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A QUARTERLY NEWSLETTER OF THE CENTRAL ZOO AUTHORITY

ex-situ UPDATES

Central Zoo Authority
केन्द्रीय चिड़ियाघर प्राधिकरण

Ministry of Environment, Forest and Climate Change

INTERNATIONAL ZOOKEEPERS DAY 2020

Talking Heads
Dr Liz Romer

Species in Focus
Gharial

CZA AWARDS | EX-SITU CONSERVATION BREEDING PROGRAMS- AN OVERVIEW
ASSAM STATE ZOO CUM BOTANICAL GARDEN, GUWAHATI | RIVER SAFARI, SINGAPORE

EDITORIAL TEAM

On the Cover:
Animal Keeper with the Greater One-horned Rhino
Assam State Zoo cum Botanical Gardens, Guwahati
(Photo: Rupankar Bhattacharjee)

Ex-situ Updates - Vol. 1 | Issue 1

Ex-situ Updates - Vol. 1 | Issue 2

CONTENTS

From the desk of Member Secretary ii

Tribute: 01
DR LALJI SINGH

MOST VISITED ZOOS IN INDIA Map 02

CZA News 03
Zoo news 04
CZA Awards - PRANI MITRA 05

EX-SITU CONSERVATION BREEDING PROGRAMS-
AN OVERVIEW 09

Talking Heads 13
DR LIZ ROMER - President International Zoo Keepers Association

Species in Focus
THE GHARIAL STORY – MCBT 15

Zoo in Focus - International 19
WILDLIFE RESERVE SINGAPORE

Zoo in Focus - India 21
ASSAM STATE ZOO CUM BOTANICAL GARDENS

From the pages of History 25
VEERMATA JIJABAI BHOSALE UDYAN & ZOO, MUMBAI

from the desk of

MEMBER SECRETARY

Hon'ble Minister of State, Shri. Babul Supriyo at National Zoological Park, New Delhi on the World Environment Day, with Dr S P Yadav, Member Secretary, CZA.

Dear readers, we thank you for the good review and feedback on our past two issues as we endeavour to bring the best stories from the zoo community. This edition is special as we prepare for the wildlife week with the campaign RoaR (Respect and Revive) Animal-Human Relationships.

Ex-situ management is a labour-intensive endeavour, where a close watch on animal healthcare, upkeep and bonding with the animal keeper is a key to conservation success.

Despite the challenges, there are 44 zoos across India that have taken up the ex-situ conservation breeding program for 20 priority species. These programs measure their success through what we term as the 4 pillars of ex-situ conservation viz. the Zoo Director/ Curator, Veterinarian, Biologist/ Educationist and Animal Keeper.

The COVID-19 pandemic brought with it an unprecedented situation, by bringing the whole world to a pause. The zoos had to take extensive precautionary measures to keep both the animals and their keepers safe. Their exemplary contribution during challenging times is commendable and widely appreciated.

Central Zoo Authority, as a first, is set to recognize such dedication with the CZA-Prani Mitra awards , as an appreciation and encouragement for people of the zoo community, who have put the welfare of the voiceless and have been a forerunner in setting an example.
To us they are truly the embodiment of zoo warriors!

DR. S P YADAV, IFS
Member Secretary - CZA

Hon'ble Minister of State, Shri. Babul Supriyo at National Zoological Park, New Delhi, with Dr S P Yadav, Member Secretary, CZA.

Dr Lalji demonstrating the 'Bkm' probe to a fellow scientist

TRIBUTE

Dr Lalji Singh

(4th July 1947 - 10th December 2017)

Father of DNA Fingerprinting in India

Text & Photos: Dr Karthikeyan Vasudevan
Senior Principal Scientist, CCMB (LaCONES)

Dr Lalji with James Watson of DNA fame

A prodigal child with humble beginnings from Jaunpur District of Uttar Pradesh; Dr Lalji Singh worked his way up the academic field by sheer determination and hard work. 'Lalji' as he was fondly called by friends, went on to obtain his doctoral degree in Cytogenetics from Banaras Hindu University, Varanasi in an era when researchers seldom ventured into this field. Later, he also enrolled as a post-doctoral fellow with Dr K. W. Jones at the Institute of Animal Genetics, University of Edinburgh, United Kingdom.

For the next 13 years, Lalji carried out research on the molecular basis of sex determination in vertebrates, using Banded Krait (*Bungarus fasciatus*) DNA. He received international acclaim for the molecular probe, famously called 'Bkm' probe, and was responsible for the establishment of DNA fingerprinting technology in India. In 1987, he was invited to take up a position as Senior Scientist at CSIR-Centre for Cellular and Molecular Biology, Hyderabad.

Lalji had an acute 'sense of purpose', he sensed and picked up problems that were novel with far-reaching applications.

His rise in the scientific arena was meteoric! In a span of 15 years, he established the Centre for DNA Fingerprinting and Diagnostics in 1995, the Laboratory for the Conservation of Endangered Species (LaCONES) in 1998, the Genome Foundation in 2004, Clinical Research Facility at CCMB in 2008. All these institutions have since blossomed, and remain proof of his visionary thinking. They personified the aspirational goals he envisioned for them.

He was conferred with 'Padma Shri' in recognition of his contribution to science and technology in 2004. He always believed that India should never lag in biological sciences, and also derive benefits from the development of technologies. His significant contribution to wildlife conservation came in the form of the development of universal primer technology, assisted reproduction technologies, and microsatellite markers for Asiatic Lion and Bengal tiger populations. What may seem like a routine activity today, is a result of hours of work put together by visionaries like Dr Lalji Singh, and the entire community of geneticists are in gratitude for the same.

Most Visited Zoos in India

Total Species Count & Iconic Species

NAME OF THE ZOO / TOTAL SPECIES

1. Sri Chamarajendra Zoological Gardens, Mysuru, Karnataka / 153
2. Kamla Nehru Zoological Garden, Ahmedabad, Gujarat / 83
3. Nandankanan Biological Park, Odisha / 154
4. Zoological Garden, Thiruvananthapuram, Kerala / 54
5. Nehru Zoological Park, Hyderabad, Telangana / 181
6. Sanjay Gandhi Biological Park, Patna, Bihar / 95
7. National Zoological Park, New Delhi / 98
8. Arignar Anna Zoological Park, Chennai, Tamil Nadu / 171
9. Bannerghatta Biological Park, Bengaluru, Karnataka / 101
10. Nawab Wazid Ali Shah Zoological Garden, Lucknow, Uttar Pradesh / 94
11. Assam State Zoo cum Botanical Garden, Guwahati, Assam / 123

Map Illustration: Vivek Sarkar

*Visitor data from Annual Report (2018-19) submitted by zoos

CZA *goes Digital!*

The post pandemic time has been a challenge, especially when we are nudged to go 'digital' and find new ways and means for communication. It increased efficiency as we moved towards paperless offices and provide opportunities of remote "work from home" to attract the best expertise in the country.

June 20, 2020

Role of Indian zoos in achieving WAZA's Animal Welfare goals - Dr Martin Zordan

July 04, 2020

Bringing back critically endangered species through ex-situ conservation - The story of Vultures
Dr Chris Bowden & Dr Vibhu Prakash

July 16, 2020

BIOBANKING - The cutting-edge science for reducing extinction risk - Dr Oliver A. Ryder & Dr Karthikeyan Vasudevan

August 04, 2020

Conservation Planning in Zoos - Dr Onnie Byers & Ms Roopali Raghavan

August 16, 2020

Conservation Designing for ex-situ facilities
Mr Erik van Vliet & Dr Rommel Mehta

August 29, 2020

Enrichment for Animal Welfare - Ms Georgina Groves & Dr Avanti Mallapur

September 13, 2020

New frontiers of Veterinary care in Zoos - Dr Paolo Martelli & Dr Budhan Pukazhenthi

September 26, 2020

Capacity building opportunities for Ex-situ conservation - Mr Jamie Copsey & Dr Bitapi Sinha

The webinar on COVID crisis at Bronx zoo on 2nd May 2020 was a trigger that motivated us to plan a series and Sri Chamarajendra Zoological Gardens, Mysuru came forward to support and co-host fortnightly webinars on zoo management featuring talks by eminent experts from across the globe on topics specific to zoo management.

- The first webinar covered aspects related to the goals of WAZA and how Central Zoo Authority and Indian zoo members are essential to achieve them.
- The second webinar covered the issue of vulture decline globally and across Asia and why ex-situ conservation of the species continues to remain important.
- The third in the series was a discussion on Biobanking, a cutting-edge science for reducing extinction risk including discussion on lab technology to support conservation breeding efforts.
- The focus continued with introductory talk on conservation planning and the emphasis on one plan approach developed by the IUCN Conservation Planning Specialist Group in the fourth session.
- Designing for ex-situ facilities has been a niche area and this was suitably discussed in the fifth session by renowned global expert team of zoo designers.
- The sixth session focused on enrichment as a tool for animal welfare, which included case studies of best practises from zoo professionals in Europe and the United States of America.
- The seventh webinar on New frontiers of veterinary care in zoos brought together zoo veterinarians to discuss the future of Zoological Clinical Medicine.
- The eighth in the series explored topics pertaining to Capacity building opportunities for ex-situ conservation.

Central Zoo Authority, New Delhi
https://www.youtube.com/channel/UC9DQs7r_Ln34K5NdcFr0iBg

Mysuru SCZG
https://www.youtube.com/channel/UChK7AmpOZP9LGxvdpPLBXZQ

ZOO NEWS

"When things do not go your way, remember that every challenge — every adversity — contains within it the seeds of opportunity and growth"

- Roy T. Bennet, Author and motivational speaker

The zoos did just that!

From virtual tours to keeper talks, the zoos reinvented themselves in the post-pandemic world. Engagement with children became digital as online competitions organized to commemorate various 'species' days were promoted, drawing enthusiastic participation by school kids.

The virtual tour programs of AAZP, Vandalur, and Alipore zoo Kolkata have been a primary attraction besides creating a digital repository of archival material.

Some of the zoos have reopened (as in Rajasthan and Karnataka) but with due consideration to safeguards on social distancing. It has been a mixed bag in terms of visitation, but with an improved situation in the country, it is expected to improve. Revenue loss has been a concern as visitor fee collection has dipped. But thanks to the philanthropic efforts by several individuals (viz Smt. Sudha Murthy, Chairman, Infosys Foundation), many cine actors, and charitable organizations, zoos benefitted from the animal adoption schemes/donations thereby ensuring a continuous supply of feed and upkeep. The scheme has also helped reconnect to RoaR (Respect and Revive) the human-animal relationship, especially in our urban city dwellers.

Knowledge sharing session with the Range Officers at Nandankanan Biological Park, Odisha

CZA Awards
Prani Mitra

Zoo warriors – an untold story

Text: Dr Gowri Mallapur, Veterinary Consultant - CZA

"Until we consider animal life to be worthy of the consideration and reverence we bestow upon old books and pictures and historic monuments, there will always be the animal refugee living a precarious life on the edge of extermination, dependent for existence on the charity of a few human beings"

- Gerald Durrell

This quote from many decades ago still holds good to this very day and zoos are an embodiment of this sentiment.

Zoos have come far from the menageries of the yesteryears and now are recognized as places where conservation action is possible in addition to research and last but not the least, entertainment. India is home to more than a hundred zoos spread across the expanse of the country, from the high-altitude zoo in the Himalayas to one with the oceanic backdrop in the Andaman Islands. One fact that binds these zoological institutions are the people who manage it.

The Director/Curator, the Veterinarian, the Biologist/Educationist, and the Animal Keeper are the 4 pillars of the zoological institution and they bear the responsibility of the health, well-being, and welfare of the animals in their care.

The Director/Curator is at the helm of the operations in the zoological institution. They oversee diverse collections and the people who manage these. The zoo directors strongly believe in the marriage of ex-situ and in-situ conservation efforts, and conceptualize and execute complex conservation breeding programs, e.g. The Red Panda Conservation Breeding Initiative at the Padmaja Naidu Himalayan Zoological Park or the Mouse Deer Conservation breeding at the Nehru Zoological Park, Hyderabad. Zoo Directors are leaders, motivators, and team players and they also plan and oversee national and international animal exchange programs. Zoos like the Madras Crocodile Bank Trust and Sanjay Gandhi Biological Park, Patna have sent animals like the Gharial and the Greater one-horned Rhinoceros to zoos internationally to build and diversify collections and form assurance colonies to support indigenous populations. Many zoos have initiated valuable CSR linkages to gain support for crucial conservation initiatives. They work with scientific institutions in the country like IVRI and CCMB to bring in better diagnostic facilities. Their action does not stop with collections as they help support urban ecological conservation e.g., Otteri Lake restoration under AAZP, Chennai, rain water harvesting initiatives by the Etawah Safari Park, growing their own food at NZP, Hyderabad, and vermicomposting initiatives of SCZG, Mysuru.

Lion-tailed Macaque has a swinging time with the enclosure enrichment at Nehru Zoological Park, Hyderabad

Pool time for the Asiatic Black Bear at the Assam State Zoo cum Botanical Gardens, Guwahati.

The zoo management is joined in their mission by the veterinary team who are directly responsible for the health of the animal and its physiological and psychological well-being. They tend to the animals daily but also attend to emergencies, that are increasingly tending towards wild animal rescue and rehabilitation in urban and peri-urban landscapes.

Several of the zoo vets are today adept at handling mobile digital radiographs, CT scans, and key-hole procedures in state-of-the-art hospitals. Veterinarians perform complex procedures from soft tissue surgeries for tumors/growths to bone repair with pinning or external fixators. Chemical Immobilisation and restraint especially at times of human-animal conflict has saved many precious human and animal lives. Hence zoo vets lead from the frontlines managing conflicts in the wild and the nutrition and the prophylactic medications in captivity so that the animals are safe and in the prime of health.

There is furthermore an unparalleled support system in the animal keepers. They are the true zoo warriors behind the scenes. Traditionally, Indian zoos have relied on lesser-educated men from humble rural backgrounds to serve as animal keepers. What sets them apart is their instinctive and lasting bonds with the animals. It is inexplicable yet one of the miracles of nature that even the wildest of species trust themselves completely to the loving care and empathy of their animal keeper. Be it the Sloth bears who like to rest in hammocks carefully prepared by Chandrajeet of VVZP, Bhopal, to Red pandas that look forward to special diet plans prepared by Dipen Gurung of PNHZP, Darjeeling. Jehangir Ali and Arup Rongpi have cared for the Golden Langur's needs at the ASZBG, Guwahati. Gurunath Narvekar of the VJBU, Mumbai, Rasikbhai Patel of INP, Gandhinagar, K. Krishna of KZP, Warangal, Ganga Durai of MCBT, Chennai, A Eswariah of SVZP, Tirupati and S. Somashekar of SCZG, Mysuru are some of the laudable frontline of our zoos who have been 24x7 on their job for more than 25 years and continue to do so even today.

Indian Pangolin mother and baby at the Nandankanan Biological Park, Odisha.

Mouse Deer bred successfully at Nehru Zoological Park, Hyderabad, and rewilded.

Last but not the least is the Biologist/ Educationist who brings in scientific rigour to the programs by maintaining meticulous complex data, studbooks for successful conservation breeding programs. They develop interpretive and interactive signages to promote awareness and conduct diverse education outreach and mentorship programs.

The COVID-19 pandemic has made the whole world come to a standstill. Zoos world-wide were affected and India is no exception. But the pillars of our zoological institutions have stood strong and have gone beyond the call of duty to maintain the captive collections. No stone was left unturned to keep the functions of the zoo going and no effort was too small. From increasing inhouse feed storage capacities to developing self-reliance by growing fodder, the zoos did everything in their power to keep the effect of the disaster outside the walls of the zoo. Rigorous disinfection and hygiene protocols were suggested and meticulously followed to keep both the animals and the staff safe.

To us, these zoo warriors are truly the epitome of dedication and selflessness that must be lauded and recognized.

The CZA has decided to institute a small step by launching the CZA-Prani Mitra awards this year to felicitate the zoo champions under the 4 categories of Director / Curator, Veterinarian, Biologist / Educationist and Animal keeper.

To sum up and as Gerald Durrell stated;
"With the millennium, perhaps, we will enter an age of ethics " it is hoped that the zoo warriors have shown the way forward to care for animals and make a small contribution towards protecting this planet. Let us take this mission forward and make the world a better place for all humans and animals alike.

Treatment of Demoiselle Crane with severe sinustitis and nasal block at Veermata Jijabai Bhosale Udyan and Zoo, Mumbai.

Getting inside information with an X-ray on a Small Indian Civet at Sanjay Gandhi National Park and Zoo, Mumbai.

Biologist, Nehru Zoological Park, Hyderabad, collecting data on Animal birth details.

Influencing young minds about conservation - Director, Nehru Zoological Park, Hyderabad.

Animal Keeper addressing IFS probationary officer at Nehru Zoological Park, Hyderabad.

Unraveling mysteries of the enigmatic Rusty Spotted Cat at Sanjay Gandhi National Park, Mumbai.

Great White Pelican, a free ranging species at the National Zoological Park, premises, New Delhi

Ex-situ conservation breeding programs- an overview

Text & Photos: Lakshminarasimha R, Scientific Officer - CZA
Archival Inputs - Bipul Chakravarty, Director, Tata Steel Zoological Park

The Conservation Breeding Programme in India is a joint venture of in-situ and ex-situ wildlife managers. CZA identified 74 species of threatened native fauna for coordinated breeding to meet the objectives of National Zoo Policy 1998. The goal of the program has been to establish 'insurance populations' of threatened species in zoos, for species restoration purposes.

A male Western Tragopan at the Sarahan Pheasantry, Himachal Pradesh.

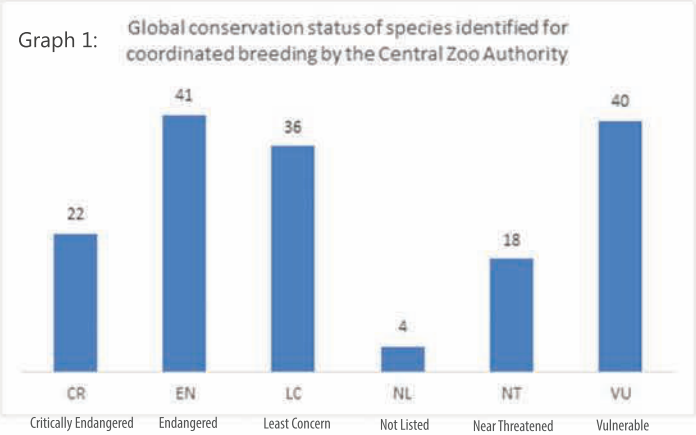
Since then, the process as initiated in 2005 with the identification of coordinating and participating zoos has yielded some results with restoration of a few populations. The coordinating zoos were selected based on their proximity to the natural distributional range of the species. Coordinating zoos were funded to establish exclusive off-exhibit facilities and participating zoos were envisioned to serve as facilities complementing the efforts of coordinating zoos. The target was proposed to establish a captive-bred population of at least 250 individuals of each targeted species in the world, of which 100 individuals are housed in India.

The initiation of the conservation breeding programs broadly followed these steps:

1) Identification, acquisition of founders (including those that need to be acquired from international zoos), and marking of animals.
2) Establishment of the database for founders including a National Studbook and liaison with International Studbook keeper.
3) Physical health screening and genetic profiling of founders in collaboration with Indian Veterinary Research Institute, Bareilly (National Referral Centre), and LaCONES, Hyderabad.
4) Engagement of technical help in the conservation breeding programs.

The taxa identified for conservation breeding include 24 bird species, 46 mammal species and 4 reptile species. The global conservation status of these species is as below:

Graph 1: Global conservation status of species identified for coordinated breeding by the Central Zoo Authority



The CZA also published the first "Guidelines/Norms for Conservation Breeding Programme of the Central Zoo Authority" in 2011.

As part of this, 25 conservation breeding programs were provided financial assistance by the Central Zoo Authority. This includes 17 threatened species (3 Critically Endangered, 5 Endangered and 9 Vulnerable species).

A female Western Hoolock Gibbon at the Assam State Zoo cum Botanical Garden, Guwahati

A Mouse Deer at the Assam State Zoo cum Botanical Garden, Guwahati

A male Gharial at the National Zoological Park, premises, New Delhi

Cumulatively, the CZA has provided more than six crore as funding exclusively to these programs in the past few years. Over eight years following the inception of conservation breeding programs, the following are the key achievements (for details refer to Graph1):

- Five breeding programs viz. Indian Chevrotain (*Moschiola indica*), White-rumped Vulture (*Gyps bengalensis*), Indian Vulture (*Gyps indicus*), Northern Pig-tailed Macaque (*Macaca leonina*), Lion-tailed Macaque (*Macaca silenus*), Cheer Pheasant (*Catreus wallichii*) have resulted in the establishment of a captive population with more than 50 individuals (range: 264 t-56).
- Six species viz. Slender-billed Vulture (*Gyps tenuirostris*), Greater One-horned Rhino (*Rhinoceros unicornis*), Western Hoolock Gibbon (*Hoolock hoolock*), Western Tragopan (T*ragopan melanocephalus*), Phayre's Leaf-monkey (*Trachypithecus phayrei*) have resulted in the establishment of captive population with more than 30 individuals (range: 48-24) in captivity.
- The following species have been reintroduced back into the wild following successful conservation breeding:
  - More than 100 individuals of Indian Chevrotain from Nehru Zoological Park, Telangana
  - 13 individuals of Cheer Pheasant from Chail Pheasantry, Himachal Pradesh
  - 6 individuals of Western Tragopan from Sarahan Pheasantry, Himachal Pradesh currently under soft-release.

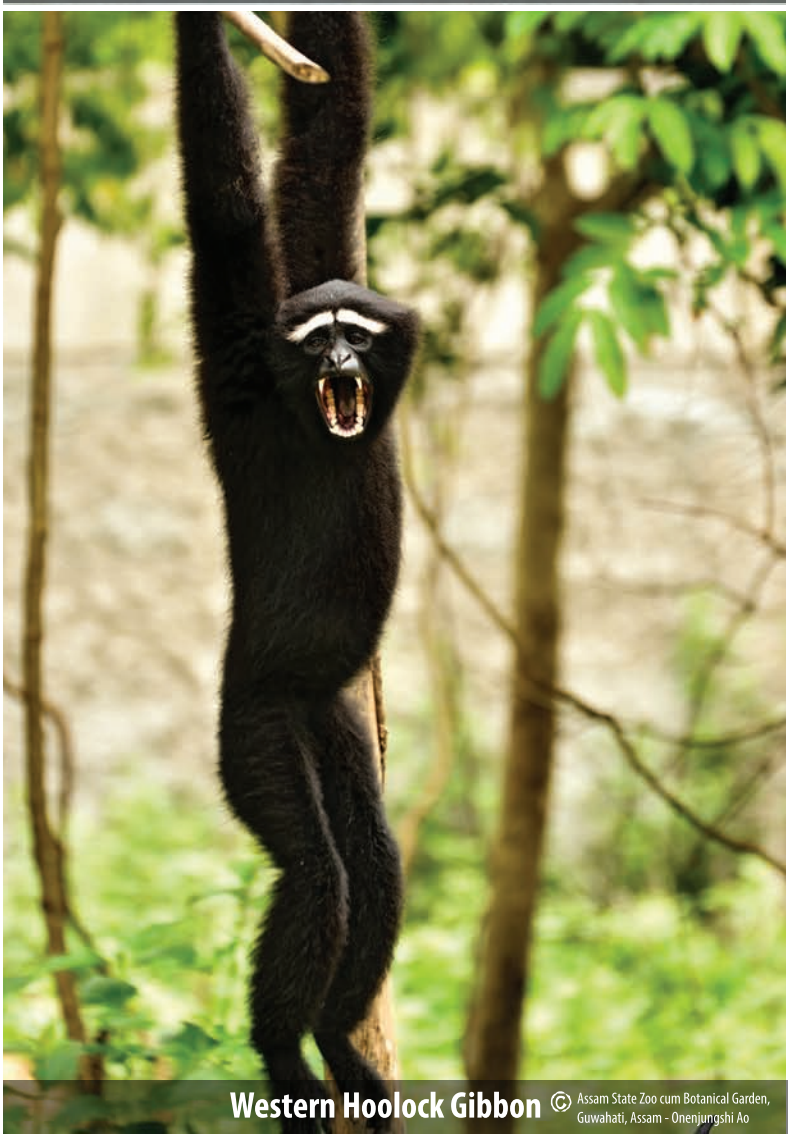
Phayre's Leaf Monkey © Bannerghatta Biological Park, Bengaluru, Karnataka- Lakshminarasimha R

Hog Deer (Fawn) © National Zoological Park, New Delhi - Lakshminarasimha R

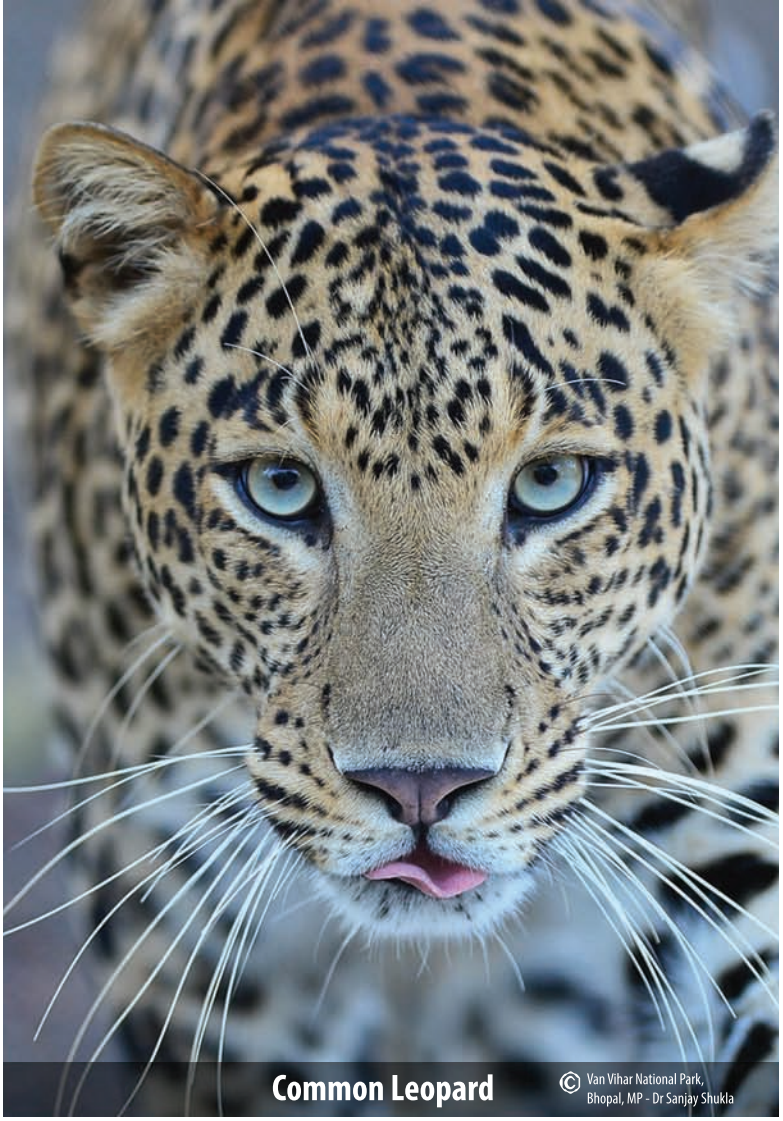
Red Panda © Padmaja Naidu Himalayan Zoological Park, Darjeeling, WB

Indian Roofed Turtle © Turtle Survival Alliance, India Dr Shailendra Singh

Himalayan Wolf © Padmaja Naidu Himalayan Zoological Park, Darjeeling, WB



Western Hoolock Gibbon © Assam State Zoo cum Botanical Garden, Guwahati, Assam - Onenjungshi Ao



Common Leopard

© Van Vihar National Park, Bhopal, MP - Dr Sanjay Shukla

Striped Hyena

© Van Vihar Rescue Centre, Bhopal, MP - Mridul Pathak

Russel's Viper

© Sri Chamarajendra Zoological Gardens, Mysuru, Karnataka - Lakshminarasimha R

Indian Peafowl

© Kamla Nehru Zoological Garden, Ahmedabad, Gujarat

Indian Pangolin

© Van Vihar National Park, Bhopal, MP - Dr Sanjay Shukla

Golden Langur

© Assam State Zoo cum Botanical Garden, Guwahati, Assam - Rupankar Bhattacharjee

Snow Leopard

© Padmaja Naidu Himalayan Zoological Park, Darjeeling, WB

Talking Heads

Dr Liz Romer

President, International Congress of Zookeepers (ICZ)

Liz Romer has worked with zoos since 1982, her expertise in the field is vast and diverse. She is currently the President of the International Congress of Zookeepers, which is a conglomerate of zookeeper associations from around the world." Published here is an exclusive interview for Ex-situ Updates, the International Zookeepers Day edition.

What according to you is the ideal role of a zookeeper?

A zookeeper's role is holistic and they must know their animals intimately so they can provide the best care for them. Zookeepers need to have diverse skills from cleaning, presenting suitable diets and enclosure habitat management. They need to be inquisitive about their animals normal behaviour and ideal body condition. They should be looking at all facets of animal care with the exception of veterinary treatments where they can participate through training behaviours to facilitate treatment without stress.

What were the problems faced by the Zookeepers during the initial stages in dealing with the pandemic? How were they kept motivated?

Many zookeepers faced losing their jobs as zoos shut their gates or reduced wages. Others just stayed full-time at the facility they worked at so as not to compromise their animals and co-workers. It was very tough but the motivation has always been the animals lives and the fact that the keepers care deeply for their animals.

What are the new norms in the Covid-19 situation that are brought in terms of Zookeeper training and animal welfare?

I don't think animal welfare changed greatly apart from more realization of zoonotic diseases and disease control. Zookeeper training needed to move to an online platform rather than the face to face formal learning.

What aspects of zoo keeping do you think should be inculcated into zoo functioning in the Indian context?

We need to recognise the role of a zookeeper as a profession and the wide variety of skills required to successfully manage the role. I personally think the issue of providing the best in terms of animal welfare based on the five domains (nutrition, environment, health and behavior and mental state) is one of the most important things we should be concentrating on. In turn visitors will use these domains in caring for other animals in their lives and around them.

What potential training opportunities are available to build capacities of Indian zookeepers?

There are more online opportunities and publications viz husbandry guidelines for zookeepers globally to access including free material on many zookeeper associations websites such as the www.aszk.org.au. The ICZ website (www.iczoo.org) also advertises workshops etc., that may be of interest. We encourage people to sign up for our quarterly e-newsletter which promotes some of these opportunities. We have also sponsored a few Indian keepers to attend the ICZ congresses. The ICZ (info@iczoo.org) is always looking for opportunities to hold it's (normally) annual committee meeting in countries where we can then assist in keeper workshops.

Please describe the ideal day of a zookeeper.

Each day is different and learning new and amazing facts or something about our animals daily is what makes the job so exciting The ideal day starts and ends with making a difference for our animals and knowing we have done the best we can with their care.

On this International Zookeepers Day, what would be your key message to the Indian Zookeepers?

The big message is to keep on caring both for your animals and your colleagues. International Zookeeper Day (IZD) on October 4th is to encourage all those who make it their life's work to care for animals, to promote professional recognition, awareness, and celebrate the important role they perform. IZD includes zoos, sanctuaries, aquariums, rescue centers, wildlife parks or reserves. On this day we encourage these facilities to engage in activities, to promote awareness and appreciation of the important role of zookeepers in wildlife conservation.

Archival images of first Gharial reaching MCBT at 1984, and of the enclosure being constructed.

Species *in focus*

The Gharial Story - A Narrative

Text & Photos: Zai Whitaker- Madras Crocodile Bank Trust (MCBT)

In the winter of 2016, I was at the base of Madras Crocodile Bank's field station, the Gharial Ecology Project (GEP) on the Chambal. This beautiful 428-kilometre river flows through three states: Uttar Pradesh, Madhya Pradesh, and Rajasthan and is home to the world's last sizeable population of the Critically Endangered gharial.

The winter mist created strange artwork on the water and sand banks. We approached a mid-river island with a perfect wildlife arrangement: a large gharial, some freshwater turtles, a few cormorants and a skimmer. Further up, there were other river dwellers like the jackal, wild pig, mugger and several water birds. Worldwide, there are 25 species of crocodilians, in 3 families of the order Crocodylia: the alligators and caimans, the "true" crocodiles, and the gavialidae. Gharial are the only true descendants of the 100-million-year-old Gavialidae family which included ocean-going species and a 15-meter monster.

Gharial are a part of the "large crocs" club, along with the saltwater and Nile crocodiles. Large male gharials can exceed 5 meters.

Using radio telemetry, our team has been studying the behaviour and biology of the gharial for over ten years with Dr Jeffrey Lang, one of the foremost crocodile biologists in the world, as the Scientific Advisor. The field team's daily routines with long hikes up and down the ravines carrying heavy equipment and supplies, in extreme weather are not for the faint-hearted! Luckily this was one of the easier days: mostly boats travel along a 20 km river stretch, to locate one of the study animals.

Jailabdeen of the GEP is studying the signals a "ghara" of the male produces, a sort of underwater Morse code. The "words" are sudden, loud "popping" sounds. The build-up time for each pop, and the interval between pops, form communication signals viz warnings, threats, and flirty messages to females.

Basu da (centre) in the field. Photo: Abhijit Das

Professor Jeff Lang and vet Gowri Mallapur radio tag a young gharial. Photo: GEP

This pot-like appendage on the snout is unique to large males… a boom-box and amplifier rolled into one.

But first things first; we cut the engine and drifted to a sand bank for a hefty breakfast. It was a good spot for "visiting" one of the adult females fitted with a transmitter. The large aluminium antenna was plugged into the receiver and held up. Holding it, I could feel the throb of the signal, weak at first then growing stronger. She was obviously on the move, swimming towards us. These transmitters, usually fitted over the tail using a strong Kevlar fishing line, have a life of 2.5 to 3 years and a range of about 3 kms. Thanks to telemetry, amazing information has come to light, which helps to work out conservation strategies for crocodiles in the countries where they occur.

We were on the river until late evening, recording locations, observing gharial and inviting river dwellers to an education program the next day. A good time for me to wander down memory lane, mentally tagging some of the highlights of India's gharial conservation story.

Alarm bells were ringing for the gharial in the early 1970s. Their numbers had declined rapidly, from thousands to hundreds in two decades due to hunting,

Indeed, all three Indian crocodilians were in bad shape. The Government launched a massive conservation research project, inviting the FAO (Food and Agriculture Organisation) as partners. FAO's chosen expert, Dr Robert "Bob" Bustard, worked on Project Crocodile for seven years. He set up the Crocodile Breeding and Training Management Institute in Hyderabad, which later became the Wildlife Institute of India and moved to DehraDun.Working with NGOs in many states, he set down a blueprint for gharial conservation including captive breeding, rear-and-release hatcheries, and habitat protection. Gharial were first bred in captivity at the Nandankanan Zoological Park in Odisha and then at the Madras Crocodile Bank.

The Crocodile Project team was a mixed bag of state and central government stakeholders as well as NGOs like WWF and the Madras Snake Park, which had already been in the game of crocodile conservation. Exceptional PhD students were selected to study crocodiles and help with field work as well as captive breeding and rearing.

And then there was the gharial stalwart Dhruvajoti Basu, who joined the Chambal project of the U.P. Forest Department in 1975, as a Wildlife Surveyor, the first one ever hired by any state!

Telemetry, an exciting new tool for wildlife studies. Photo: GEP

He was with the U.P. Forest Dept for 33 years and then with WWF-India. His tragic death in 2012 during a survey on the Brahmaputra was a huge loss for conservation.

"Basu da" as he was known, started his reptile career at the Madras Snake Park. He was a student at IIT Madras/Chennai, and a veritable polymath: whether it was a math, science, art or literature question, he had the answer. He was obviously one of those ace students who did well in spite of much "bunking" of classes; as more time was spent at the Snake Park!.

IIT's loss was the gharial's gain. Basu da collected the first wild gharial nest for Project Crocodile, which hatched in a brick incubator designed by Bob Bustard, a big moment for gharial conservation. He also helped set up and run the gharial breeding and hatching centre in Kukrail, Lucknow. Thousands of gharials were hatched here under his supervision and guidance, and many released in wild habitats.

In 1978 there was another landmark moment; the Chambal River National Gharial Sanctuary was declared. It was our first tri-state sanctuary, spanning the three "home states" of the Chambal. Other endangered species also benefited from this move: the Ganges river dolphin, smooth coated otter, red-crowned roof turtle, mugger, and mahseer.

Basu da and his team traversed the river, studying the gharial's natural history and populations and locating nests. They convinced fishermen not to kill or maim gharial that got caught in their nets. Once, during a night survey, he had a close encounter with a defensive nesting female. But his most memorable "encounter" was with Phoolan Devi, popularly known as the Bandit Queen of Chambal ravines. She struck up a conversation with Basu da, and was amused that he was risking his life to count gharial! Unfortunately, she took a liking to his 10 x 50 binoculars and asked for them. It was a gentle request, Basu da would explain later, rather than a demand. She went on to say, "I know the Forest Department will give you trouble for losing your durbeen (binoculars), so I'll give you a receipt with my signature." And she actually did!

In the winter of 2007-08 (December and January), just as the gharial population was beginning to recover, there was another scare. About 100 adult gharials were found dead 60 kms above the Chambal-Yamuna confluence. The MoEFCC took quick cohesive action with government bodies and NGOs. Vets from India and abroad conferred; zoos and conservation organisations sent funds, and a team from the Crocodile Bank helped to coordinate the exercise. The diagnosis was that the cause of these deaths was probably a nephrotoxin. The severely damaged kidneys of the affected animals were not removing uric acid forming debilitating deposits of uric acid crystals in the joints, or gout.

How the poison entered the river and its food chain is still a mystery, but rivers are, unfortunately often used as dumping grounds. The incident was a chilling reminder about how quickly a species can be decimated.

The die-off indicated the urgency for a greater conservation presence on the Chambal. The GEP is one of these. Its multidisciplinary work, along with other partners in the field, is revealing fascinating pieces of the life of the gharial. For example, the individual adult range is up to 200 kms, especially that of nesting females. Unlike most other crocodiles, gharial are colonial nesters, with multiple nests at one site. A big- daddy ghara male, along with some adult nesting females, patrol the nesting area, or creche, keeping predators away. Up to a thousand hatchlings emerge and hang round the creche -which the male guards for around a month. This is a crucial period for them. At their size, predators are plenty, from bullfrogs and big fish to jackals and herons. He warns the hatchlings about any danger, chases away the predators from the area, and summons additional help from the females.

The gharial is now considered extinct in four of its original range countries, Pakistan, Bhutan, Myanmar and Bangladesh where occasional gharials from the Indian side are sometimes sighted. That leaves us, and Nepal. Most of the breeding population inhabit the Chambal, with smaller numbers of adults in Katerniaghat Wildlife Sanctuary (Girwa), Corbett National Park and the Gandak which straddles Nepal and India. There are rehabilitated populations in Hastinapur on the Ganges and on the Beas.

There are still many challenges, such as illegal sand mining and fishing, but a good start has been made by including local communities in conservation efforts.

As conservationists all over the world have repeatedly said, nothing is possible unless the local inhabitants are involved and supported. Let us hope that this aspect will be further strengthened. To be the last home of one of the most endangered large predators in the world, is both an honour and a responsibility. Looking at how much has been achieved, I am optimistic about the gharial's future.

A ghara-male creche guardian. Photo: GEP

Tagged and about to be released back into the river. Photo: GEP

A young visitor admires an Indian Gharial at River Ganges underwater viewing exhibit.

ZOO *in focus*

River Safari, Singapore

Life Above and Below Freshwater

Text & Photos: Mr Mike Barclay - CEO, WRS

River Safari, opened in 2013, is the youngest of Wildlife Reserves Singapore's four wildlife parks. Occupying an area of 12 hectares, River Safari celebrates life above and below freshwater ecosystems of the world.

Located next to her sister institution Singapore Zoo, River Safari nicely complements the bigger park. With more than 80 per cent of River Safari under shelter, guests can comfortably explore this all-weather venue anytime, rain or shine. This, combined with the linear layout and ease of navigation within the park, makes River Safari a most family-friendly park, from young children to senior citizens, and everyone else in between. River Safari hosts an annual average of 0.9 million guests.

Guests can admire the aquatic denizens of the freshwater realms via a leisurely stroll. Aquariums or paludariums of various sizes and dimensions recreate the natural habitats of the species they provide homes for.

Giant River Otters family explore their underwater home at Singapore's River Safari.

The exhibits range in size from 'jewel tanks' to ballroom-sized mega-aquariums. Habitat-wise, there is the lush greenery of a tropical forest riverbank, through the rocky lake bed of Lake Tanganyika, to the temple steps reaching down to the sacred Ganges.

Guests also get the chance to experience Amazon River Quest, an exciting boat ride to observe wildlife on the riverbanks such as Jaguar, Brazilian Tapir and many species of neotropical monkeys.

Guests encounter a Brazilian Tapir on the Amazon River Quest boat ride.

Sensitisation of the Giant Mekong Sting Ray for close-up examinations by hand feeding.

A herd of West Indian Manatee swimming peacefully in the Flooded Forest exhibit. River Safari has been highly successful in breeding this aquatic mammal species.

Signature exhibits of River Safari include the climate-controlled Giant Panda Forest, home to Singapore's beloved pair of Giant Pandas Kai Kai and Jia Jia; and Amazon Flooded Forest, home to our herd of Manatees and a variety of impressive fish such as the Arapaima and Red-tailed Catfish.

River Safari is home to about 250 species (~8000 specimens) of fishes, mammals, reptiles, birds and amphibians. The park features many 'giants' of the mightiest river systems of the world, including Giant freshwater stingray, Giant catfish from the Mekong, Indian gharial from the Ganges, Goliath tigerfish from the Congo, as well as Arapaima and Giant river Otters from the Amazon.

To help ensure the highest standards of animal welfare, River Safari keepers and aquarists use Positive Reinforcement Training (PRT) to condition many of our animals for up-close physical examination and simple medical procedures without having to resort to stressful physical restraints. This allows our animal carers to closely monitor the health of our animals, and to provide medical care early in a safe manner to both animals and staff members.

River Safari contributes to the conservation of threatened aquatic species by convening IUCN Red List assessment on Southeast Asian freshwater fishes, as well as ongoing protection of Southern River Terrapin and Siamese Crocodile in Cambodia, among others.

Ex situ conservation research and breeding in River Safari include the critically endangered Singapore Freshwater Crab and the Licorice Gouramis; the former is endemic to Singapore while the latter is a group of fascinating fishes that live in the acidic blackwaters of the peat swamps of Southeast Asia.

A majestic Greater One - horned Rhino in the naturalistic enclosure at the Assam State Zoo cum Botanical Garden, Guwahati.

ZOO *in focus*

Assam State Zoo cum Botanical Garden, Guwahati

Text: Mr Tejas Mariswamy, IFS - Director *Photos: Rupankar Bhattacharjee*

Established in 1957 and spread across an area of 175 ha, in the picturesque landscape of the Hengrabari Reserve Forest lies the Assam State Zoo cum Botanical Garden popularly known as the Assam Zoo, a large category zoo. Being the largest zoo in the northeast India, it has around 55 enclosures housing over 41 species of mammals, 51 species of birds & 32 species of reptiles totalling over 1000 individuals. Among them are some iconic species; Western Hoolock Gibbon, Golden langur, Oriental Pied-hornbill, Leopard (melanistic), Greater One-horned Rhino, Pygmy Hog, Himalayan Serow and Greater Adjutant Stork of which, most of the species have been bred successfully by the zoo.

Under the ten-year Vision Plan, the zoo is on the brink of a major makeover to be completed by 2022 with new and futuristic enclosures which are based on animals' wild habitat as the theme. The Assam State Zoo firmly believes that the enclosures are animal-centric and provide for their physical and psychological needs; making people be a part of this immersive experience. A few ambitious plans are already under implementation - African Savannah Habitat and Indigenous Walk-in Aviary. The African Savannah Habitat, the first of its kind, aims to visually transport the zoo visitor to the African Savannah with Giraffe, Zebra and Ostrich together. The Aquascape, Amazonian habitat, and futuristic Vulture and Leopard enclosures are also on the anvil.

The Assam State Zoo is the coordinating zoo for the conservation breeding program of five conservation dependent species namely- Greater One-horned Rhino, Golden Langur, Golden cat, Himalayan Serow and Grey Peacock-pheasant. Recently the zoo has proposed to include two more endangered species in the list- Black Soft-shell Turtle and the White-winged Wood Duck.

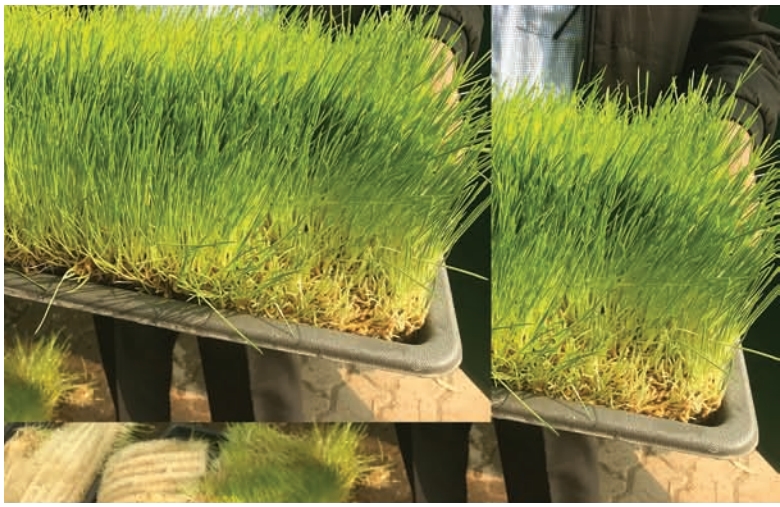
In September 2019, the zoo and its associates, have supplemented in-situ populations of the endangered Black Softshell Turtle artificially incubating the eggs collected from temple ponds. The hatchlings have been reared to the appropriate size and in accordance to the IUCN protocols released in the vicinity of Pobitora Wildlife Sanctuary.

As part of the conservation breeding plan, a joint initiative by Nagaland Zoological Garden, Dimapur and Assam State Zoo the lone individuals of Himalayan serow at both the zoos were paired by means of a breeding loan which led to successful breeding. The Assam State Zoo is also actively engaged in rescue of wildlife straying into human habitat, and their rehabilitation or life-time care of those that cannot be rehabilitated in the wild. The Guwahati city is surrounded by Amchang Wildlife Sanctuary on one side and Meghalaya forests on the other. As such, the role played by the Assam State Zoo in mitigating man - animal conflict in the city is unparalleled, especially with regard to wild elephants. Twice in the last 20 months, the Assam State Zoo has successfully restrained wild elephants that had strayed into the city thereby preventing any major casualties or damage to property. This apart, mitigation of conflict concerned with leopards and reptiles is a regular activity for the zoo personnel.

The Assam State Zoo is also the first zoo in the country to introduce the concept of Hydroponics - a system which can produce up to 1200 kg green fodder per day in a space of 1000 sq. feet.

The Guwahati Refineries under their CSR initiative have funded the project. This is a step towards self-reliance, which the zoo is striving for. Another important development for the Assam State Zoo is the creation of a society to retain the revenue generated and later strive for financial self-sufficiency. Such a system is already in place in many zoos in the country.

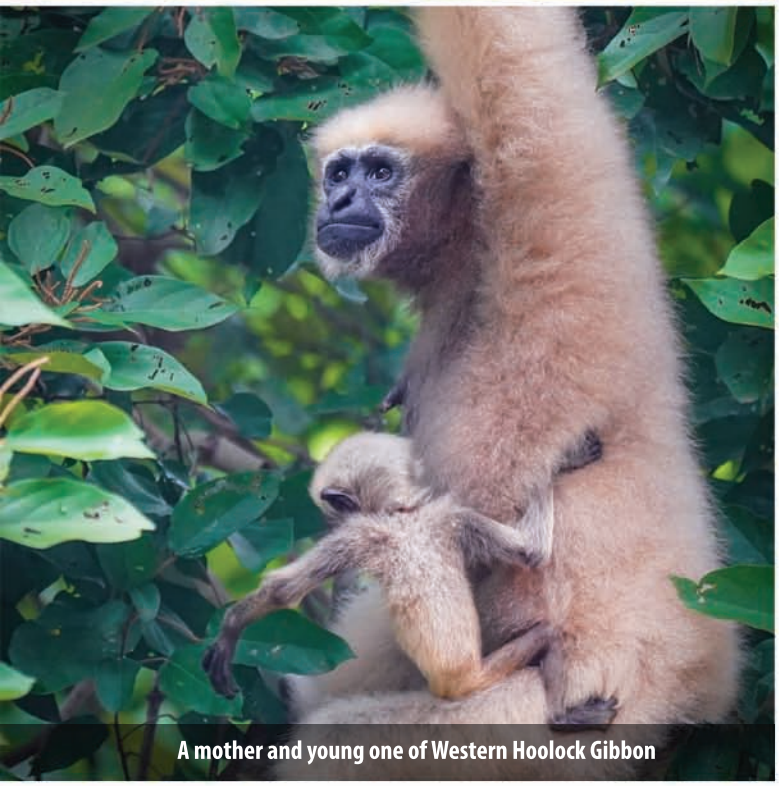
Fodder grown using the concept of Hydroponics.



The fodder to be fed to the animals from the freshly in-housegrown batch.

The Greater One-horned Rhinos being fed with the fodder grown using Hydroponics.

Green Cat Snake



A mother and young one of Western Hoolock Gibbon

Diversification of Zoo Activities

As indicated earlier, the Assam State Zoo can be divided into two sections - zoo area with animal enclosures of 30 ha. and the pristine forest area of 145 ha. The forest patch of the Zoo is very diverse in terms of its biodiversity. Approximately 637 species of flora and over 100 species of fauna are found in the area. The zoo intends to retain this patch and propose forest-based ecotourism activities. The zoo being in the centre of the Guwahati City, the Forest area acts as its Green lung, providing the city inhabitants various ecosystem services. The Assam State Zoo has signed an agreement with the Assam Mountaineering Association and it is proposed to initiate adventure-based tourism.

To summarize, the Assam State Zoo is now successfully implementing its core objective of conserving endangered native species, while also imparting conservation education to the citizens of the country in diverse ways. The Assam State Zoo has their foot on the accelerator on the long journey it has embarked upon.

Brow Antlered Deer in their enclosure © Rupankar Bhattacharjee

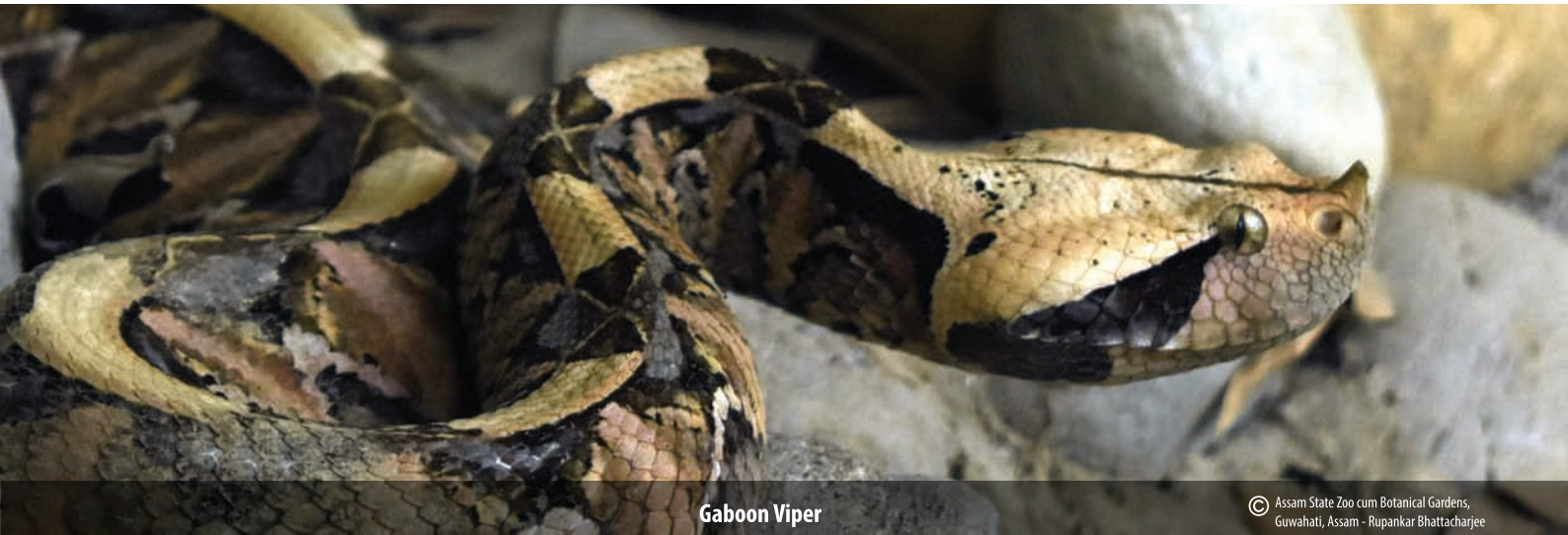
Northern giraffe, necking around © Rupankar Bhattacharjee

Jungle Cat kittens

Egyptian Vulture

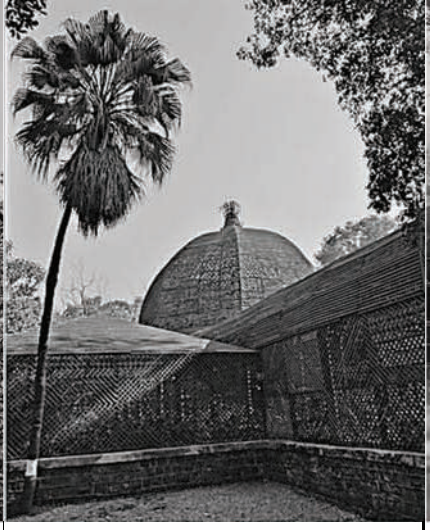
Binturong

Himalayan Vulture



Gaboon Viper

The 67-foot-high Italianate Sassoon clock tower, stands close to the main road adding charm and character to the neighbourhood.



Exquisite lattice woodwork inspired by Decimus Burton's Palm House at the Royal Botanic Gardens, Kew

The stony grotto, made from basalt stone with high compression and abrasion strength, was once used as the hiding den and feed house for the Asiatic black bear and is symbolic of the olden time concept of animal housing.

from the pages of **HISTORY**

Veermata Jijabai Bhosale Udyan & Zoo, Mumbai

Text & Photos: Dr Sanjay Tripathi - Director

June 1861

Established as Victoria Garden

November 1862

Formally opened to the public by Lady Frere, wife of the then Governor, Sir Bartle Frere

1873

Society handed over management to Municipal Corporation of Greater Mumbai

1969

Name changed to Veermata Jijabai Bhosle Udyan

January 1980

Name was modified to Veermata Jijabai Bhosle Udyan and Zoo

The Victoria Garden has the wildest species of trees and historic monuments like the Triumphal Arch, Kala Ghoda statue, Italianate Clock Tower, the Frere Temple and a Greek style-Rotunda, among many others. V.J.B. Udyan and Zoo, fondly recognised as Ranibag (Queen's Garden) by Mumbaikars, has a 63% garden area and animal enclosures in the remaining 37%. It has over 4,000 trees of more than 250 species belonging to 54 families, and 297 animals of 41 species. It is a "Heritage Grade II (B)" site and is recognised as "Medium Zoo" by Central Zoo Authority, New Delhi. Recently, the zoo has undergone some monumental changes. The zoo bid farewell to the old enclosures and moat systems. New state of the art facilities was developed for the animals, keeping in mind their behavioral requirements. A well-equipped zoo hospital, exhibits mimicking the animal's natural habitats, electrical fencing for animal safety, sound proof glass viewing for non-intrusive immersive visitor experience have been introduced.

Pictures of the newly developed enclosures

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