Mist Chamber, Khallini, Shimla - 171 002 (H.P.).
C.	Telephone No.	0177-2623993(O) Fax - 0177-26239930177-2648249 (Zoo)
E.	E-mail ID	nagesh_guleria@yahoo.com
5.	**Name of Zoo**	**Rescue and Rehabilitation Home, Tutikandi, Himachal Pradesh**
A.	Category of Zoo	Rescue Centre
B.	Contact Details	Divisional Forest Officer,Zoos & Rescue Centre Division, Shimla (HP)
C.	Telephone No.	Wildlife Division,Mist Chambder, Khallini, Shimla - 171 002 (H. P.).
6.	**Name of Zoo**	**Nehru Pheasantry, Manali, Himachal Pradesh**
A.	Category of Zoo	Conservation Breeding Centre/ Mini Zoo
B.	Contact Details	Field Director Great Himalayan National Park, Shamshi, Distt. - Kullu (Himachal Pradesh)
C.	Telephone No.	1902-65320
7.	**Name of Zoo**	**Rewalsar Mini Zoo, Rewalsar (Mandi), Himachal Pradesh**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer (Wildlife), Kullu (Himachal Pradesh)

JHARKHAND

1.	**Name of Zoo**	**Bhagwan Birsa Muda Biological Park, Ranchi, Jharkhand**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Director Bhagwan Birsa Munda Biological Park, P.B. No. 41, Doranda GPO, Ranchi - 834 002, Jharkhand.
C.	Telephone No.	0651-2576531, Fax - 0651-2814614
2.	**Name of Zoo**	**Birsa Mrig Vihar, Kalamati, Jharkhand**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer Wildlife Division, Ranchi - 2, Jharkhand.
C.	Telephone No.	0651-2480948
3.	**Name of Zoo**	**Jawaharlal Nehru Biological Park, Bokaro, Jharkhand**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Deputy General Manager (Town Administrator & In charge) Jawaharlal Nehru Biological Park, Bokaro Steel Plant, SAIL, Bokaro Steel City - 827 004, Jharkhand
C.	Telephone No.	06542-231839/ 287239
D.	Fax No.	06542-240227/ 242305
E.	E-mail ID	bsp.la@rmo.sril.in/ bko_labs@sancharnet.in
4.	**Name of Zoo**	**Tata Steel Zoological Park, Jamshedpur, Jharkhand**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Director,Tata Steel Zoological Park, Jubilee Park, Jamshedpur - 831 001,Jharkhand.
C.	Telephone No.	0657-6508011, Fax - 0657-2433918
5.	**Name of Zoo**	**Muta Zoo, Muta, Ranchi, Jharkhand**
A.	Category of Zoo	Mini Zoo (18 Km from the BBBP Zoo)
B.	Contact Details	Divisional Forest Officer, Wildlife Division, Ranchi - 2, Jharkhand.
C.	Telephone No.	0651-2480948

JAMMU AND KASHMIR

1.	**Name of Zoo**	**Wildlife Centre, Leh, Jammu & Kashmir**
A.	Category of Zoo	Small Zoo

B.	Contact Details	Wildlife Warden, Leh, Wildlife Division, Badami Bagh, Sakara, Leh (Jammu & Kashmir)
C.	Telephone No.	01982-252171 (Telefax)
2.	**Name of Zoo**	**Jammu Zoo, Manda, Jammu, Jammu and Kashmir**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Wildlife Warden, Jammu Manda Hills, Near Ashoka Hotel, Jammu, Jammu and Kashmir
C.	Telephone No.	0191-2544575 (Tele Fax)
3.	**Name of Zoo**	**Kashmir Zoo, Srinagar, Jammu and Kashmir**
A.	Category of Zoo	Small Zoo (four different facilities under one intuition)
B.	Contact Details	Wildlife Warden, Srinagar, Central Wildlife Division, PO: New Theed Harwan, Dachigam National Park, Srinagar (Jammu & Kashmir)
C.	Telephone No.	0194-2462327 (Tele fax)

KARNATAKA

1.	**Name of Zoo**	**Bellary Zoo, Bellary, Karnataka**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Deputy Conservator of Forests, Bellary Division, Bellary, Karnataka.
C.	Telephone No.	08392-240797, Fax - 08392-240797
E.	E-mail ID	dcf_bellary@rediffmail.com
2.	**Name of Zoo**	**Kittur Rani Channama Nisargadhama, Bhutaramanahatti, Belgaum Mini Zoo, Karnataka**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Executive Director & Deputy Conservator of Forests, (Zoo Authority of Karnataka) Belgaum Forest Division, Belgaum - 590 016, Karnataka
C.	Telephone /FAXNo.	0831-2467071
3	**Name of Zoo**	**Tungabhadra Dam Mini Zoo, Hospet, Karnataka**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Superintendent of Gardens Tungabhadra Board, Tungabhadra Dam - 583 225, Via - Hospet, Distt. - Bellary, Karnataka.
C.	Telephone No.	08394-259110 Extn. 40. Fax - 08394-259112

4.	**Name of Zoo**	**Mini Zoo-cum-Children Park, Gulbarga, Karnataka**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Deputy Conservator of Forests, (Zoo Authority of Karnataka) Gulbarga Forest Division, Gulbarga, Karnataka.
5.	**Name of Zoo**	**Indira Priyadarshini Prani Sangrahalaya, Anagodu, Davenagere, Karnataka**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Deputy Conservator of Forests, Davanagere Forest Division, Davanagere - 262 527, Karnataka.
6.	**Name of Zoo**	**Shri Kshetra Sogal Someshwar Deer Park, Soudatti (Belgaum) Karnataka**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Deputy Conservator of ForestsGhataprabha Division, Gokak, Ghataprabha Division, Gokak - 591 307, Distt. - Belgaum, Karnataka.
C.	Telephone/FAX No.	08332-225079
7.	**Name of Zoo**	**Gadag Zoo, Gadag, Karnataka**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Deputy Conservator of Forests Gadag Forest Division, Gadag, Distt. Dharwar, Karnataka.
C.	Telephone/FAX No.	08372-238502
8.	**Name of Zoo**	**Adu Malleswara Balvana-cum-Mini Zoo**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Deputy Conservator of Forests Chitradurga Forest Division, Chitradurga, Karnataka.
C.	Telephone/FAX No.	08194-230402
9.	**Name of Zoo**	**Bannerghatta Biological Park, Bangalore, Karnataka**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Executive Director & Deputy Conservator of Forests Bannerghatta Biological Garden - National Park,Bangalore - 560 083 (Karnataka).
C.	Telephone No.	080-27828540, Fax - 080-27828400
E.	E-mail ID	bannerghatta@vsnl.net

10.	**Name of Zoo**	**Sri Chamarajendra Zoological Park, Mysore, Karnataka**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Executive Director, Sri Chamarajendra Zoological Gardens, Mysore - 570 010, Karnataka.
C.	Telephone No.	0821-2520302-2440752, Fax - 0821-2563494
E.	E-mail ID	zoomysore@gmail.com
F.	Web site	www.mysorezoo.in
11.	**Name of Zoo**	**Tiger-Lion Safari, Shimoga, Karnataka**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Deputy Conservator of Forests Wildlife Division, Shimoga - 577 201, Karnataka.
C.	Telephone/FAX No.	08182-222983
E.	E-mail ID	dcfwl_smg@hotmail.com / mailto:sundervan@ceeindia.org
12.	**Name of Zoo**	**Namada Chilume Deer Park, Tumkur, Karnataka**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Deputy Conservator of Forests Tumkur Forest Division (T), Tumkur - 572 101, Karnataka.
C.	Telephone No.	0816-2201196
D.	Fax No.	0816-2201197
13.	**Name of Zoo**	**Dr. Shivarama Karanth Pilikula Biological Park, Mangalore, Karnataka**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Director Dr. Shivarama Karanth Pilikula Biological Park, Pilikula Nisarga Dhama, Vamanjoor, Mangalore - 575 028, Karnataka
C.	Telephone No.	0824-2263300/2263565
D.	Fax No.	0824-2263562
E.	E-mail ID	pilikulazoo@gmail.com / mailto:nmdcdiom@bir.vsnl.net.in
F.	Web site	www.pilikula.com
14.	**Name of Zoo**	**Deer Park, NMDC Ltd., Donimalai, Karnataka**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	General Manager, Donimalai Iron Ore Mine, Donimalai Township - 583 118, Distt. Bellary, Karnataka.

C.	Telephone No.	08395-574624, 274618
D.	Fax No.	08695-274649
F.	Web site	http://dnm-ca:9090/
16.	**Name of Zoo**	**Deer Park, Gendekatte, Hassan, Karnataka**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Deputy Conservator of Forests, Hassan Forest Division, Hassan (Karnataka)
17.	**Name of Zoo**	**People For Animals Rescue Centre, Bangalore (Karnataka)**
A.	Category of Zoo	Rescue Centre
B.	Contact Details	General Manager People for Animals - Bangalore, Survey No. 67, Uttarahalli Road,Next to Abhiman Studio, Kengeri, Bangalore - 560 060, Karnataka.
C.	Telephone No.	080-28603986/ 28604767/ 22733350
18.	**Name of Zoo**	**Wildlife Rescue and Rehabilitation Centre, Bangalore, Karnataka**
A.	Category of Zoo	Rescue Centre
B.	Contact Details	President, Wildlife Rescue & Rehabilitation Centre (WRRC), (Bannerghatta Rehabilitation Centre-BRC), 'Southern' Cross', 9 A Myrtle Lane, Richmond Town, Bangalore - 560 025, Karnataka.
C.	Telephone No.	080-22293771/ 22212215/ 22947300, Fax - 080-22293771
D.	E-mail ID	wrrccb@gmail.com / mailto:nmdcdiom@bir.vsnl.net.in
19.	**Name of Zoo**	**Kaiwara Tapovana - Mini Zoo, Kolar**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Deputy Conservator of Forests, Kolar Forest Division, Kolar (Karnataka)

KERALA

1.	**Name of Zoo**	**Neyyar Mini Zoo, Neyyar, Kerala**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Wildlife Warden, Wildlife Division, Rajeev Gandhi Nagar, Vattiyoorkavu PO, Thiruvananthapuram - 695 013, Kerala.
C.	Telephone No.	0471-2360762/ 9447979082, Fax - 0471-2360762
E.	E-mail ID	wlw-tvm@yahoo.co.in / mailto:sgnmumbai@rediffmail.com
F.	Web site	Kerala Forest-org

2.	**Name of Zoo**	**Thiruvananthapuram Zoo, Thiruvananthapuram, Kerala**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Director Museums & Zoos, Thiruvananthapuram Zoo, Thiruvananthapuram - 695 033, Kerala.
C.	Telephone No.	0471-2316275, Fax - 0471-2318294
E.	E-mail ID	museumzoo@sancharnet.in
F.	Web site	www.keralamuseumandzoo.org
3.	**Name of Zoo**	**State Museum and Zoo, Thrissur, Kerala**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Superintendent State Museum & Zoo, Thrissur-680 020, Kerala.
C.	Telephone /FAXNo.	0487-2333056
4.	**Name of Zoo**	**Parassinikkadavu Reptile Park, Parassinikkadavu, Kannur, Kerala**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	In-charge, Parassinikkadavu Reptile Park, P.O. Parassinikkadavu, Distt. Kannur - 670 563, Kerala.
C.	Telephone No.	0497-2780738
5.	**Name of Zoo**	**Hill Palace - Mini Zoo, Erankulam, Kerala**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Director General, Centre for Heritage Studies Department of Cultural Affairs, Government of Kerala, Hill Palace, Thirupunithura, Ernakulam - 682 301 (Kerala)
C.	Telephone No.	0484-2779102/ 2776374
D.	Fax No.	0484-2776374
E.	E-mail ID	kknkurup@hotmail.com
F.	Web site	www.centreforheritagestudies.com
6.	**Name of Zoo**	**Sri Loknayak Jaya Prakash Narayan Smriti Van-Deer Park, Walayar, Palakad, Kerala**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer, Palakad, Kallekulangura Post, Olavakkode, Palakad - 678 009 (Kerala)
C.	Telephone No.	0491-2555156
E.	E-mail ID	dfopkd@rediffmail.com

7.	**Name of Zoo**	**Snake Park, Malampuzha, Kerala**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer, Palakad, Kallekulangura Post, Olavakkode, Palakad - 678 009 (Kerala)
C.	Telephone No.	0491-2555156
D	E-mail ID	dfopkd@rediffmail.com
8.	**Name of Zoo**	**Kaprikkad Zoo, Kaprikkad, Kerala**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Divisional Forest Officer, Malayattor Division, PO: Kodanad - 683 544 (Kerala)
C.	Telephone No.	0484-649052
D.	E-mail ID	dfomal@yahoo.com
9.	**Name of Zoo**	**Jumbo Circus**
A.	Category of Zoo	Circus
B.	Contact Details	Partne, Jumbo Circus, Shankar Bhavan, P.O. - Varam, Kannur - 670 594, Kerala.
C.	Telephone No.	09845035352/080-41124461
10.	**Name of Zoo**	**Great Bombay Circus**
A.	Category of Zoo	Circus
B.	Contact Details	Partner, Great Bombay Circus, Kalyani Niwas, Court Road, P.O. Tellicherru, Kerala.
C.	Telephone No.	0490-2341128
11.	**Name of Zoo**	**Great Rayman Circus**
A.	Category of Zoo	Circus
B.	Contact Details	The Proprietor 'Rayman' G-77, Panampalli Nagar, Cochin - 682 036, Kerala.
C.	Telephone No.	0484-2319556
13.	**Name of Zoo**	**Rajkamal Circus**
A.	Category of Zoo	Circus
B.	Contact Details	Proprietor Rajkamal Circus, Rajkamal Bhavan, Dharamdam P.O., Via Tellicherry, Distt. Cannanore, Kerala - 670 106.
C.	Telephone No.	0490-2346673

14.	**Name of Zoo**	**Amar Circus**
A.	Category of Zoo	Circus
B.	Contact Details	Managing Partner, Amar Circus, 'Amar', Chakorathkulam, Calicut - 673 011, Kerala.
C.	Telephone No.	0495-2765332
15.	**Name of Zoo**	**Jamuna Circus**
A.	Category of Zoo	Circus
B.	Contact Details	Proprietor, Jamuna Circus, Akavil House, P.O. Dharmadam, Thalaseery - 670 106, Kerala.
C.	Telephone No.	011-2373656409810136053

MADHYA PRADESH

1.	**Name of Zoo**	**Van Vihar Zoo, Bhopal, Madhya Pradesh**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Director, Van Vihar National Park, Post Box No. 348, Bhadhad Road, Bhopal - 462 003, Madhya Pradesh.
C.	Telephone No.	0755-2674278/ 6538401
D.	Fax No.	0755-2674278
E.	E-mail ID	dirvvnp@sancharnet.in
F.	Web site	vanvihar.org
2.	**Name of Zoo**	**Kamla Nehru Prani Sangrahalaya, Indore (Madhya Pradesh)**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Officer-in-Charge Kamla Nehru Prani Sangrahalaya, Indore, Navlakha, Indore - 452 001, Madhya Pradesh.
C.	Telephone No.	0731-2700972
D.	Fax No.	0731-2434489/2531166
3.	**Name of Zoo**	**Gandhi Zoological Park, Gwalior, Madhya Pradesh**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Zoo Officer, Gandhi Zoological Park, Gwalior Municipal Corporation, Phoolbaug, Gwalior - 474 001, Madhya Pradesh.
C.	Telephone No.	0751-2438344/2326252
D.	Fax No.	0751-2326252/ 2324996

E.	E-mail ID	zoogwl@sancharnet.in
F.	Web site	www.gwaliormunicipalcorporation.com
4.	**Name of Zoo**	**Gharial Rearing Centre, Deori, Murena, Madhya Pradesh**
A.	Category of Zoo	Conservation Breeding Centre/ Mini Zoo
B.	Contact Details	Divisional Forest Officer, Murena, A. B. Road, Forest Colony, Murena - 476 001 (Madhya Pradesh)
C.	Telephone No.	07532-243742, Mobile: 9424791800
5.	**Name of Zoo**	**Kuno Palpur Asiatic lion Conservation Breeding Centre, Durendi, Madhya Pradesh**
A.	Category of Zoo	Conservation Breeding Centre
B.	Contact Details	Mr. Murali Krishnan, Conservator of Forests (Wildlife) Kuno Project, Gwalior (Madhya Pradesh).
C.	Telephone No.	0751-2467581, Fax - 0751 - 2235290

MAHARASHTRA

1.	**Name of Zoo**	**Maharaj Baag Zoo, Nagpur, Maharashtra**
A.	Category of Zoo	Mini Zoo (to be developed as small zoo)
B.	Contact Details	Zoo Controller and Associate Dean, College of Agriculture, Nagpur, Maharashtra
C.	Telephone No.	0712-2560059/ 2522621, Fax - 0712/2554820
2.	**Name of Zoo**	**Veermata Jijabai Bhosale Udyan and Zoo, Byculla, Mumbai, Maharashtra**
A.	Category of Zoo	Medium
B.	Contact Details	Superintendent of Gardens, Veermata Jijabai Bhosle Udyan-Zoo, Mumbai, Dr. B. Ambedkar Marg, Byculla (East), Mumbai - 400 027,
C.	Telephone No.	022-23725799/ 23723578, Fax - 022-23759821
3.	**Name of Zoo**	**Mahatma Gandhi Udyan-Zoo, Solapur, Maharashtra**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Garden Superintendent Solapur Municipal Corporation, Solapur - 413 001, Maharashtra.
C.	Telephone No.	0217-2740394, Fax - 0217-2723477
E.	E-mail ID	spr_smcgad@sancharnet.in/ mailto: sgnmumbai@rediffmail.com

4.	**Name of Zoo**	**Sanjay Gandhi National Park & Zoo, Borivali, Mumbai, Maharashtra**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Conservator of Forests & Director, Sanjay Gandhi National Park, Borivali (East), Mumbai - 400 066, Maharashtra
C.	Telephone No.	022-28860362, Fax - 022-28860389
D.	E-mail ID	sgnpmumbai@rediffmail.com
5.	**Name of Zoo**	**Maharaja Shahji Chhtrapati Zoo, Kohlapur, Maharashtra**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Operating Trustee Maharaja Shahaji Chhatrapati Zoo Trust, New Palace, Kohlapur - 416 003, Maharashtra.
C.	Telephone No.	0231-265054/ 5620337
6.	**Name of Zoo**	**Aurangabad Zoo, Aurangabad, Maharashtra**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Director, Aurangabad Municipal Zoo,Aurangabad Municipal Corporation, Siddharth Garden, Near Central Bus Stand, Aurangabad - 431 001, Maharashtra.
C.	Telephone No.	0240-2331956, Fax - 0240-2331213
7.	**Name of Zoo**	**Snake Park, Shetkari Shikshan Mandal, Dholgarwadi, Distt. Kohlapur, Maharashtra**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Secretary Snake Park, Shetkari Shikshan Mandal, At & P.O. - Dholgarwadi, Taluka - Chandgad, Distt. - Kohlapur, Pin - 416 507, Maharashtra
C.	Telephone No.	02320-231048/ 231049
8.	**Name of Zoo**	**Nisargakavi Bahinabai Chaudhary Prani Sangrahalaya, Chinchwad**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Director Nisargakavi Bahinabai Choudhary Prani Sangrahalaya, Pipri-Chinchwad Municipal Corporation, Shambhaji Nagar, 'G' block, Chinchwad, Pune - 411 019, Maharashtra.
C.	Telephone No.	020-27496036

9.	**Name of Zoo**	**Rajiv Gandhi Zoological Park and Wildlife Research Centre, Pune, Maharashtra**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Zoo Director Rajiv Gandhi Zoological Park & Wildlife Research Centre, Pune Municipal Corporation, Opposite Katraj Dairy, Katraj, Pune - 411 046 (Maharashtra).
C.	Telephone No.	020-24367712, F ax - 020-25501104
D.	E-mail ID	punezoo@vsnl.net
10.	**Name of Zoo**	**Leopard Rescue Centre, Manikdoh, Junnar**
A.	Category of Zoo	Rescue Centre
B.	Contact Details	Deputy Conservator of Forests Ghod Project Division, Near Tehasil Office, Junnar,Distt. - Pune, Pin - 410 502, Maharashtra.
C.	Telephone No.	02132-222063, Fax - 02132-224363
D.	E-mail ID	junnarforestdn@vsnl.net
11.	**Name of Zoo**	**Amte's Animal Ark at Hemalksa, Distt. Gadchiroli, Maharashtra**
A.	Category of Zoo	Rescue Centre
B.	Contact Details	Director Lok Biradari Prakalp, At: Hemalkasa, Post: Bhamragad, District: Godchiroli, Pin - 442 710, Maharashtra.
C.	Telephone No.	07134-220001, Fax - 07134-220112
D.	E-mail ID	lbp@sancharnet.in or aniket_amte@rediffmail.com
12	**Name of Zoo**	**The Great Royal Circus**
A.	Category of Zoo	Circus
B.	Contact Details	Partner The Great Royal Circus, 475/6001, Sunder Bhavan, 16th Road, Khar (West), Mumbai - 400 052, Maharashtra.
C.	Telephone No.	022-26464875
13.	**Name of Zoo**	**Rambo Circus**
A.	Category of Zoo	Circus
B.	Contact Details	Proprietor Rambo Circus, 73/2+3A, Mariam Villa, B.T. Kawade Road, Ghorpuri, Pune - 1, Maharashtra.
C.	Telephone No.	020-25123452/ 25123455/ 0982205486/ 09421449039
D.	E-mail ID	rambocircus@yahoo.com

MANIPUR

1.	**Name of Zoo**	**Manipur Zoological Garden, Iroishemba, Imphal**
A.	Category of Zoo	Medium
B.	Contact Details	Deputy Conservator of Forests, Wildlife (HQ) Manipur Zoological Garden, Iroisemba, Imphal, Manipur.
C.	Telephone No.	0385-2416703

MEGHALAYA

1.	**Name of Zoo**	**Nehru Park Zoo, Tura, Meghalaya**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer, East & West Garo Hills, Wildlife Division, Tura, Meghalaya.
C.	Telephone/FAX No.	03651-23225
2.	**Name of Zoo**	**Lady Hydari Park & Animal Land, Shillong (Meghalaya Zoo, Shillong)**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Divisional Forest Officer East & West Garo Hills, Wildlife Division, Tura, Meghalaya.
C.	Telephone/FAX No.	03651-23225

MIZORAM

1.	**Name of Zoo**	**Mizoram Zoo, Aizawl (Mizoram)**
A.	Category of Zoo	Small
B.	Contact Details	Deputy Conservator of Forests (WL) Wildlife Division, B. Sanghnuna Building, Tuikhuahtlang, Aizawl - 796 001, Mizoram / Aizawl Zoological Park, B. Sanghnuna Building, Tuikhuahtlang, Aizawl - 796 001, Mizoram.
C.	Telephone/FAX No.	0389-2326151
D.	E-mail ID	azlzoopkmiz@rediffmail.com/ mailto:sundervan@ceeindia.org
2.	**Name of Zoo**	**Deer Park, Thenzawl, Mizoram**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer, Thenzawl Forest Division, Thenzawl, Pin - 796 181, Mizoram.
C.	Telephone No.	03838-261475

NAGALAND

1.	**Name of Zoo**	**Nagaland Zoological Park, Rangapahar, Nagaland**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Director, Nagaland Zoological Park, Rangapahar, Dimapur - 797 112, Nagaland.
C.	Telephone No.	03862-229365

ORISSA

1.	**Name of Zoo**	**Kuanria Deer Park, Nayagarh (Orissa).**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer Mahanadi Wildlife Division, College Road, Nayagarh - 762 069,Distt. Nayagarh, Orissa.
C.	Telephone/FAX No.	06753-253971
E.	E-mail ID	dfo_mailto:sundervan@ceeindia or gmahanadiwl@yahoo.co.in
2.	**Name of Zoo**	**Taptapani Deer Park, Distt. Ganjam, Orissa**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer, Paralakhemundi Division, Paralakhemundi, Orissa.
3.	**Name of Zoo**	**Indira Gandhi Park Zoo, Rourkela (Orissa)**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Sr. Manager (Horticulture) & In-charge Indira Gandhi Zoo & Deer Park, Town Service, Rourkela Steel Plant, Sector - IV, Rourkela - 769 002, Orissa.
C.	Telephone No.	0661-2510641-46 (Extn. 9563)
4.	**Name of Zoo**	**Gharial Research and Conservation Unit, Tikarpada, Distt. Angul, Orissa**
A.	Category of Zoo	Conservation Breeding Centre/ Mini Zoo
B.	Contact Details	Divisional Forest Officer, Satkosia Wildlife Division, Hakimpada, Angul - 759 143, Distt. - Angul (Orissa).
5.	**Name of Zoo**	**Wild Animal Conservation Centre, Motijharan, Sambalpur, Orissa**
A.	Category of Zoo	Mini Zoo (to be developed as Small Zoo)
B.	Contact Details	Divisional Forest Officer, Hirakund Wildlife Division, P.O. Motijharan, Sambalpur - 768 001, Orissa.
C.	Telephone/ FAXNo.	0663-2548743

6.	**Name of Zoo**	**H. A. L. Deer Park, Koraput, Sunabeda, Orissa**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Manager (Works) Township, Hindustan Aeronautics Limited, P.O. - Sunabeda - 763 002, Distt. - Koraput (Orissa).
C.	Telephone No.	06853-220220 Ext. 2779/ Fax - 06853-220004
D.	E-mail ID	halkpt@dte.vsnl.net.in
7.	**Name of Zoo**	**Kapilash Zoo, Kapilash, Dhenkanal, Orissa**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer , Dhenkanal Forest Division,Dhenkanal - 759 001, Orissa.
C.	Telephone No.	06762-226717/ 224977 (Off. & res. of DFO), Fax - 06762-226717
E.	E-mail ID	dfodhenkanal@dataone.in / mailto:sundervan@ceeindia.org
8.	**Name of Zoo**	**Nandankanan Biological Park, Bhubaneswar**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Director Nandan Kanan Biological Park, Mayur Bhavan, Janpath, Sahid Nagar,Bhubaneswar - 751 007, Orissa.
C.	Telephone No.	0674-2547850, Fax - 0674-2547840
E.	E-mail ID	nandankananzoo@yahoo.com
F.	Web site	www.nandankanan.org
9.	**Name of Zoo**	**Harishanker Deer Park, Bolangir, Orissa**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer (West), Bolangir Division , Orissa
10.	**Name of Zoo**	**Deer Park, Berhampur University, Berhampur, Orissa**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Registrar, Berhampur University Bhanja Vihar, Berhampur - 760 007, Distt. Ganjam (Orissa)
C.	Telephone No.	0680-2242234, 0680-2242172-74
11.	**Name of Zoo**	**Deer Park, Papadahandi, Orissa**
A.	Category of Zoo	Mini Zoo

B. Contact Details	Divisional Forest Officer, Nabarangpur Division, Nabarangpur (Orissa)
C. Telephone No.	06858 - 222014, Fax - 06858 - 222390
12. Name of Zoo	**Deer Park, Cuttack, Orissa**
A. Category of Zoo	Mini Zoo
B. Contact Details	Executive Director, Cuttack Municipal Corporation, Cuttack (Orissa)
C. Telephone No.	0671-2626517, 2612424, FAX - 0671-2616004

PUNJAB

1. Name of Zoo	**Mini Zoo, Bir Talab, Bhatinda, Punjab**
A. Category of Zoo	Mini Zoo
B. Contact Details	Divisional Forest Officer, Wildlife Division, Firoj Pur, Punjab
C. Telephone No.	01632-220245, Fax - 01632-229838/ 220698 (P.P. Fax)
2. Name of Zoo	**Mahendra Choudhury Zoological Park, Chhatbir, Chandigarh, Punjab**
A. Category of Zoo	Large Zoo
B. Contact Details	Field Director M.C. Zoological Park, Chhatbir, Distt-Mohali, (Punjab)
C. Telephone No.	0172-2795612
3. Name of Zoo	**Ludhiana Zoo, Ludhiana, Punjab**
A. Category of Zoo	Small Zoo
B. Contact Details	Field Director M.C. Zoological Park, Chhatbir, Distt-Mohali, (Punjab)
C. Telephone No.	01762-286303
4. Name of Zoo	**Mini Zoo, Neelon, Ludhiana, Punjab**
A. Category of Zoo	Mini Zoo
B. Contact Details	Field Director M.C. Zoological Park, Chhatbir, Distt-Mohali, (Punjab)
C. Telephone No.	01762-286303
5. Name of Zoo	**Patiala Zoo, Patiala, Punjab**
A. Category of Zoo	Small Zoo

B.	Contact Details	Divisional Forest Officer (WL), Patiala Office of DFO, Wildlife Division, Patiala, Opp. Mini Sect. Patiala, Punjab.

RAJASTHAN

1.	**Name of Zoo**	**Udaipur Zoo, Udaipur, Rajasthan**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Deputy Chief Wildlife Warden Wildlife Division, Udaipur - 313 001, Rajasthan.
C.	Telephone No.	0294-2421361
2.	**Name of Zoo**	**Jodhpur Zoo, Jodhpur, Rajasthan**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Deputy Conservator of Forests (Wildlife) Wildlife Division, Jodhpur - 342 001, Rajasthan.
C.	Telephone No.	0291-2635429, Fax - 0291-2635425
3.	**Name of Zoo**	**Safari Park, Haridasji-ki-Magri, Hotel Trident, Hilton, Udaipur, Rajasthan**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	In-charge Safari Park, Haridasji ki Magri, Operating Unit of EIH Associated Hotels Limited, Mull Talai, Udaipur - 313 001 (Rajasthan).
C.	Telephone No.	0294-2432200, Fax - 0294-2432211
E.	E-mail ID	udaipur@trident-hilton.com / mailto:sundervan@ceeindia.org
F.	Web site	www.hilton.com
4.	**Name of Zoo**	**Mini Zoo, Shri Goverdhan Trust, Udaipur, Rajasthan**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Deputy Secretary Shri Goverdhan Trust, Goverdhan Vilas, P.O., City Palace, Udaipur - 313 001 (Rajasthan).
C.	Telephone No.	0294-2419024, Fax - 0294-2528006
5.	**Name of Zoo**	**Kota Zoo, Kota, Rajasthan**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Zoo Supervisor Wildlife Division, Nayapura, Kota, Rajasthan.
C.	Telephone No.	0744-2321263

6.	**Name of Zoo**	**Jaipur Zoo, Jaipur, Rajasthan**
A.	Category of Zoo	Medium Zoo
B.	Contact Details	Deputy Chief Wildlife Warden, Jaipur Zoo, Ram Niwas Bagh, Jaipur - 302 004, Rajasthan.
C.	Telephone No.	0141-2617319, Fax - 0141-2227836
7.	**Name of Zoo**	**Panchwati Deer Park, Pilani, Rajasthan**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Incharge , Panchwati Deer Park, Pilani Charity Trust, Post Box No. 10, Pilani - 333 031, Rajasthan.
C.	Telephone No.	01596-242105, Fax - 01596-243805
8.	**Name of Zoo**	**Bikaner Zoo, Bikaner, Rajasthan**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Deputy Conservator of Forests (Wildlife) O/O Divisional Forest Officer (Wildlife), Bikaner - 334 001 (Rajasthan)
C.	Telephone No.	2527901
9.	**Name of Zoo**	**Bustards Breeding Centre, Raasla or Ramdeogarh, Jaisalmer, Rajasthan**
A.	Category of Zoo	Conservation Breeding Centre
B.	Contact Details	Divisional Forest Officer & Field Director Desert national Park, Jaisalmer (Rajasthan).
C.	Telephone No.	02992-252489

SIKKIM

1.	**Name of Zoo**	**Himalayan Zoological Park, Bulbuley, Gangtok (Sikkim)**
A.	Category of Zoo	Mini (to be developed as small Zoo)
B.	Contact Details	Joint Director of Forests (National Park & Zoo) Department of Forests, Environment and Wildlife Management, Forest Secretariat, Deorali - 737 102, Gangtok, Sikkim.
C.	Telephone No.	03592-281188, 229878 (Zoo), Fax - 03592-281778

TAMIL NADU

1.	**Name of Zoo**	**Arignar Anna Zoological Park, Vandalur, Chennai, Tamil Nadu**
A.	Category of Zoo	Large

B.	Contact Details	Chief Conservator of Forests & Director, Arignar Anna Zoological Park, Vandalur, Chennai - 600 048, Tamil Nadu.
C.	Telephone No.	044-22751089, Fax - 044-22750741
D.	E-mail ID	aazp@vsnl.com & aazp@hotmail.com
F.	Web site	www.aazoopark.com
2.	**Name of Zoo**	**Chennai Snake Park, Guindy, Chennai (Tamil Nadu)**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Chairman, Chennai Snake Park, Rajbhavan Post, Chennai - 600 022, Tamil Nadu.
C.	Telephone No.	044-22353623
3.	**Name of Zoo**	**Children's Park, Guindy, Chennai (Tamil Nadu)**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Wildlife Warden, 259, Anna Salai, DMS Campus, Teynampet, Chennai - 600 006, Tamil Nadu.
C.	Telephone No.	040-24321471 (O)040-22301328 (Zoo)
4.	**Name of Zoo**	**V. O. C. Park Zoo, Coimbatore (Tamil Nadu)**
A.	Category of Zoo	Mini Zoo (to be relocated to new site as Small Zoo)
B.	Contact Details	Zoo Director, V.O.C. Park Zoo, Coimbatore Municipal Corporation, Coimbatore - 641 018, Tamil Nadu.
C.	Telephone No.	0422-2303613, Fax - 0422-2390167/ 23998702
D.	E-mail ID	cbecorp@gmail.com
5.	**Name of Zoo**	**Madras Crocodile Bank Trust/ Centre for Herpetology, Mamallapuram, Tamil Nadu**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Curator, Centre for Herpetology/ Madras Crocodile Bank Trust, Post Bag - 4, Mamallapuram - 603 104, Tamil Nadu.
C.	Telephone No.	044-27472447/ 27472953, Fax - 044-27472958
D.	E-mail ID	mcbtindia@vsnl.net
F.	Web site	www.madrascrocodilebank.org
6.	**Name of Zoo**	**Shivganga Garden Mini Zoo, Thanjavur, Tamil Nadu**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Commissioner, Thanjavur Municipality,Thanjavur - 613 001, Tamil Nadu.

C. Telephone No.	04362-239881, Fax - 04362-277280
D. E-mail ID	tnj_commis@sanchanet.in
7. Name of Zoo	**Kurumbapatti Zoological Park, Salem, Tamil Nadu**
A. Category of Zoo	Mini Zoo
B. Contact Details	District Forest Officer, Salem Forest Division, Salem - 636 007, Tamil Nadu.
C. Telephone No.	0427-2413097
8. Name of Zoo	**Amirdhi Mini Zoo, Amirdhi, Tamil Nadu**
A. Category of Zoo	Mini Zoo
B. Contact Details	District Forest Officer Vellore Forest Division, Vellore - 632 004, Tamil Nadu.
C. Telephone No.	0416-2220329
8. Name of Zoo	**Nilgiri Mini Zoo and Breeding Centre Udhagamandalam (Nilgiri Distt.), Tamil Nadu**
A. Category of Zoo	Mini Zoo
B. Contact Details	Wildlife Warden, Mudumalai Wildlife Sanctuary and National Park,Udhagai, Udhagamandalam - 643 001, Tamil Nadu.
9. Name of Zoo	**Trichy Zoo, Tiruchirapalli, Tamil Nadu**
A. Category of Zoo	Small Zoo
B. Contact Details	Divisional Forest Officer Trichy, Tiruchirapalli (Tamil Nadu)
TRIPURA	
1. Name of Zoo	**Sepahijala Zoo, Agartala, Tripura**
A. Category of Zoo	Large Zoo
B. Contact Details	Director, Sepahijala Zoo, P.O. Bishalgarh, Tripura (West)- 799 012,. Tripura
C. Telephone No.	0381-2361225/ 2361227, FAX - 0381-2225253
D. E-mail ID	Bhomik_ak@yahoo.com
UTTAR PRADESH	
1. Name of Zoo	**Sarnath Deer Park, Sarnath, Uttar Pradesh**
A. Category of Zoo	Mini Zoo
B. Contact Details	Divisional Forest Officer, Social Forestry Division, Pahariya, Varanasi - 221 007, Uttar Pradesh
C. Telephone No.	0542-2585574

2.	**Name of Zoo**	**Gorakhpur Zoological Park, Gorakhpur, Uttar Pradesh**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Divisional Forest Officer, Gorakhpur Forest Division, Gorakhpur, Uttar Pradesh.
3.	**Name of Zoo**	**Lucknow Zoo, Lucknow, Uttar Pradesh**
A.	Category of Zoo	Large Zoo
B.	Contact Details	Director, Lucknow Zoological Park, Lucknow - 226 001, Uttar Pradesh.
C.	Telephone/FAX No.	0522-2239588
E.	E-mail ID	lucknowzoo@yahoo.com
F.	Web site	lucknowzoo.org
4.	**Name of Zoo**	**Deer Park, IFFCO Township, Aonla, Bareilly, Uttar Pradesh**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Senior Manager (P&IR) / CM (P&A) Indian Farmers Fertilizer Cooperative Limited, P.O.- IFFFCO Township, Distt. Bareilly - 243 403 (Uttar Pradesh).
C.	Telephone No.	0581-2404006, FAX - 0581-234888
E.	E-mail ID	Sgmoffico@iffco.nic.in
F.	Web site	www.iffco.nic.in
5.	**Name of Zoo**	**Agra Bear Rescue Centre Facility, Keetham, Agra, Uttar Pradesh**
A.	Category of Zoo	Rescue Centre
B.	Contact Details	The Secretary Wildlife S.O.S., D-210, Defence Colony, New Delhi - 110 024.
C.	Telephone No.	011-24651440, FAX - 011-51550480
E.	E-mail ID	wsos@vsnl.com
6.	**Name of Zoo**	**Nawabgunj Deer Park, Distt. Unnao, Uttar Pradesh Deer Park**
A.	Category of Zoo	Mini Zoo
B.	Contact Details	Divisional Forest Officer, Social Forestry Division, Unnao - 209 801, Uttar Pradesh
7.	**Name of Zoo**	**Van Prani Udyan, IVRI, Izatnagar, Bareilly, Uttar Pradesh**
A.	Category of Zoo	Mini Zoo

B. Contact Details	In-charge Centre for Wildlife Conservation, Management and Disease Surveillance, Indian Veterinary Research Institute, Izatnagar - 243 122, Bareilly, Uttar Pradesh.
C. Telephone No.	0581-2300587, Fax - 0581-2447284
D. E-mail ID	dswarup@ivri.up.nic.in
8. Name of Zoo	**Kanpur Zoo, Kanpur, Uttar Pradesh**
A. Category of Zoo	Large Zoo
B. Contact Details	Director, Kanpur Zoological Park, Azad Nagar, Kanpur-208 002, Uttar Pradesh.
C. Telephone/FAX No.	0512-2560257
D. E-mail ID	Kanpur-zoo@yahoo.co.in
9. Name of Zoo	**Great Apollo Circus**
A. Category of Zoo	Circus
B. Contact Details	Partner/ Manager, Great Apollo Circus, Village : Moudaha, P.O. Kasba, Distt. Hamirpur, Uttar Pradesh.
C. Telephone No.	0941515045117/ 09839951877
10. Name of Zoo	**Rajmahal Circus**
A. Category of Zoo	Circus
B. Contact Details	The Proprietor Rajmahal Circus, Station Road, Near Elai Tank, P.O. Kasba, PS. - Mahada, Distt. Hamirpur, Uttar Pradesh
C. Telephone No.	09415145975/ 09826494774/05284-280368
11. Name of Zoo	**Apollo Circus**
A. Category of Zoo	Circus
B. Contact Details	Proprietor, Apollo Circus,123, Mirchi Tola, Post & District - Buland Shahar, Uttar Pradesh.
C. Telephone No.	09412227564

UTTARAKHAND

1. Name of Zoo	**Almora Zoo, Almora, Uttarakhand**
A. Category of Zoo	Small Zoo
B. Contact Details	Divisional Forest Officer, Civil and Soyam Forest Division, Almora, Uttarakhand
C. Telephone/FAX No.	05962-230229
E. E-mail ID	csalmdfo@rediffmail.com

2.	**Name of Zoo**	**Bharat Ratan Pt. Gobind Ballabh Pant High Altitude Zoo, Nainital, Uttarakhand**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Director Bharat Ratan Pt. G.B. Pant High Altitude Zoo, Nainital - 263 002, Uttarakhand.
C.	Telephone/FAX No.	05942-237927
D.	E-mail ID	nainitalzoo@rediffmail.com/ nainitalzoo@gmail.com
3.	**Name of Zoo**	**Dehradun Zoological Park, Malsi (Dehradun), Uttarakhand**
A.	Category of Zoo	Medium Zoo
B.	Contact Details	Divisional Forest Officer, Dehradun Forest Division, 5-Tilak Road, Dehradun, Uttarakhand.
C.	Telephone/FAX No.	0135-2627612
E.	E-mail ID	dfoddun@yahoo.co.in
F.	Web site	www.uttaranchalforest.org (Forest Deptt. Uttarakhand)
4.	**Name of Zoo**	**Musk Deer Breeding Centre, Harshil, Distt. Uttarkashi, Uttarakhand**
A.	Category of Zoo	Conservation Breeding Centre
B.	Contact Details	Divisional Forest Officer, Uttarakhashi Forest Division, Uttarakhashi (Uttarakhand)

WEST BENGAL

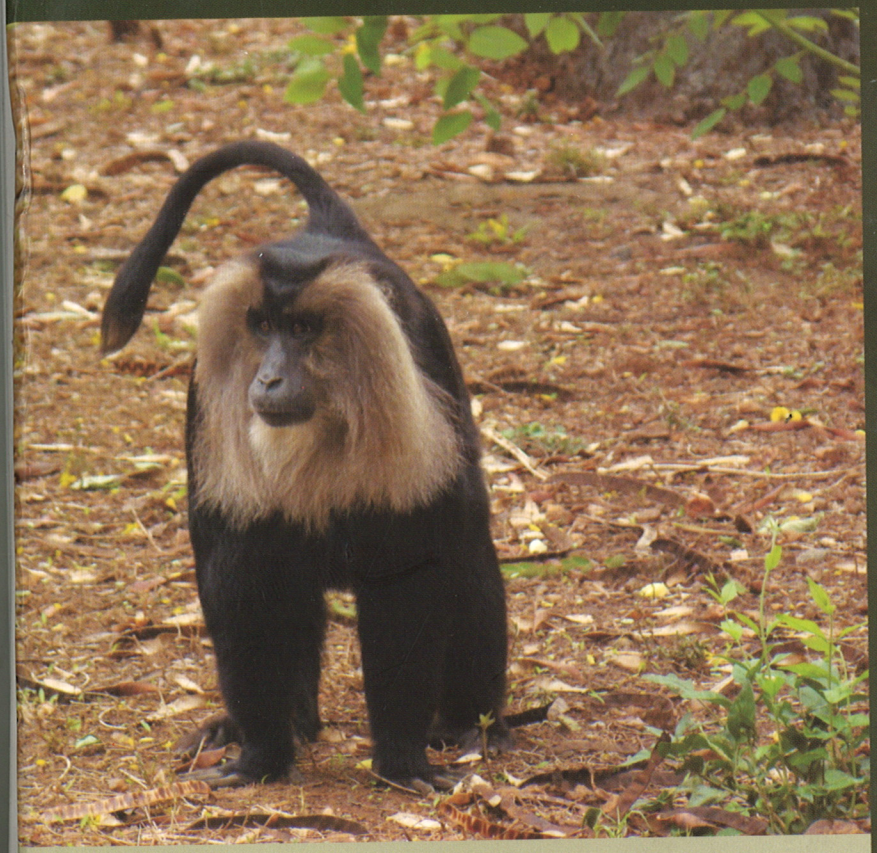
1.	**Name of Zoo**	**West Bengal Snake Park and laboratory, Kathore (24 parganas South) West Bengal**
A.	Category of Zoo	Snake Park (Mini Zoo).
B.	Contact Details	In-charge/ Proprietor, West Bengal Snake Park & Laboratory, Vill. - Kathore, P.O. - Badu, Distt. 24 Parganas (North), West Bengal.
C.	Telephone No.	09830888168 & 9331219434
2.	**Name of Zoo**	**Kolkata Snake Park, Badu (24 Parganas South) West Bengal**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Proprietor, Calcutta Snake Park, 31, Hindustan Park, Kolkata - 700 029, West Bengal.
C.	Telephone No.	033-25263741/ 24632425, Mob. 09831404379

E.	E-mail ID	dipak_snake_park@hotmail.com
F.	Web site	www.dipakmitra.net
3.	**Name of Zoo**	**Marble Palace Zoo, Kolkata (West Bengal)**
A.	Category of Zoo	Small
B.	Contact Details	In-charge , Marble Palace Zoo,40, Muktaram Babu Street, Jarasanka Police Station, Kolkata - 700 007, West Bengal.
C.	Telephone No.	033-22693628/22693110
4.	**Name of Zoo**	**Jhargram Zoo, Jhargram (West Bengal)**
A.	Category of Zoo	Small Zoo
B.	Contact Details	Divisional Forest Officer Jhargram Forest Division, Distt. West Midnapur (Paschim), Jhargram - 721 507, West Bengal.
C.	Telephone No.	03221-255010
D.	Fax No.	03221-255010
E.	E-mail ID	panditpk@sify.com
5.	**Name of Zoo**	**Kumari Kangsabati Deer Park, Bonpukuria (Bankura) West Bengal.**
A.	Category of Zoo	Deer Park/Mini Zoo
B.	Contact Details	Divisional Forest Officer Bankura (South) Division, Bankura, West Bengal.
C.	Telephone No.	03242-250307, FAX - 03242-252371
6.	**Name of Zoo**	**Padmaja Naidu Himalayan Zoological Park, Darjeeling, West Bengal**
A.	Category of Zoo	Small
B.	Contact Details	DirectorPadmaja Naidu Himalayan Zoological Park, Jawahar Parbat (West), Darjeeling - 734 101, West Bengal.
C.	Telephone No.	0354-2254250/ 2253709, FAX - 0354-2252522
E.	E-mail ID	pnhzp@yahoo.com
7.	**Name of Zoo**	**Zoological Garden, Alipore, Kolkata (West Bengal)**
A.	Category of Zoo	Large
B.	Contact Details	Director, Zoological Garden, Alipore, Kolkata - 700 027, West Bengal.
C.	Telephone/FAX No.	033-24791150 & 24399391
D.	E-mail ID	kolkatazoo@yahoo.co.in

8. Name of Zoo	**Garchumuck Mini Zoo, Ulughata (Howrah), West Bengal**
A. Category of Zoo	Mini Zoo
B. Contact Details	Divisional Forest Officer, Howrah Social Forestry Division, Howrah, West Bengal.
9. Name of Zoo	**Purulia Mini Zoo, Surulia (Purulia), West Bengal**
A. Category of Zoo	Mini Zoo
B. Contact Details	Divisional Forest Officer, Kangsabati Soil Conservation Division - I, Purulia - 723 101, West Bengal.
C. Telephone/FAX No.	03252-222231
E. E-mail ID	dfo_kangsabati@sancharnet.in
10. Name of Zoo	**Kunjanagar Eco Park, Kunjanager (Jalpaiguri) West Bengal.**
A. Category of Zoo	Mini Zoo
B. Contact Details	Divisional Forest Officer, Coochbehar Division, Post & Distt. Coochbehar, West Bengal - 736 101.
C. Telephone No.	03582-227185, Fax - 03582-227513
E. E-mail ID	slg_dforcob@sancharnet.in
11. Name of Zoo	**South Khairabari Leopard Safari and Rehabilitation Centre, South Khairabari (Jalpaiguri) West Bengal**
A. Category of Zoo	Leopard Safari and Rescue Centre (Mini Zoo)
B. Contact Details	Divisional Forest Officer Coochbehar Division, Coochbehar, West Bengal - 736 101.
C. Telephone No.	03582-227185, Fax - 03582-227513
D. E-mail ID	slg_dfocob@sancharnet.in
12. Name of Zoo	**Ramnabagan Mini Zoo, Burdwan (West Bengal)**
A. Category of Zoo	Mini Zoo
B. Contact Details	Divisional Forest Officer, Burdwan Forest Division, Golapbug, P.O. - Rajbati, Burdwan - 713 104, West Bengal.
C. Telephone No.	0342-2657172, Fax - 0342-2559507
E. E-mail ID	dfobdn@sancharnet.in
13. Name of Zoo	**Adina Deer Park, Adina (Malda), West Bengal**
A. Category of Zoo	Mini Zoo

B. Contact Details	Divisional Forest Officer, Malda Forest Division, Nazrul Sarani, P.O. & Distt. - Malda, West Bengal
14. Name of Zoo	**Rasikbeel Mini Zoo, Rasikbeel (Coochbihar), West Bengal**
A. Category of Zoo	Mini Zoo
B. Contact Details	Divisional Forest Officer, Social Forestry Division, Coochbehar, West Bengal.
C. Telephone No.	03582-227727, FAX - 03582-230751
15. Name of Zoo	**Pugmark - PFA Rescue Centre, Shantiniketan (Birbhum), West Bengal**
A. Category of Zoo	Rescue Centre (Mini Zoo)
B. Contact Details	Secretary & Incharge Pugmarks Society for Conservation of Natural Heritage (PFA-Shantiniketan), Dera Purabpalli, P.O. Shantiniketan, Distt. : Birbhum - 731 235, West Bengal.
C. Telephone No.	03463-329354/ Mob. 09333523095, Fax - 033-30225509
E. E-mail ID	pugmarks@vsnl.com
16. Name of Zoo	**Weston Circus**
A. Category of Zoo	Circus
B. Contact Details	Proprietor, Weston Circus, 50B, Elliot Road,Kolkata - 16, West Bengal.
C. Telephone No.	09431423183
17. Name of Zoo	**Asiad Circus**
A. Category of Zoo	Circus
B. Contact Details	Proprietor, Asiad Circus,50 B, Elliot Road, Kolkata - 16, West Bengal
C. Telephone No.	09325309674033-22294856
18. Name of Zoo	**Ajanta Circus**
A. Category of Zoo	Circus
B. Contact Details	Partner Ajanta Circus, 89/3, Ripon Street, Kolkata - 16, West Bengal.
C. Telephone No.	09903440800/ 033-28295020
19. Name of Zoo	**Olympic Circus**
A. Category of Zoo	Circus

B.	Contact Details	Manager, Olyimpic Circus, 48, R.N. Tagore Road, Dakshineshwar, Kolkata - 700 076, West Bengal.
C.	Telephone No.	09433498904/ 033-25645398
20.	**Name of Zoo**	**Famous Circus**
A.	Category of Zoo	Circus
B.	Contact Details	Manager Famous Circus, 48, R.N. Tagore Road, Dakshineshwar, Kolkata - 700 076, West Bengal.
C.	Telephone No.	033-25645398/ 0937797463 (Mob.)
21.	**Name of Zoo**	**Kohinoor Circus**
A.	Category of Zoo	Circus
B.	Contact Details	Proprietor Kohinoor Circus, 50 B, Elliot Road, Kolkata - 16, West Bengal.
22.	**Name of Zoo**	**Natraj Circus**
A.	Category of Zoo	Circus
B.	Contact Details	Manager Natraj Circus, Village - Bhaskur, P.O. - Balihati, Distt. Howrah - 711 405, West Bengal.
C.	Telephone No.	03212-24638509831692913
23.	**Name of Zoo**	**Empire Circus**
A.	Category of Zoo	Circus
B.	Contact Details	Proprietor, Empire Circus, 50B, Elliot Road, Kolkata - 700 016, West Bengal.
C.	Telephone No.	033-22294856 09325309678



Indian Zoo
Directors'
Association
&
Central Zoo
Authority