ex-situ

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Central Zoo Authority
केन्द्रीय चिड़ियाघर प्राधिकरण

Ministry of Environment Forest and Climate Change

CONTENTS

ex-situ

Cover and Back Cover Photo Credit: Dr. Sanjay Kumar Shukla, IFS

FROM THE DESK OF

MEMBER SECRETARY

Zoos in India function as ex situ conservation institutions that contribute significantly to biodiversity conservation through scientifically guided animal management, research, education, and capacity building. In alignment with the provisions of the Wild Life (Protection) Act, 1972 and the standards prescribed by the Central Zoo Authority, Indian zoos are increasingly adopting evidence-based practices to ensure optimal animal welfare and long-term conservation outcomes.

The integration of technology has markedly strengthened zoo management systems in recent years. Digital animal inventory and record-keeping platforms facilitate accurate documentation of individual life histories, health parameters, reproductive status, and pedigree data. Continuous behavioural monitoring through CCTV surveillance enables early detection of stress, abnormal behaviours, and health anomalies.

Breeding programmes in Indian zoos are implemented using established scientific protocols that emphasize genetic management, demographic stability, and behavioural compatibility. Emphasis is placed on maintaining genetic diversity, minimizing inbreeding depression, and promoting natural breeding behaviours through enclosure design, social structuring, and nutritional optimization. In select cases, hand-rearing and assisted breeding interventions are applied under strict veterinary and ethical oversight.

Overall, the integration of scientific management and technology has positioned Indian zoos as critical conservation facilities contributing to long-term species survival and national wildlife conservation objectives.

Dr. V. Clement Ben
Member Secretary,
Central Zoo Authority

"Rose" at Agra Bear Rescue Facility, Uttar Pradesh

In Memoriam — Rose

In the early hours of a serene spring morning, Rose, a beloved wild sloth bear, passed away. As the sun's warm rays touched the earth, a profound stillness filled the air, as if nature itself was mourning the loss of the bear. The trees, shedding the remnants of winter, bowed to honour the bear who had roamed beneath them for eight years. Her departure in spring, a season of new beginnings, felt like a bittersweet farewell.

Rose's journey with Wildlife SOS began in 2016 when she was just a nearly one-year-old cub. Villagers near Bhopal spotted her limping, her left front paw mangled, likely from a vicious jaw trap. Despite her injury, Rose displayed incredible resilience, using her tiny muzzle as a crutch to search for food. Her vulnerability without a mother and her deteriorating condition prompted the villagers to alert the forest department and they in turn Wildlife SOS.

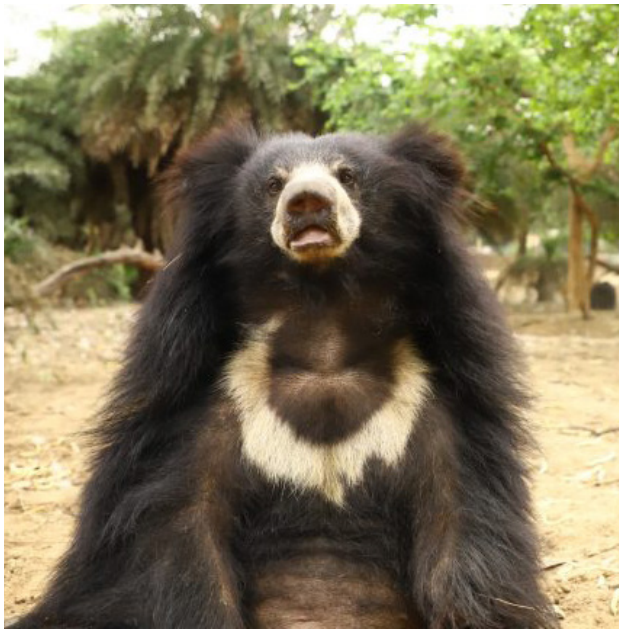
The team found Rose hiding among the trees, struggling to move on her remaining limbs. She was immediately taken to a Wildlife SOS sloth bear rescue facility for urgent treatment. Initially defensive, she tried to protect herself with her injured forelimb, showcasing her incredible strength and spirit. Despite her emaciated state, Rose's will to survive touched the hearts of her rescuers. Medical examinations confirmed that her paw was too damaged to recover fully, and survival in the wild seemed impossible. Rose was then entrusted to Wildlife SOS for long-term care.

The dedicated veterinary team tended to her wounds while caregivers created a comfortable environment tailored to her needs. Rose, shy at first, gradually warmed up to her caregivers, who admired her intelligence and gentle nature. She quickly became a beloved resident, impressing the team with her ability to grasp cues during target training, making routine checkups easier.

In the year 2023, Rose's health began to decline as she developed a limp in her left hindlimb, which led to hindquarter lameness. Her appetite waned, even for her favourite treat, honey. By January 2024, Rose had tested positive for tuberculosis despite receiving preventative medication. Her condition worsened, and she became reliant on intravenous fluid therapy. Paralysis and prolonged immobility eventually compromised her cardiopulmonary system and overall health. Rose passed away peacefully in April 2024, with her caregiver and the team by her side.

Rose's story was one of resilience and strength. Despite losing a paw, she adapted and thrived, even climbing 25-foot-high trees with ease, much to the amazement of her caregivers. Her zest for life was evident in everything she did, from digging pits to nestle in to forging close bonds with her enclosure mates, Bintha and Mandro, lovingly referred to as the 'three musketeers'. As the 'peacemaker' among the trio, Rose played a crucial role in maintaining harmony within their group.

With Rose gone, Bintha and Mandro's enclosure feels lonelier. But her memory lives on, reminding all who knew her of the power of will and the courage to overcome adversity. Though Rose is no longer with us, her legacy endures in the hearts of everyone she touched, inspiring us to live each moment with strength and determination.

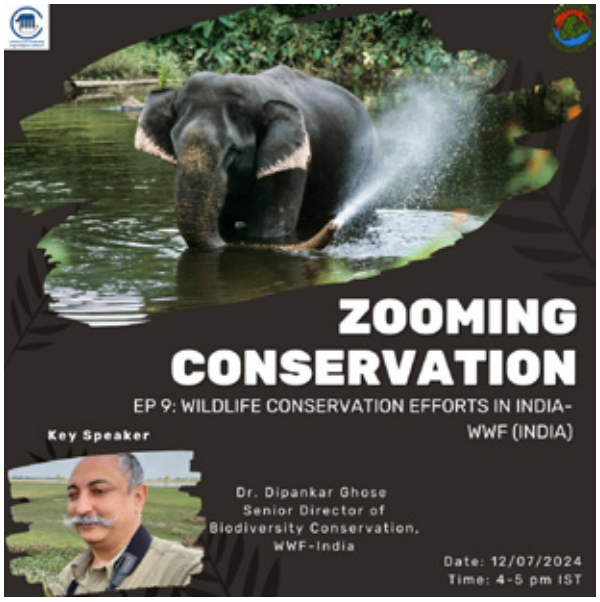


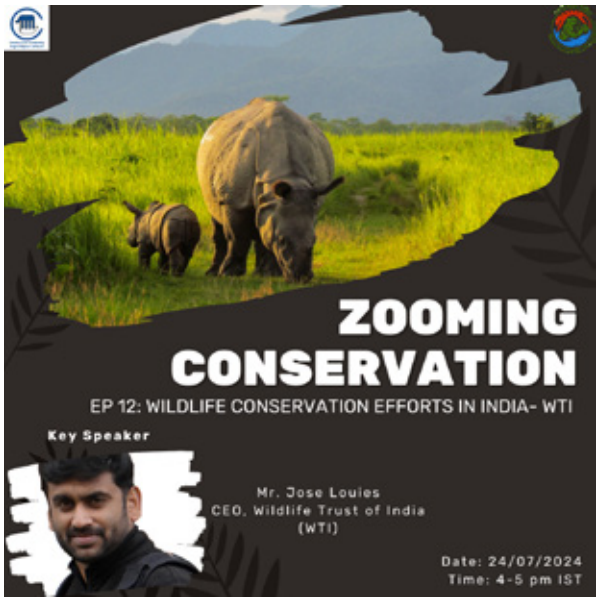
41st Meeting of the Governing Body of Central Zoo Authority

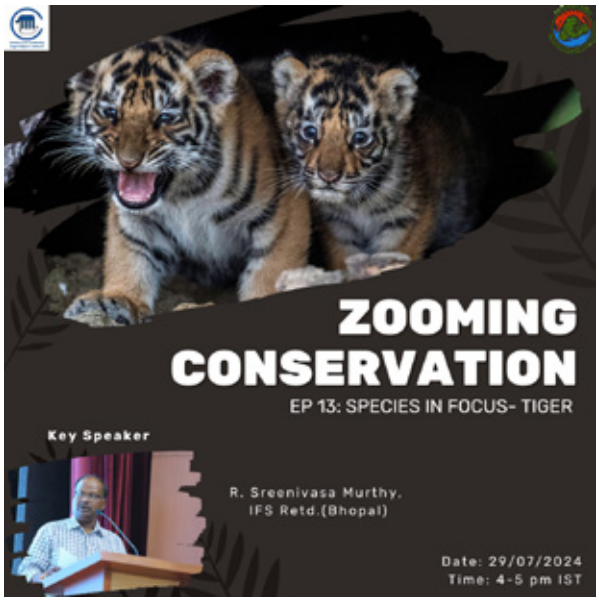
The Governing Body Meeting of the Central Zoo Authority held under the chairpersonship of Shri Bhupender Yadav, Hon'ble Minister For Environment, Forest and Climate Change, Government of India on 8th August 2024, at Indira Paryavaran Bhawan, Jorbagh Road, Aliganj, New Delhi.

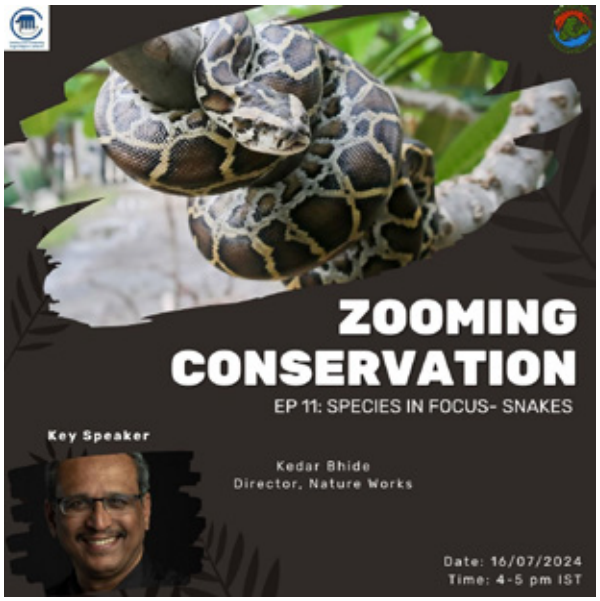
“Ek Ped Maa Ke Nam” / “एक पेड़ माँ के नाम” Campaign

“Zooming Conservation”









Captive Breeding of Ostrich *(Struthio camelus)* at Bhagwan Birsa Biological Park, Ormanjhi, Ranchi, Jharkhand

Text & Photos: Mr. Vivekanand Kumar- Senior Zoo Biologist and Dr. Om Prakash Sahu-Veterinary officer of Bhagwan Birsa Biological Park, Ormanjhi, Ranchi, Jharkhand

Abstract

The captive breeding of the Indian Ostrich (*Struthio camelus*) at Bhagwan Birsa Biological Park, Ranchi, has been an essential step in the conservation and preservation of this iconic species. This captive breeding aims to enhance the population of the Indian Ostrich by establishing a breeding within the zoo. Over the course of the breeding season, various techniques were employed to ensure optimal conditions for mating, egg-laying, and hatching. The health and genetic integrity of the ostriches were continuously monitored, and veterinary care was provided when necessary. The activity involved close observation of behavior, nutrition, and habitat management. Preliminary results show a promising success rate in egg hatching and chick survival, marking a significant achievement in the zoo's conservation efforts. The project also aims to study the broader implications of such captive breeding efforts for species conservation and the role of Indian zoos in supporting biodiversity.

Introduction

The Ostrich (*Struthio camelus*), the world's largest bird, is a fascinating species native to the Africa. Known for their striking appearance, unique behaviors, and economic value, ostriches have intrigued humans for centuries. Ostriches are highly social birds, often forming small groups or family units. In the wild, breeding is typically seasonal and synchronized with the rainy season, which provides abundant food and water resources. During this period, ostriches exhibit complex courtship displays, engage in nest building, and lay eggs. A typical clutch consists of 10–15 large, hard-shelled eggs, incubated for approximately 45-55 days by both parents, who alternate duties to protect the eggs from predators.

In recent years, wild ostrich populations have been increasingly threatened by habitat loss, poaching, and climate change. Captive breeding activity have emerged as a vital conservation strategy to mitigate these threats and ensure the survival of this iconic species. Bhagwan Birsa Biological Park in Ormanjhi, Ranchi, Jharkhand, India, has initiated a captive breeding to support ostrich conservation. This effort not only aids in the preservation of the species but also facilitates the study of ostrich reproductive biology, behavior, and nutritional needs in a controlled environment. By gaining insights into the nuances of ostrich breeding behavior and physiology, such programs can optimize conditions to improve hatching rates and overall breeding success.

Through meticulous monitoring and management, zookeepers and researchers can identify factors influencing reproduction, such as diet, habitat quality, and social interactions. These efforts are pivotal for developing strategies that enhance reproductive outcomes in the captive population.

The captive breeding initiative at Bhagwan Birsa Biological Park has the potential to make significant contributions to both conservation and scientific research. Studying ostrich reproductive biology in captivity provides valuable data that can inform the development of effective breeding strategies. Such initiatives exemplify the critical role zoos play in the conservation of species.

Study Area

Bhagwan Birsa Biological Park, nestled in the serene landscapes of Ormanjhi, Ranchi, Jharkhand, India, is a significant zoological institution. Established in 1994, the park is categorized as a medium zoo by the Central Zoo Authority. Situated on the Ranchi-Ramgarh section of National Highway 33, approximately 20 kilometers from Ranchi city, the park spans a vast area of 104 hectares. This expansive terrain is characterized by a gently undulating topography and natural dry deciduous Sal forests, providing an ideal habitat for a diverse range of wildlife. With its GPS coordinates of 23°27'47"N 85°27'18"E, the park is easily accessible to visitors and researchers alike, offering a unique opportunity to observe various species in a semi-natural setting. The park's commitment to wildlife conservation and education is evident in its well-maintained enclosures, informative exhibits, and dedicated staff. The park houses a variety of animals, including tigers, lions, leopards, bears, deer, and numerous bird species. The park's serene environment, coupled with its rich biodiversity, makes it a popular

destination for nature enthusiasts, families, and students.

Methodology

The methodology for the captive breeding for ostriches at Bhagwan Birsa Biological Park involved several key stages. These stages were designed to ensure the success of breeding and egg hatching, and were carried out with the guidance of established best practices.

Step 1: Preparation of the Nesting Area

A secure, naturalistic, and comfortable nesting area was crucial to the breeding success. The nesting area was constructed well in advance, starting in September

before the breeding season, which begins in October. This ensured ample time to finalize the structure and optimize the environment for egg-laying and incubation. The nesting area, measuring 15 feet by 15 feet with the center rising to 10 feet, was designed to provide enough space for the ostriches to lay eggs.

An incubation pit was dug in the center, 2 feet deep in the center and 1 foot deep at the edges, with a slight slope towards the center. Fine, clean sand filled the pit, cushioning the eggs and protecting them from external factors. Paddy straw was placed around the pit to mimic natural nesting materials and provide additional insulation. To protect against rainwater, the edges of the nesting area were raised, and the roof was constructed with wooden logs and multi-layered covering. The first layer of paddy straw served as an insulator, while a plastic tarpaulin beneath protected the eggs from rain, and a second layer of paddy straw helped minimize disturbances.

Step 2: Breeding Pair Selection, Initial Observation, and Nutritional Care

Selecting a mature compatible breeding pair was a critical step in the program. The birds' physical health, including body condition, mobility, and clarity of the eyes, was closely evaluated. Veterinary assessments ensured the selected birds were free from health conditions that might hinder breeding.

Behavioral compatibility was also important. Male ostriches were monitored for aggression, as territorial behaviors like wing-flapping and vocalizations could disrupt the mating process. Female ostriches were observed for receptiveness to the male's courtship

behavior. The pair was chosen based on their readiness to mate, as indicated by their courtship behaviors.

The ostriches' diet remained consistent with the addition of calcium to support females during egg-laying. The diet included high-quality bird feed and fresh green like spinach. Calcium-enriched grit and crushed egg shells

were added to ensure the females received enough calcium to produce strong eggshells.

Step 3: Minimizing Visitor Disturbances

Minimizing disturbances from visitors was essential during the breeding and incubation periods. The visitor viewing area was positioned at a safe distance from the nesting site to reduce minimal disturbance with humans. Signage was placed around the visitor area to encourage low noise levels, and zoo staff monitored the area during peak visitation times to ensure compliance.

Step 4: Egg Protection and Monitoring of Incubation Progress

Once the eggs were laid, protecting them during incubation was critical. The nest was covered with a layer of paddy straw to provide insulation and maintain stable temperature and humidity.

Results

The captive breeding program at Bhagwan Birsa Biological Park successfully documented the laying of 11 ostrich eggs during the breeding season, with six eggs

successfully hatching. This resulted in a hatch success rate of over 50%, which is consistent with the success rates reported in other similar breeding programs.

Several key strategies were instrumental in achieving this positive outcome. Enclosure adjustments, including limiting visitor access to the nesting area during critical stages of incubation, were crucial in minimizing stress among the ostriches. By restricting human interaction, the park was able to provide the ostriches with a more peaceful environment conducive to successful egg development and hatching.

The use of candling and manual cracking techniques further contributed to the success of the activity. Candling, a method that involves shining a light through the eggs to monitor embryo development. This allowed staff to assess the viability of the embryos without disturbing the natural incubation process. Additionally, when necessary, manual cracking was performed to assist in the hatching of chicks, ensuring optimal survival rates. These interventions were carried out with the utmost care and attention to ensure that the chicks had the best chance of survival.

The success of the breeding program underscores the importance of refined husbandry techniques and continuous staff training. The collaboration between the Zoo Biologist, zoo staff, veterinary experts and the management team contributed valuable data on ostrich breeding and has the potential to inform future conservation efforts for this species. The outcome of this project highlights the critical role that zoos and other captive breeding programs play in species conservation and animal management.

Conclusion

The successful captive breeding of ostriches at Bhagwan Birsa Biological Park, Ormanjhi, represents a significant achievement in both the conservation and scientific understanding of the species. Through careful attention to habitat design, behavioral monitoring, and nutrition. The breeding program has contributed to the overall conservation of ostriches. Additionally, this success provides valuable insights into the factors influencing reproductive success, offering lessons for future breeding and conservation efforts.

The positive results of the breeding activity reinforce the importance of similar initiatives at other zoos and wildlife parks, underscoring their role in preserving species at risk of extinction. Furthermore, the breeding activities serves as a model for other institutions interested in replicating these efforts, ensuring that ostriches and other threatened species continue to thrive in both captivity and the wild.

Acknowledgments

We would like to express our sincere gratitude to the Forest Department of Jharkhand for their unwavering support, which was critical to the success of this project. Special thanks are owed to Mr. Jabber Singh, IFS (CCF and Director), whose leadership were invaluable, as well as the dedicated team at Bhagwan Birsa Biological Park, including Range Forest Officer, Forest Guard, and Animal Keeper. Their commitment, expertise, and hands-on assistance were integral to the successful implementation of the project.

Captive Breeding of Smooth Coated Indian Otter at Dr. Shyamaprasad Mukherjee Zoological Garden, Surat

Text & Photos: Dr. Rajesh Patel, Zoo Superintendent, Surat Municipal Corporation

Introduction :

There are total 13 different Otter species around the globe, out of thirteen species only three are found in India are Eurasian Otter *(Lutra lutra),* Smooth Coated Otter *(Lutrogale perspicillata)* and Small clawed Otter *(Aonyx cinereus)* The smooth-coated otter is an otter species occurring in most of the Indian subcontinent and Southeast Asia, with a disjunct population in Iraq. It is listed as Vulnerable on the IUCN Red List since 1996 and is threatened by habitat loss, pollution of wetlands and poaching for the illegal wildlife trade. There is sizablepopulation of Smooth coated otter in wild forest in South Gujarat region.

Detail of species :

Name of Animal : Smooth Coated Otter

Scientific name: *Lutrogale perspicillata*

Conservation status: Vulnerable (Population decreasing)

Gestation period: 62-65 days

Mass: 8-9 kg (Adult) & 120-150 gm (puppies)

Order : Carnivorous

Family: Mustelidae

Kingdom: Animalia

Material / Method :

Dr. Shyamaprasad Mukherjee Zoological Garden, Surat proud to be the only Zoo in India having successful captive breeding of Smooth Coated Otter. Initially Three injured rescued Otter animals (1 : 2) received during2006 post city flood condition and was kept together at the open moated enclosure having 725 sq.mts area with huge water body In the Zoo. First time captive breeding started in 2008, and from 2008 to till date total 42 puppies successfully breed and reared in captivity.

Discussion :

Behavior in captivity:

As working with the species since last 19 years we have observed that otter is very social and playful animal we have noticed largest 16 animals in one group once upon a time. The group have only one Alfa male and one Alfa female who dominate all other members within the group. Further, we have noticed severe infighting in the group while challenge to Alfa male or female. Life threatening Infighting within two male or two female in the group is obvious. Till date in fighting among two females within group noticed frequently in captivity in which we have lost one female animal due to severe infighting injuries by another female within the group and in second incidence severely injured female was saved due to timely separation from the group. Gestation period is 62-65 days. The puppies are born blind and are delivered in burrows excavated by the parents. The litter size generally ranges from one to four puppies. However, in 2024, a record was achieved at Surat Zoo when a single female successfully delivered seven puppies—the highest number recorded in the history of captive breeding at the zoo. Puppies open eyes at the age of 10- 15 days , breeding season in captivity is August to December some time up to January species having very good parental care from both male and female taking very good care of puppies.

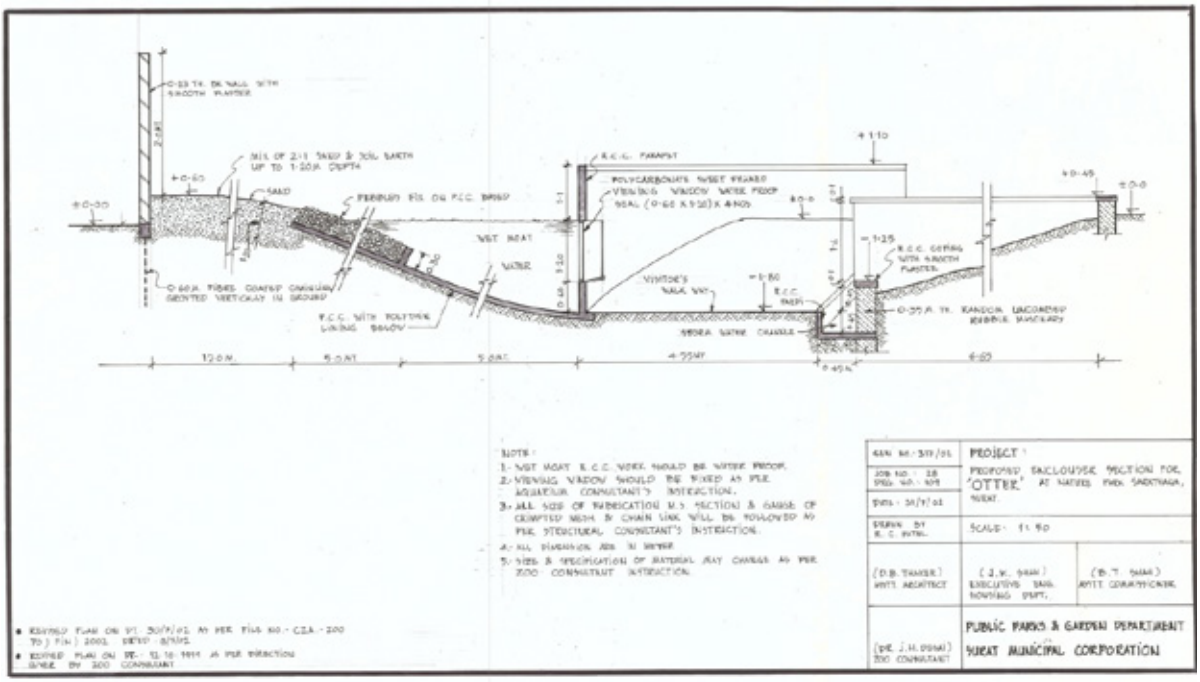
Breeding History of smooth coated otter in Surat Zoo : Till date 60 puppies successfully bred in captivity presently 13: 09 : 17 : 39 (M:F:U:T) animals are in captivity at Dr. Shyamaprasad Mukherjee Zoological garden, Surat. Keeping in view the behavior observation of species in captivity we have initially constructed three quarantine/ off exhibit breeding enclosure facilities and kept one pair of animals in each enclosure. on successful breeding at off exhibit quarantine / breeding facility further three more off exhibit enclosure constructed and now total six pair of animals are kept for off exhibit breeding and one pair kept in public display enclosure.

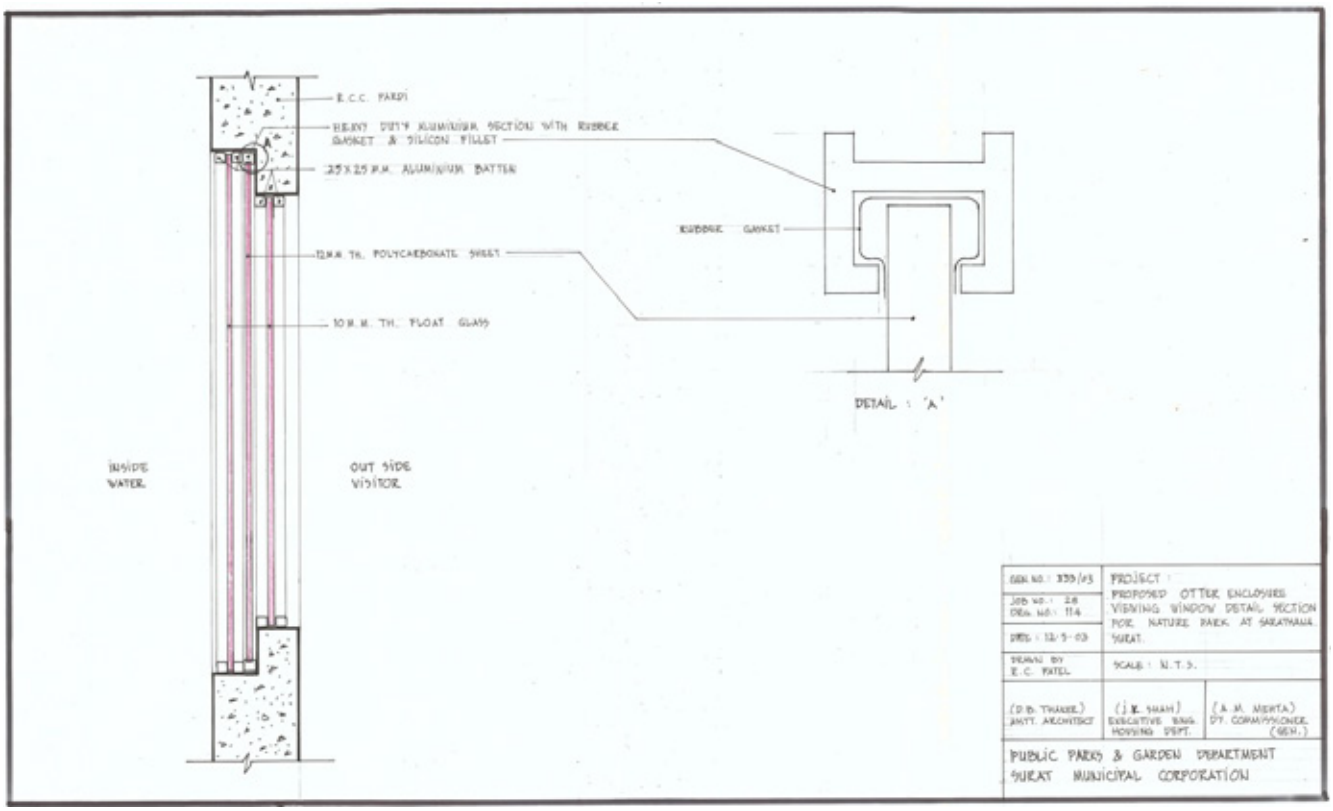
Feeding : In captivity we are giving small size 4-5" fresh dead fish, sometime live cat fish is also offered after through washing / dipping in1 % Chlorine Dioxide (ClO_2) solution. Average 1 to 1.5 kg fish offered daily per animal in captivity.

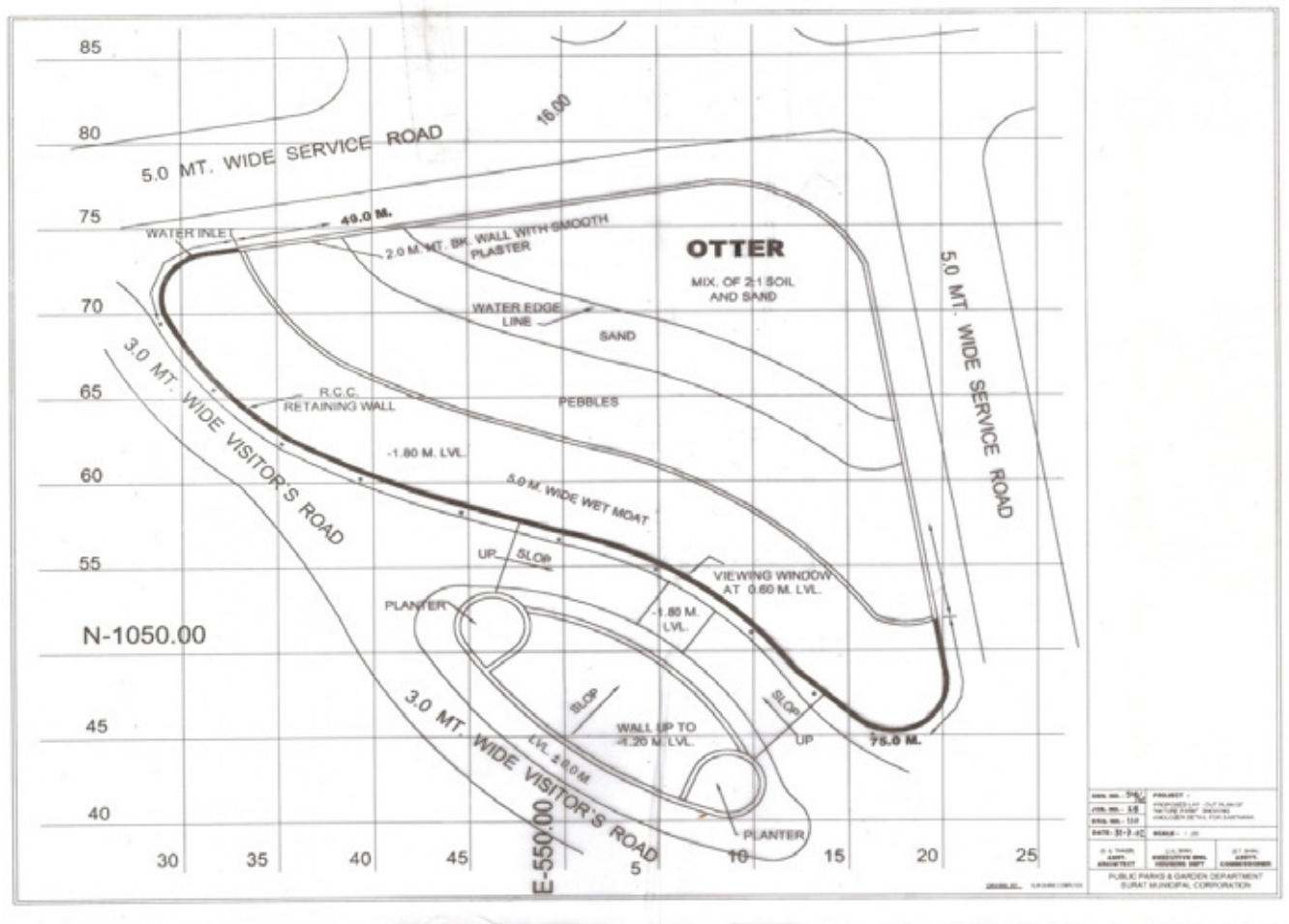
Veterinary Care and Management :

Deworming is done regularly every three months with rotational anthelmintic drugs in fish. Water body in open moated enclosure cleaned weekly and at off exhibit Quarantine /Breeding enclosure facilities daily basis, all the water body once in a fortnight thoroughly cleaned with bleaching powder. Till date we have not given any vaccine to this animal in captivity. Very few occasion treatment is required mainly for Respiratory infection, Infighting injuries and Maggot wound condition. We have noted highest longevity for the species in captivity is 15 year

Design of Enclosure in Zoo for Smooth Coated Otter for display:




R.C.C. PARPI
HEAVY DUTY ALUMINIUM SECTION WITH RUBBER GASKET & SILICON FILLET
25 X 25 M.M. ALUMINIUM BATTEN
12 M.M. TH. POLYCARBONATE SHEET
10 M.M. TH. FLOAT GLASS
RUBBER GASKET
DETAIL : 'A'
INSIDE WATER.
OUT SIDE VISITOR.
DRG NO. : 333/03
JOB NO. : 28
DRG. NO. : 114
DATE : 12-5-03
DRAWN BY R. C. PATEL
SCALE : N. T. S.
PROJECT : PROPOSED OTTER ENCLOSURE VIEWING WINDOW DETAIL SECTION FOR NATURE PARK AT SARATHANA, SURAT.
(D. D. THAKER) ASSTT. ARCHITECT
(J. K. SHAH) EXECUTIVE ENG. HOUSING DEPT.
(A. M. MEHTA) DY. COMMISSIONER (GEN.)
PUBLIC PARKS & GARDEN DEPARTMENT
SURAT MUNICIPAL CORPORATION


5.0 MT. WIDE SERVICE ROAD
16.00
49.0 M.
WATER INLET
2.0 M. HT. BK. WALL WITH SMOOTH PLASTER
OTTER
MIX. OF 2:1 SOIL AND SAND
WATER EDGE LINE
SAND
PEBBLES
R.C.C. RETAINING WALL
3.0 MT. WIDE VISITOR'S ROAD
-1.80 M. LVL.
5.0 M. WIDE WET MOAT
UP SLOP
VIEWING WINDOW AT 0.60 M. LVL.
PLANTER
-1.80 M. LVL.
N-1050.00
SLOP
SLOP
UP
WALL UP TO -1.20 M. LVL.
LVL ± 0.0 M.
75.0 M.
PLANTER
E-550.00
85
80
75
70
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60
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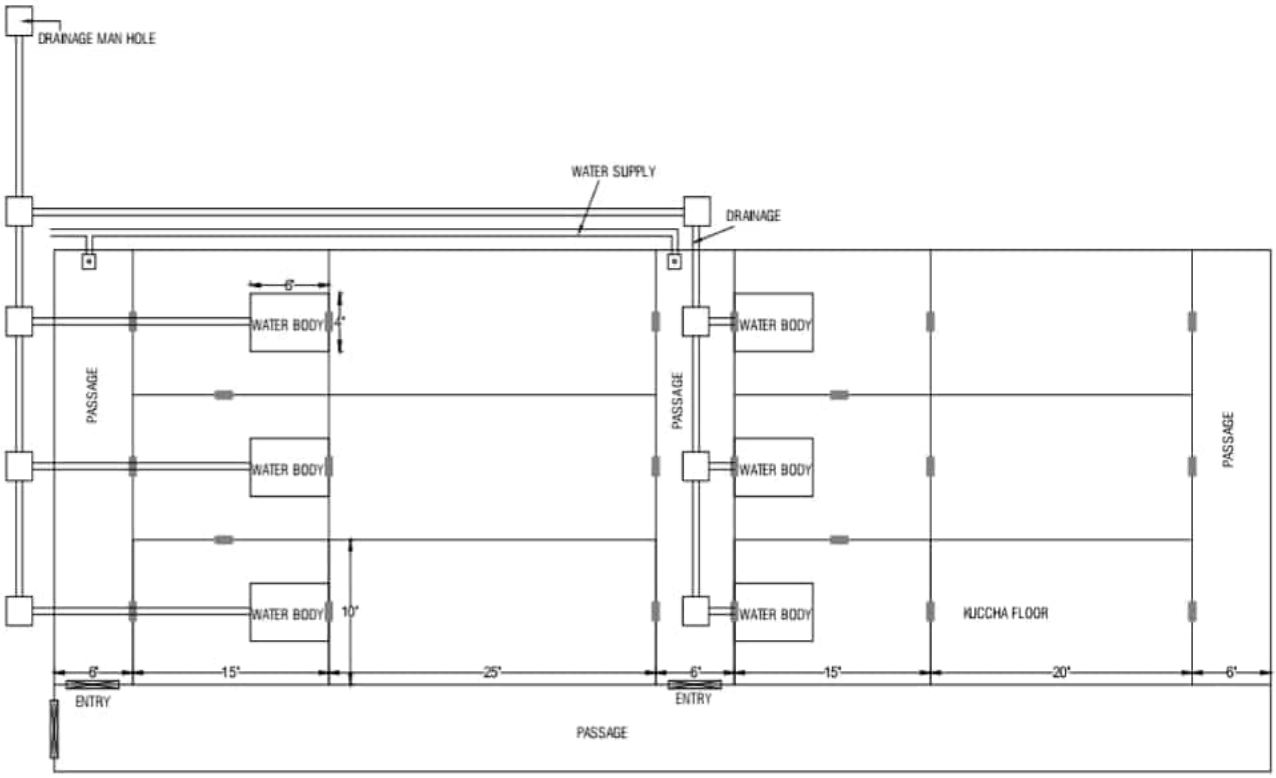
PUBLIC PARKS & GARDEN DEPARTMENT
SURAT MUNICIPAL CORPORATION

Off exhibit quarantine / Breeding enclosure design.



INVENTORY REPORT FOR SMOOTH COATED OTTER AT SURAT ZOO

YEAR	OTTER	BIRTH	DEATH	TOTAL	EXCHANGE	EXCHANGE WITH ZOO
2006-07	1+2+0=3	0	0	3	00	
2007-08	1+2+0=3	0	0	3	00	
2008-09	1+2+0=3	2	0	5	00	
2009-10	2+3+0=5	3	1	7	00	
2010-11	3+4+0=7	3	1	9	00	
2011-12	3+4+2=10	0	0	9	00	
2012-13	3+4+2=9	0	0	9	00	
2013-14	3+4+2=9	3	0	12	00	
2014-15	6+4+2=12	3	0	15	01	AHMEDABAD
2015-16	5+4+5=14	2	0	14	02	HYDERABAD
2016-17	4+3+7=14	0	1	13	02	CHANDIGHADH
2017-18	2+2+7=11	1	0	10	02	MYSURU
2018-19	1+1+8=10	1	0	11	00	
2019-20	1+2+8=11	4	0	15	00	
2020-21	6+9+0=15	3	1	15	02	RAIPUR
2021-22	8+7+0=15	4	0	17	02	RAJKOT
2022-23	8+05+4=17	6	0	19	04	JAMNAGAR+ MYSURU+RAIPUR
2023-24	10+06+03=19	8	0	25	02	JAIPUR
2024-25	14+11+0 =25	17	1	39	02	RAJKOT, CHANDIGADH
TOTAL	**13+09+17=39**	**60**	**05**	**39**	**19**	

Smooth Coated Otter At Surat Zoo

Female Otter with seven puppies

Conservation Breeding: Bondla Zoological Park's Pioneering Efforts in Safeguarding Free-Ranging Indian Giant Squirrels *(Ratufa indica)*

Text & Photos: Paresh Porob, Ashish Kumar Yadav, Stephen Dias
Bondla Zoological Park

Bondla Wildlife Sanctuary, situated in Goa, is the smallest protected area of the state, covering an area of 7.95 km2. Within the sanctuary lies the Bondla Zoological Park, which houses a variety of native and exotic attractions. The establishment of the Bondla Zoological Park can be traced back to 1969, when the Forest Department of the Government of Goa established an animal rescue center. The primary objective of this center was to provide rescue and rehabilitation services for wildlife in Goa, and over time, the number of rescued animals increased, necessitating the need for proper care and management in a scientific manner. Consequently, the Zoological Park was established. After four decades, the status of Bondla Zoo was upgraded from "Mini-Zoo" to a "Small Zoo" category by Central Zoo Authority of India. The geographic location of the Zoo in Bondla Wildlife Sanctuary is such that the Zoo lies in the middle of a valley surrounded by hills. This provides a unique diversity of flora in the area. The predominant tree species which are found in the Zoo area includes *Terminalia tomentosa, Terminalia paniculata, Terminalia bellerica, Xylia xylocarpa, Mangifera indica,* and *Peltophorum pterocarpum.*

The Indian Giant Squirrel *(Ratufa indica)* (henceforth IGS) is a large arboreal squirrel with a long tail and tufted ears. The dorsal color of the body varies from rusty-red or maroon to black while the ventral portion is creamy. There is considerable variation in the color of the dorsal pelage and tail across the inter and intra populations of this squirrel (Abdulali & Daniel, 1952a). IGS is endemic to the Indian subcontinent with population distributed in the southwestern, central, and eastern regions of the peninsula (Baskaran et al., 2011). It is a forest-dwelling species found in evergreen, semi-evergreen, dry deciduous, and moist deciduous forests. Additionally, the species is also reported to occur in

a. Free ranging Indian Giant Squirrel Feeding

b. IGS exhibiting vigilance behaviour

c. Active Drey of free ranging IGS

d. Resting activity of free ranging IGS

dry scrub environments (Menon, 2014). This species is categorized as "Least Concern" on the IUCN Red List of Threatened Species and is listed under Schedule I of the Wild Life Protection (Amendment) Act, 2022 of India (Ministry of Law and Justice 2022; Molur, 2016). Despite this protection, the populations of this species are declining due to habitat loss and hunting (Molur, 2016; Srinivas et al., 2008).

Nesting behavior is a vital aspect for reproductive success in various animal species, including birds, reptiles, insects, and mammals. While traditionally associated with small mammals, this behavior is prevalent across various taxa, demonstrating the evolutionary significance of ensuring offspring survival. Nesting behaviors vary widely across species and can be observed in both small and large mammals. For instance, small mammals like rodents often create intricate nests for shelter and protection. This behavior serves the common purpose of providing a secure environment for their offspring, contributing significantly to the species reproductive success (Guillette & Healy, 2015).

The movement Free ranging IGS is throughout the Bondla Zoo, however it is observed that the foraging areas and roosting/nesting areas of free ranging IGS are distinctly separate. The encounter rate of free ranging of IGS in zoo areas is on regular basis. In order to understand the movement pattern and the land use pattern, ground surveys were conducted. The dreys were identified and nesting trees were marked with help of Garmin Etrex 20 GPS device, so as to ascertain drey (nest) trees and the number of dreys. The nesting tree were grouped to form clusters, and altogether there are 8 clusters in the Zoo area. Some clusters have larger number of nesting trees due to certain factors like terrain, tree height and also human disturbance. Dreys were also characterized into active dreys, decoy dreys and abandoned dreys. The dreys were monitored and all observations were recorded.

A large number of dreys were found to be occurring on the tree species like Terminalia tomentosa, Terminalia paniculata and Xylia xylocarpa, on an average each tree has two dreys. As mentioned earlier the IGS has typical habit of approaching its active nests only after hopping from decoy dreys, such practice is self-defense mechanism to mislead predatory species. There were couple of abandoned nests in the identified clusters, which are more than year old. The nesting trees in clusters has good network of woody climbers providing unhindered arboreal access for easy movement of free ranging IGS from cluster area to foraging areas. The cluster areas are frequented by free ranging IGS for roosting/breeding, but during day time they are also seen feeding on certain tree species, and may cover adjacent areas for foraging. The animal being territorial

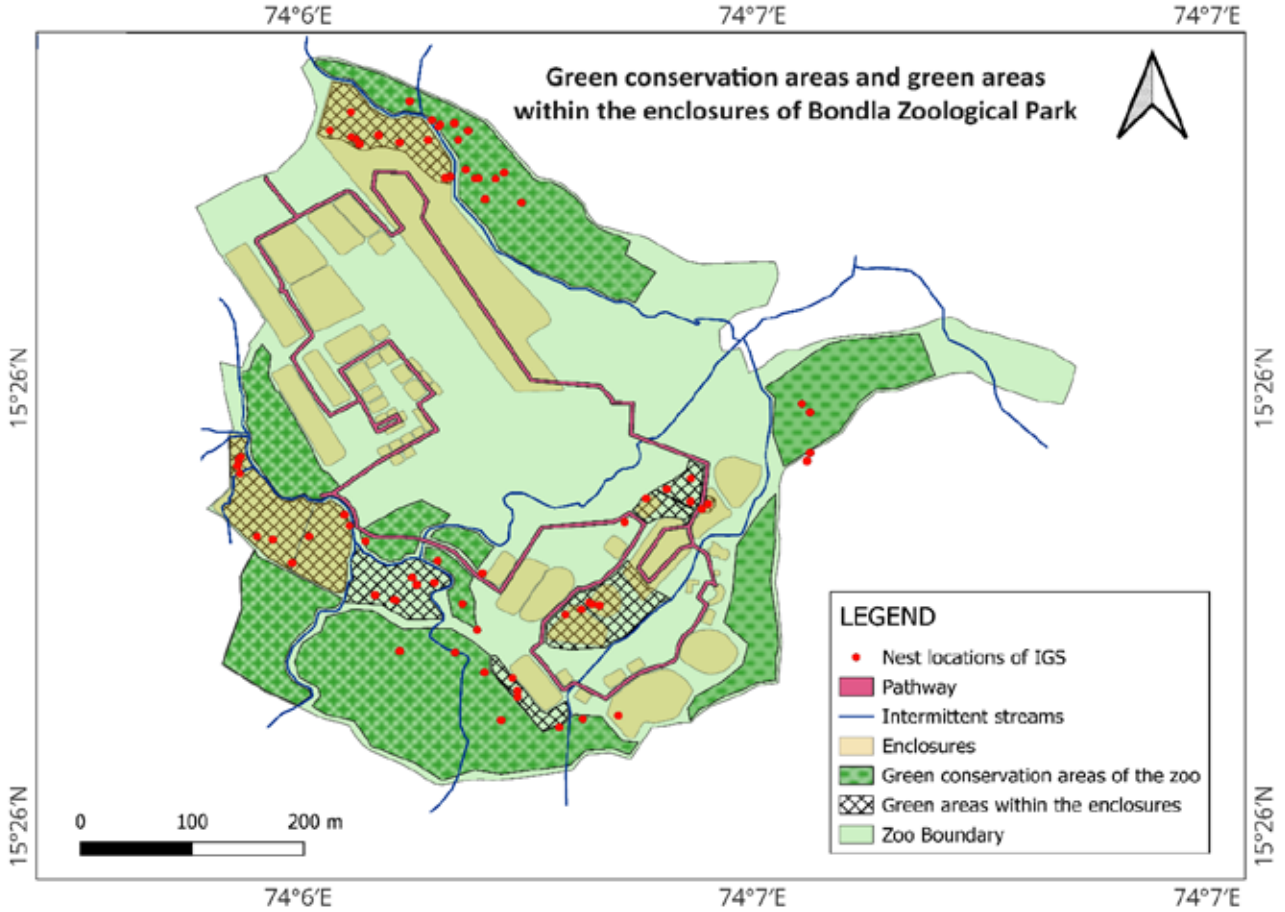


Figure 1

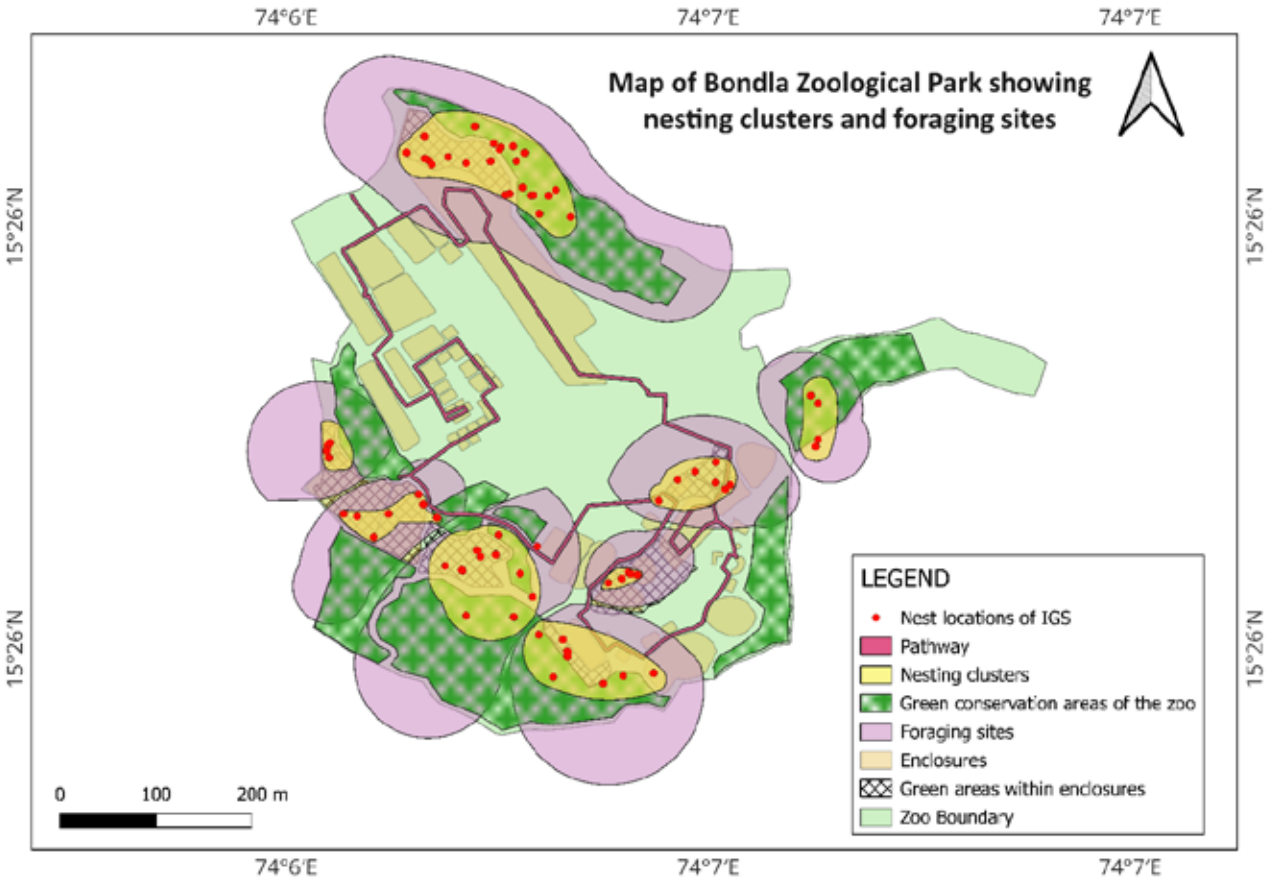


Figure 2

in nature the foraging site areas of some clusters overlap and territorial fights between individuals are observed. The foraging area of free ranging IGS is determined by regular monitoring by the field staff. The common food plants of free ranging IGS were found to be *Artocarpus heterophyllus, Mangifera indica, Terminalia bellericia, Terminalia tomentosa, Macaranga peltata, Careya arborea, Ficus recemosa* and *Bauhinia racemosa.*

Drey tree coordinates were plotted with the help of QGIS software version 3.34.3, to visualize the drey distribution within the Zoo. Drey tree clusters of free ranging IGS have been highlighted (figure 2). Through the current study, a total of eight drey tree cluster of free ranging IGS has been observed within the Zoo area. A single large drey tree cluster is seen towards the northern most part of the Zoo. While the maximum drey tree cluster is found towards the extreme south of the Zoo. However, the foraging area of the free ranging IGS overlaps with Zoo area in the adjacent Wildlife Sanctuary.

Population of free ranging Indian Giant Squirrel in Bondla Zoo

As per the field assessment done in the said work, it was observed that the Bondla Zoo has about 79 drey trees, on which the active dreys were 48, with the balance dreys are either abandoned or decoy dreys. The drey trees are segregated in clusters as per their proximity to each other, and we have total 8 clusters of drey trees in Bondla Zoo.It is estimated that the total population of free ranging Indian Giant Squirrels within Bondla Zoo are 23 individuals, this estimation was done by field observers on day-to-day basis, the said population is breeding population of free ranging Indian Giant Squirrels. Though the said breeding population of Indian Giant Squirrels are not in captivity but has been contributing to In situ conservation of western ghat arboreal mammalian species, the interventions carried out by forest department has resulted in setting precedent of successful conservation practice in Zoo.

Best Practices

The cluster zones of dreys trees within the Zoo area is set aside as a green cover area and no kept as no development zone.

The indigenous plant species which are preferred by free ranging IGS are maintained and conserved, to ensure food security to the breeding population.

The awareness is generated among the Zoo staff to protect and preserve the foraging and the nesting area of the free ranging IGS.

Arboreal corridors are important for the breeding population of free ranging IGS. Hence no cultural

operations of any kind are carried out in the said drey cluster areas, in order to prevent any damage to woody lianas which are essential for movement of species.

In order to ensure better protection to the area, the said cluster area is demarcated as a green cover area in the Master Plan of the Bondla Zoo for 2020-2040.

The fire tracing work is carried out in the said area in order to prevent any damage to vegetation, thus possessing any threat to the habitat of free ranging IGS.

The area is again enriched with planting of indigenous species of fruit bearing trees species mainly foraging species for the species.

Conclusion:

The total number of drey tree of free ranging Indian Giant Squirrels in Bondla Zoo are 79. Drey sites are important breeding resources in terms of population dynamics, especially in the forest system where drey trees influences the population. The drey structure is made up of twigs and branches and the same is internally lined with leaves, the life of the drey is estimated to be year, however it is observed that the species subsequently repairs by reinforcing the old dreys to be used for next breeding seasons. Therefore, understanding its dynamics is essential for the conservation of the species (Jiménez□Franco et al., 2018).

The spill over population of free ranging Indian Giant Squirrels is accommodated in the adjacent Bondla Wildlife Sanctuary, for ensuring food security indigenous plants are being planted in the said areas annually. The best conservation practices of Bondla Zoo are highlighted by successful breeding of free ranging Indian Giant Squirrel in the earmarked areas in the Zoo. The Conservation practice is like species recovery programme, though it is not projected in the manner, this scientific approach of In-Situ conservation practice within the zoo is one of its kind and sets precedents for other zoos to emulate such conservation practice and help in survival of such Western Ghat arboreal mammalian fauna or any other faunal species occurring in the area.The best conservation practice with limited interventions has yielded good results and this article makes an effort to showcase the same.

Acknowledgement

The Chief Wildlife Warden, Goa Forest Department, for permitting the study. Director, Bondla Zoological park , for extending his financial and morale support for the study. Range Forest officer and Staff of Bondla Zoological park for their logistical support .

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Hand-Rearing a Mandrill Infant at Tata Steel Zoological Park, Jamshedpur

Text & Photos: Dr. Manik Palit and Dr. Naim Akhtar, Tata Steel Zoological Park

At Tata Steel Zoological Park (TSZP), every new birth brings a sense of pride and promise, especially when it involves a rare and captivating species like the mandrill *(Mandrillus sphinx)*. Known for their vibrant faces and complex social behaviour, mandrills are among the most striking primates in the world. Native to the forests of Central Africa, they are listed as Vulnerable due to habitat loss and poaching.

In April 2024, the zoo celebrated the birth of a male mandrill to a first-time mother. However, joy soon turned to concern when the mother showed no signs of maternal care—refusing to nurse, groom, or even hold the newborn. Such rejection, though not uncommon among inexperienced primates, can be life-threatening for the infant. Acting swiftly, the veterinary and animal management teams decided to intervene, beginning a dedicated and delicate hand-rearing process.

A Delicate Beginning

The newborn Ranga (name given by Ms Kundu) weighed only 660 grams and required constant warmth, nutrition, and attention. Under the guidance of Dr. Manik Palit and Dr. Naim Akhtar, the baby was carefully shifted to a controlled nursery environment. The first three months were particularly critical, and Mr. and Mrs. Kundu played a vital role in the infant's daily care during this period—preparing feeds, maintaining hygiene, and monitoring every behavioural cue. Mr. and Mrs. Kundu even created a rearing room in their house.

The nursery was temperature-controlled, later upgraded to an air-conditioned room at zoo to ensure comfort and stability. To maintain hygiene and prevent infections, baby diapers were used regularly—an unusual but effective step in primate care. Every feeding bottle and utensil was sterilized, and the bedding was changed multiple times a day to keep the enclosure clean.

Dedicated Care and Tireless Effort

As the infant grew, the responsibility of care expanded. Namsi Hembram, Linsa Harpal, and Manoj Nag, three dedicated animal keepers, took over the day-and-night care of the young mandrill. Their patience and affection became the foundation of the animal's survival. They not only ensured timely feeding and comfort but also dealt with the emotional and physical challenges of caring for an infant primate that required attention round the clock.

For the first three months, the baby needed to be fed every few hours, even at night. The keepers maintained warmth through heating pads and constant observation. Their commitment was such that the young mandrill became an inseparable part of their daily routine, responding affectionately to their voices and presence.

Healthy Growth and Social Learning

By the age of four months, the infant had transitioned from formula milk to soft foods like banana, papaya, cereal, and sweet potato, later progressing to a full diet of fruits, nuts (ground nuts), and vegetables. His weight steadily increased to 4.65 kg by 12 months and reached to around 8 kg in next 6 months, a clear indicator of healthy development.

Behavioural enrichment played a key role. The infant was given safe toys, mirrors, climbing branches, and puzzle feeders to stimulate curiosity and motor skills. The team ensured minimal human dependence, gradually familiarizing him with the sounds and sights of his troop in the adjoining enclosure.

A Celebration of Care and Compassion

The care team's bond with the infant grew stronger over time. Their dedication extended beyond routine work—it became a story of compassion and teamwork. To celebrate his progress, the zoo organized a birthday celebration for the young mandrill, an event that brought together more than 130 school children and 90 students from Jamshedpur Women's University. The occasion highlighted not just the animal's survival, but also the human commitment behind it.

During the celebration, Mr. and Mrs. Kundu, along with Namsi Hembram and Linsa Harpal, were felicitated by the Hon. Secretary, Captain Amitabh of the Tata Steel Zoological Society, on the occasion of Friendship Day. Their recognition symbolized the zoo's appreciation for the unseen hard work, compassion, and dedication that go into wildlife care.

A Model for Primate Welfare

The successful rearing of this mandrill infant reflects the collaborative spirit and expertise of the Tata Steel Zoological Park team. It demonstrates how timely intervention, scientific care, and emotional commitment can ensure the survival and welfare of even the most delicate newborns.

Beyond being a remarkable animal care success story, it

stands as an inspiring example of teamwork, empathy, and dedication—showing that conservation is not only about protecting species, but also about the human values that make such efforts possible.

Looking Ahead

The hand-reared mandrill at Tata Steel Zoological Park now stands as a living example of how science, dedication, and empathy can come together for wildlife conservation. His story underscores the importance of individualized care, early intervention, and behavioural enrichment in managing captive-bred animals.

More broadly, it reminds us that every animal life—no matter how small or fragile—has immense value, and that zoos today are not just centres of display but hubs of learning, research, and compassion.

Fig 1: (A) New-born Mandrill,

Fig 1: (B) Hand- rearing of the infant using a feeding bottle, and

Fig 1: (C) Infant Mandrill in a supportive enclosure with a soft toy for comfort.

Fig. 2 Ranga (Baby mandrill) while in rearing in AC nursery

Fig. 3 Ranga food and close association of the top management of the zoo

Breeding of Hippopotamus *(Hippopotamus Amphibius)* at Arignar Anna Zoological Park, Vandalur, Chennai

Text & Photos: S. R. Chandramouli, G. Kamaraj and Ritto Cyriac,
Arignar Anna Zoological Park, Vandalur, Chennai

There are four large zoos in southern region of India namely, Arignar Anna Zoological Park (Chennai), Tiruvananthapuram Zoological Garden (Tiruvananthapuram), Sri Chamarajendra Zoological Garden (Mysore) and Sri Venkateshwara Zoological Park (Tirupati). Among these, Arignar Anna Zoological Park is one of the oldest zoos in India, established way back in the 1850s. It has been housing an array of endangered and threatened species from all around the world. One such species displayed here is the Hippopotamus (*Hippopotamus amphibius*) which is native to Africa. The Park houses a total of seven individuals with two males and five females.

Hippopotamus are maintained in a four-chambered enclosure, with two chambers kept on display and two at the back. The animal shelter is located in between the two paired chambers. The total area of the enclosure is 3949.55 sq. m in which, the fringes at front and back are filled with water upto a depth of about 2.0 m. They are maintained well and the water in their enclosure is changed periodically (once in 15 days on average) and replaced with fresh water. They are provided with the following food items (Table 1) with seasonal enrichments, wherein, watermelons are offered during the summer season to combat heat-stress.

Hippopotamus has been breeding quite well at Arignar Anna Zoological Park since the past and we have had a good track record of animal births in captive condition. In the last one year (between August 2024 and August 2025), our zoo has seen a good trend in the courtship and breeding of hippopotamus, which has resulted in three instances of animal births.

Each of these three cases are detailed below. The first birth took place in August 2024 after a period of eight months of gestation. The female Prakathi (6 years old) gave birth to a male calf on 20 August 2024 after mating with the male Laxmanan (eight years old). However, this calf could not survive for long and it died within 10 days after birth.

The second birth took place on 16 Nov 2024. The female Riya (8 years old), after mating with the adult male Lakshmanan, gave birth to a female calf after eight months of gestation. This pair of mother and calf have been kept off-display to provide them with some privacy and isolation from the visitors since its birth. The juvenile is now seven months old and is

in a healthy state, continuing to remain in the isolated enclosure with its mother. This calf has not been kept on display for the visitors yet, in order to provide it with the necessary privacy to minimize the stress caused.

Subsequently, on the 30th of July, another female Kala (6 years old) has given birth to a calf after a gestation period of eight months. This calf is also sired by the same male Laxmanan. Courtship and mating took place on 23.11.2024 when the male and females were introduced together in the same partition of the enclosure. Currently, this female and the new-born calf are kept isolated from the other females and male for privacy. The calf is in a healthy state and suckling milk from the mother periodically.

In addition to the above cases, two more females, Pragathi (5 years old) and Trisha (6 years old) were found to be gravid. On 31st of August 2025, the female Prgathi gave birth to a female calf and on 6 Oct 2025, the other adult female Trisha gave birth to a male calf, both fathered by the male Laxman. Thus, the breeding programme for Hippopotamus at Arignar Anna Zoological Park has been quite successful and the animals currently in surplus are being planned to be exchanged with other Indian zoos for other species of animals.

Feed chart for Hippopotamus at Arignar Anna Zoological Park

Item	Quantity/Animal
Wheat bran	10 kgs
White Bengal gram	250 gms
Salt	250 gms
Apple	2 Nos
Potato	500 gms
Carrot	2 kgs
Cabbage	1 kg
Onion	250 gms
Banana	10 Nos
Grass	100 kgs
Greens	1 kgs
Bread	2 loaves (800 gms)
Multivitamin Mixture	50 gms

Advanced Scientific Management of Small Wild Felids at the Greens Zoological Rescue and Rehabilitation Centre (GZRRC)

Text & Photos: Dr. Brij K Gupta, Dr. Akshaya Mane, Dr. Ajay Deshmukh

Greens Zoological Rescue and Rehabilitation Centre (GZRRC), Jamnagar, Gujarat, India.

Summary

Small wild felids represent a diverse group of carnivores exhibiting varied ecological adaptations and behavioral needs. Their ex-situ conservation and welfare management pose significant challenges due to species-specific habitat requirements and sensitivity to captive environments. The Greens Zoological Rescue and Rehabilitation Centre (GZRRC) manages 18 focal species: Rusty-spotted Cat (*Prionailurus rubiginosus*), Sand Cat (*Felis margarita*), Black-footed Cat (*Felis nigripes*), Amur Leopard Cat (*Prionailurus bengalensis*), Asiatic Golden Cat (*Catopuma temminckii*), Marbled Cat (*Pardofelis marmorata*), Fishing Cat (*Prionailurus viverrinus*), African wildcat (*Felis lybica*), Bobcat (*Lynx rufus*), Eurasian Lynx (*Lynx lynx*), Flat-headed cat (*Prionailurus planiceps*), Jungle Cat (*Felis chaus*), European Wildcat (*Felis silvestris*), Caracal (*Caracal caracal*), Serval (*leptailurus serval*), Margay (*Leopardus wiedii*), Ocelot (*Leopardus pardalis*) and Jagurundi (*Herpailurus yagouaroundi*), through a scientifically informed approach to enclosure design, enrichment, veterinary care, and behavior-based welfare assessment.

A systematic literature review of 109 publications (58.72% books/reports, 41.28% journal articles) was conducted to synthesize best practices and inform management protocols. Enclosures are designed to replicate species-specific natural habitats, incorporating vegetative cover, substrates, arboreal or aquatic features to enable expression of natural behaviors. Veterinary protocols emphasize preventive care and stress minimization, while welfare is monitored through behavioral observation and response to enrichment.

This article presents an integrated framework of advanced scientific management in small felid husbandry, highlights species-specific strategies, and outlines future challenges and research directions in the ex-situ conservation of small wild cats.

Understanding the Needs of Small Wild Felids

The Felidae family encompasses a wide range of carnivores inhabiting ecosystems from deserts and savannas to forests and wetlands (Sunquist & Sunquist, 2002). Despite their diversity, small wild felids remain understudied in terms of captive husbandry, welfare needs, and conservation roles.

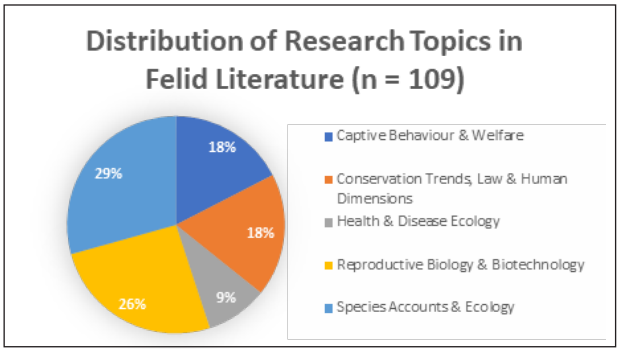
The Greens Zoological Rescue and Rehabilitation Centre (GZRRC) is among few institutions in India with a dedicated focus on small felid species. Through evidence-based management, GZRRC adopts an integrative approach that includes:

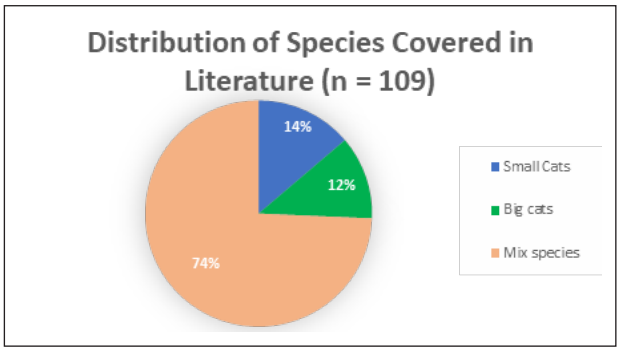
- Enclosure design grounded in ecological realism
- Preventive veterinary care
- Environmental and cognitive enrichment
- Behavioral and physiological welfare monitoring

This article synthesizes literature and empirical data to present a scientifically advanced management framework for small wild felids in captivity and highlights GZRRC's contribution to their conservation.

Literature Review

A comprehensive literature review of 109 publications (58.72% books/reports, 41.28% journal articles) was conducted using a Boolean search across databases including Google Scholar, Web of Science, Springer Link, and Scopus (for year 2000 to 2025). Key search terms focused on husbandry, welfare, ex-situ conservation, and specific small felid species. After filtering for quality and relevance, the publications were analyzed thematically to inform management protocols.





Facility Infrastructure and Management Framework at GZRRC

The GZRRC follows minimum dimension standards prescribed by the Central Zoo Authority (CZA) for housing small cats, comprising:

1. Night House
2. Paddock
3. Kraal
4. Food Chute

This infrastructure facilitates species segregation, social pairing, and quarantine, supporting adaptive, welfare-based management.

Housing and Enclosure Design for Small Cats

The housing infrastructure for small felids has been meticulously designed and constructed in accordance with established zoological standards for animal welfare and species-specific behavioral and physiological needs. The facility combines interactive paddocks with secure holding areas to promote physical activity, reduce stress, and encourage natural behaviors while ensuring the safety of both animals and caretakers.

Each night shelter prioritizes structural integrity and thermal comfort. These enclosures are spacious, featuring three solid load-bearing brick masonry walls with textured finishes to simulate natural terrain and provide visual enrichment. The fourth wall, designed for viewing and access, consists of reinforced toughened safety glass and high-strength vertical steel bars, allowing secure observation without compromising security.

Animal movement is carefully controlled through a single entrance and a dedicated exit, engineered to maximize control while minimizing stress. The primary access gate is constructed from mild steel (MS) for strength and low maintenance. A stainless steel (SS) food chute is mounted on the upper section of this gate, chosen for corrosion resistance and ease of sanitation, thereby reducing contamination risks.

Each unit also features an integrated drop gate within the main access point, enabling controlled transfers between night shelters and paddocks during routine care or veterinary procedures. The drop gate's design emphasizes safety and operational efficiency for both animals and staff, facilitating effective enclosure management.

Design Considerations for Low-Stress Veterinary Access and Treatment

Beyond thermal and structural requirements, enclosure design prioritizes elements that facilitate low-stress veterinary care, promoting welfare during medical procedures. Minimizing psychological and physiological stress during routine examinations and treatments is a primary goal.

One major challenge is small felids' reluctance to voluntarily enter squeeze cages, essential for safe physical restraint. Traditional approaches often rely on coercion, increasing stress, reducing future compliance, and risking defensive or aggressive reactions.

To address this, the facility employs a behaviorally informed design by integrating the squeeze unit into the animals' daily transit routes. Positioned as a corridor between night shelters and paddocks, the squeeze tunnel becomes a familiar and regularly used space during routine transfers. This encourages voluntary entry, reduces fear, and supports positive reinforcement conditioning. Additionally, it allows passive monitoring of individual animal movement and behavior.

The squeeze units are fabricated entirely from high-grade stainless steel, providing a corrosion-resistant, non-porous surface essential for effective disinfection. This is particularly important for procedures involving open wounds, post-operative care, or infectious conditions.

This integrated design reduces the need for forced handling, allowing veterinary interventions to occur naturally within animals' routines, enhancing safety and reducing stress. Detailed schematics and visual documentation follow to illustrate its design and function.

Water Provision and Flooring Infrastructure

All night enclosures are equipped with automated waterers (5 Liters capacity) and manual waterers to ensure continuous access to clean drinking water. The automated waterers automatically refill when water levels drop, minimizing manual labor while ensuring consistent hydration. This is especially critical during heat stress or post-transport acclimatization when maintaining physiological stability depends on adequate water intake.

Flooring in night shelters is carefully designed for safety and hygiene. Anti-skid tiles with textured surfaces provide secure footing, reducing slip and fall risks, vital for small carnivores, particularly older or medically sensitive individuals. Stable footing supports joint health

and reduces injury risk during movement or behavioural episodes.

The tiles are made from durable, non-porous material, allowing for efficient cleaning and rapid drying. This supports routine disinfection, lowers microbial load, and maintains a hygienic, dry environment, key factors in preventing disease transmission.

Environmental Enrichment and Behavioral Engagement

Design elements are based on species' ecological adaptations:

- Vegetation: natural shrubbery, trees
- Substrates: sand, soil, grass
- Topography: burrows, arboreal platforms, water bodies
- Thermal regulation: seasonal shelters, shaded zones

Species-specific enrichment includes:

- Food puzzles
- Scent trails
- Auditory stimulation (species-specific sounds)
- Cognitive devices (e.g., problem-solving feeders)
- Positive Reinforcement Training (PRT) for routine medical checkups

Enrichment Schedule Summary for Small Felids at GZRRC

Day	Enrichment Type	Key Activities	Operational Notes
1	Food-Based	Dispersed food, hidden treats, popsicles, rolling feeders	Release animals individually; use clean tools; log feeding response
2	Olfactory & Auditory	Leaf mounds, spices, essential oils, playback of natural sounds	Secure placement; sanitize materials/ devices after use; document responses
3	Tactile & Olfactory	Boxes, hose-pipe items, wooden toys, paper-based enrichments scented with oils or spices	Remove within 48 hrs; disinfect reusable items; record interaction levels
4	Positive Reinforcement Training (PRT)	Target training, stationing, voluntary shifting, medical examination desensitization	Conducted by trained keepers; reinforces cooperation and reduces stress; record data

Hospital Infrastructure and Facilities at GZRRC

The Greens Zoological Rescue and Rehabilitation Centre (GZRRC) maintains a state-of-the-art veterinary hospital designed to support advanced medical care, diagnostics, and recovery for small wild felids. The hospital is equipped with specialized rooms and modern instruments to ensure optimal health outcomes and minimize stress during treatment.

Key Hospital Areas

1. **Preparation Room** A dedicated area for initial animal assessment and stabilization before further procedures, equipped with basic monitoring and restraint facilities.
2. **Surgery Preparation Room** Space for pre-operative preparation including sedation, sterilization of surgical tools, and anesthetic setup.
3. **Operating Theatre (OT)** A sterile environment for surgical interventions, featuring adjustable surgical tables, overhead lighting, and essential surgical instruments to handle complex procedures.
4. **Laboratory** Equipped for hematology, biochemistry, microbiology, and parasitology testing, enabling rapid diagnosis and treatment planning.
5. **Sterilization Room** Dedicated to cleaning, disinfecting, and sterilizing surgical and medical equipment using autoclaves and chemical sterilant to prevent infections.
6. **Pharmacy Room** Secure storage of medications, vaccines, anesthetics, and supplements with temperature control and inventory management.
7. **In-patient Ward** Comfortable housing for post-operative recovery and long-term treatment, designed to reduce stress with appropriate lighting, ventilation, and noise control.

Hospital Instruments and Equipment

- **Endoscopy Unit** Enables minimally invasive internal examinations and biopsies, crucial for diagnosis without extensive surgery.
- **Digital X-ray System** Provides rapid, high-resolution imaging for trauma assessment, bone fractures, and internal organ evaluation.

- **CT Scan and MRI Machines** Advanced imaging modalities offering detailed cross-sectional and soft tissue visualization essential for complex diagnostic cases.
- **Dental Scaler** Used for routine dental hygiene and treatment of oral diseases common in captive felids.
- **Otoscope and Ophthalmoscope** Essential for detailed ear and eye examinations, respectively, ensuring early detection of infections or injuries.
- **Gaseous Anesthesia Machine** Facilitates safe and controlled anesthesia administration during surgeries and diagnostic procedures.
- **HEPA Filter System** Installed to maintain air purity in sensitive areas like the OT, reducing airborne contamination risks.

Additional Facility

- **Veterinary Ambulance** Equipped for safe transport of animals to and from the hospital or external diagnostic centers, ensuring stress-minimized handling during transit.

Rescue Team and Restraining Equipment

The Greens Zoological Rescue and Rehabilitation Centre (GZRRC) boasts a specialized rescue team equipped with advanced tools and training to safely capture and handle small wild felids. The team is outfitted with essential restraining devices including three anesthetic guns for remote sedation, snare poles, Y poles, and nets to ensure humane and stress-minimized restraint during rescue operations. These resources enable the team to efficiently manage emergency captures and transfers while prioritizing animal welfare and safety. This modern approach underscores GZRRC's commitment to advanced, science-based rehabilitation and conservation efforts.

Veterinary and Welfare Protocols

- Vaccination against FPV, FHV, FCV, CDV, FeLV, FIV, FIP and rabies
- Biannual deworming and regular fecal checks
- Preventive diagnostics: blood panels, imaging
- Behavioral observation using ethograms
- Positive Reinforcement Training (PRT) used for cooperative health procedures

Vaccination for Small Felines followed at GZRRC

Vaccine	Full Name	Target Disease / Purpose
FPV	Feline Panleukopenia Virus	Prevents panleukopenia, a highly contagious and often fatal parvovirus infection in felines.
FHV	Feline Herpesvirus	Protects against viral rhinotracheitis, a common upper respiratory infection in felines.
FCV	Feline Calicivirus	Prevents calicivirus-related respiratory disease and oral ulcerations.
FeLV	Feline Leukemia Virus	Protects against leukemia, immunosuppression, and related cancers caused by FeLV infection.
FIV	Feline Immunodeficiency Virus	Immunization helps manage immunosuppression caused by FIV, reducing susceptibility to secondary infections.
FIP	Feline Infectious Peritonitis	Protects against a fatal, immune-mediated disease caused by feline coronavirus mutation (limited efficacy).
CDV	Canine Distemper Virus	Critical protection against distemper, a potentially fatal viral disease affecting many carnivores, including wild felids.
Rabies	Rabies Virus	Essential for preventing rabies, a universally fatal and zoonotic viral infection.

Species-Specific Housing Requirement Considered at GZRRC

Species	Habitat	Enclosure Features
Rusty-spotted Cat	Forest/Scrub	Dense foliage, climbing structures
Sand Cat	Desert	Sandy substrate, burrows, minimal vegetation
Black-footed Cat	Savanna	Grass cover, nocturnal shelters
Amur Leopard Cat	Temperate Forest	Layered vegetation, seasonal temperature control
Asiatic Golden Cat	Mid-elevation Forest	Mixed vertical and terrestrial space
Marbled Cat	Arboreal Forest	Tall vertical structures, canopy pathways
Fishing Cat	Wetlands	Ponds, shallow pools for hunting simulation

Enrichment and Welfare Monitoring

- Multi-modal enrichment delivered weekly
- Welfare monitored through:
- Activity budgets
- Stereotypy frequency
- Response latency to enrichment
- Feeding behavior
- Use of camera traps and night-vision CCTV in night house

Veterinary Health Outcomes

- 100% vaccination compliance.
- Zero reported outbreaks.
- Significant reduction in stereotypic behaviors post enrichment revision.

Naturalism Meets Management: Small Cat Enclosure Strategies

Ecological realism in enclosure design, supported by a multi-disciplinary welfare approach, is proving vital in maintaining small wild felids under human care. Housing at GZRRC reinforces the idea that replicating environmental complexity, respecting species-specific needs, and integrating behavioral science are not luxuries, they're necessities.

What's Working

Enclosures mimicking natural habitats improve welfare by encouraging species-typical behaviors and reducing chronic stress.

Positive reinforcement training (PRT) and enrichment programs actively reduce stress while facilitating handling and medical compliance.

Aligning veterinary care with continuous behavioral observation allows for early intervention and better long-term outcomes.

Ongoing Challenges and New Opportunities

Captive populations of small wild cats often suffer from low genetic diversity, threatening their long-term survival. Enclosure size limitations can also suppress natural behaviors, especially in shy or elusive species. Moreover, small felids remain understudied compared to their larger counterparts, creating significant gaps in knowledge about their care and health management.

Moving Forward in Small Wild Cat Conservation

The GZRRC exemplifies how science-driven, species-specific management can significantly improve the welfare, health, and long-term survival of small wild felids. Its approach offers valuable lessons for conservation programs globally, highlighting the importance of data-informed husbandry.

Future priorities include enhancing genetic management through broader collaboration, developing targeted welfare measures, innovating enrichment that challenges natural behaviors, and increasing research efforts focused on these often-overlooked species. Embracing these steps will be crucial for securing a sustainable future for small wild cats in captivity and beyond.

With Gratitude

We sincerely thank the Central Zoo Authority of India for their unwavering support, and VANTARA for their invaluable logistical and operational assistance. Our deepest appreciation goes to the dedicated GZRRC team: Dr. Ankush Dube (Veterinary Officer), Mr. Naman Dani, (Facility Manager), Mr. Shubham Chapekar, Ms. Chandralekha Lochan and Ms. Revathi M. (Biologist, GZRRC) for their exceptional care of the animals. We also acknowledge the broader scientific community whose foundational research continues to shape and enhance the management and welfare of small wild felids.

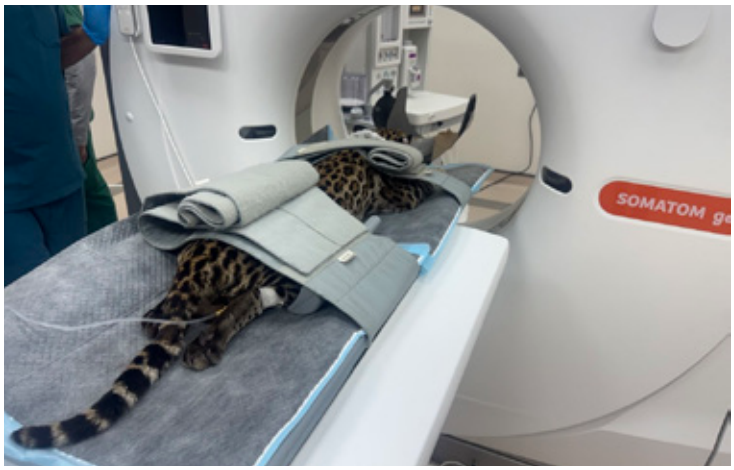


Figure 1: Oncilla undergoing MRI screening at GZRRC, advanced diagnostic imaging in action.

Figure 2: Temperature-controlled night cell with enrichment features and automatic waterer (Capacity – 5 ltr.) at GZRRC

Figure 3: Fishing cat habitat with water body and climbing structures.

Figure 4: Sand cat habitat with sand piles and concealed hideouts for enrichment.

Figure 5: Enclosure with dense vegetation and vertical structures for climbing.

Figure 6: Enclosure featuring dense vegetation, artificial shade for summer management, and climbing structures.

Figure 7: Cave and vegetation-based habitat designed for small felids.

Figure 8: Climbing structures as enrichment in small cat habitats.

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Figure 9: VANTARA application for digital record keeping and welfare monitoring.

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Sardar Patel Zoological Park: Advancing Research, Welfare, and Sustainability in the Modern Zoo

Text & Photos: Dr. Shashikant Sharma, Darshit Shah, Krunal Trivedi and Soham Mukherjee
Sardar Patel Zoological Park

Located next to the Statue of Unity in Gujarat, Sardar Patel Zoological Park (SPZP) has grown into a living laboratory where evidence-based research, high-standard welfare, resource-smart operations and visitor engagement reinforce one another. During 2023-25 the park hosted more than a dozen postgraduate dissertations and in-house studies whose findings are already informing day-to-day practice and long-term planning.

1. Toward Carbon-Conscious Zoos

A pioneering environmental audit calculated SPZP's total footprint at ≈ 20,732 t CO_2 yr^{-1}, with water pumping and visitor transport the largest sources (Fig. 1). Although the zoo's roof-top solar array offsets a share of the load, researchers recommend demand-side water savings, a larger photovoltaic field and "green-visit" incentives for guests to approach carbon neutrality.

In parallel, exhibit soils were profiled for texture, organic carbon and microbial diversity. Results showed markedly richer micro-biota in mixed-hoofstock paddocks than in large-carnivore groves, guiding a new programme of species-specific soil amendments and rotational rest to boost on-site carbon sequestration and enclosure hygiene (Fig. 2).

Figure 1: Aerial view of Sardar Patel Zoological Park, Ektanagar.

Figure 2: Soil sampling within the white lion enclosure conducted for microbial and organic carbon profiling as part of species-specific soil health assessment

2. Enrichment and Animal Welfare Science

Psittacine cognition – Contrafreeloading trials revealed that macaws willingly "work" for identical food they could obtain freely, validating effort-based foraging as a welfare metric for parrots (Fig. 3).

Figure 3: Observation of contrafreeloading behavior in macaws during cognitive enrichment trials.

Big-cat behaviour – Alternate sensory-, feeding- and structural-enrichment cycles eliminated stereotypic pacing in African lions and raised jaguar play by >800 % (Fig. 4).

Figure 4: Preparation and deployment of feeding and sensory enrichment devices for African lion and Jaguar pair that reduced stress behaviors and enhanced play activity during behavioral welfare assessments.

Ungulate problem-solving – Puzzle feeders showed that adult male sambar deer and blackbuck invest the most effort in complex foraging tasks, challenging assumptions that cervids are "low-cognition" species (Fig. 5).

Figure 5: Cognitive enrichment trials with Sambar deer (top) and Blackbuck (bottom)

These studies now feed directly into the Curatorial-Veterinary Enrichment Cell's calendars and are logged in the Antz digital management platform for ongoing review (Fig. 6).

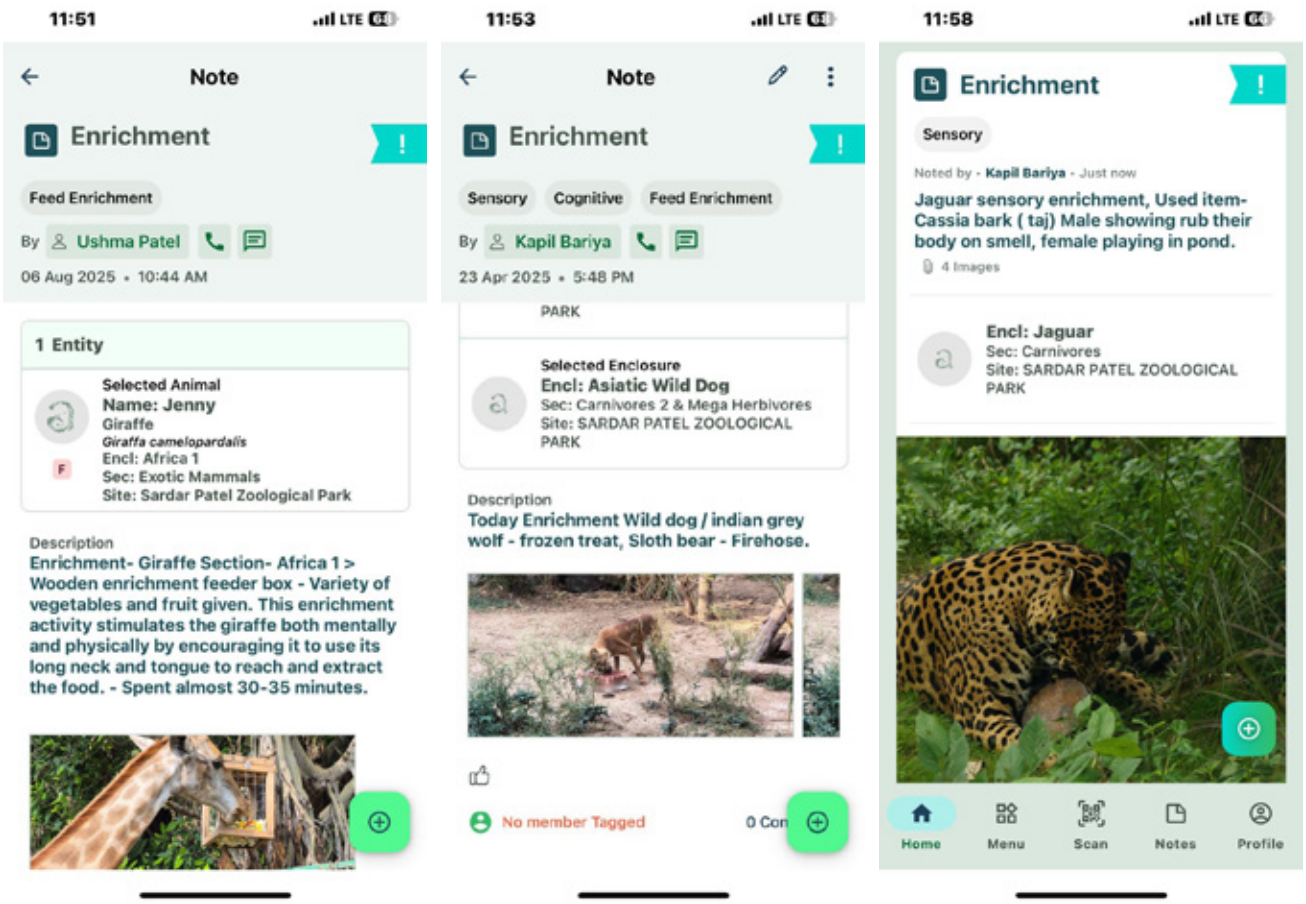

Figure 6: In-house developed ANTZ software for Animal welfare and management used by SPZP staff.

3. Visitor-Centric and Welfare-Aligned Exhibit Designs

Glass-fronted viewing bays were compared with traditional barriers for both animal stress and guest experience. Large carnivores favoured back-of-house retreats, whereas primates engaged actively with the viewing plane; visitors felt more emotionally connected but cited glare as a drawback (Fig. 7).

Figure 7: Immersive experience for visitors at Tiger exhibit

Recommended upgrades—anti-glare films, quiet zones and behaviour-cue signage—are being phased in. Spatial-use mapping in the Indian and Exotic Aviaries found dominant flocks monopolising central perches while shyer species shifted to peripheral trees. Multilevel feeders and canopy "bridges" are now diversifying resource access and flight paths.

4. Research Partnerships and Capacity Building

All projects were conducted in collaboration with The Maharaja Sayajirao University of Baroda and Gujarat University, mentored by SPZP's education and veterinary teams.

Findings are archived in the zoo's open-access repository, presented at national conferences and translated into keeper SOPs, ensuring that scholarship loops back into measurable husbandry gains.

Living Floors, Thriving Fauna: Bio-Active Substrates at Sardar Patel Zoological Park

Text & Photos: Mitesh Patel, Dhaval Gohil, Soham Mukherjee
Sardar Patel Zoological Park

From bio-floor to bio-active enclosure

When Sardar Patel Zoological Park (SPZP) welcomed its first guests in 2020, most indoor pens still rested on concrete slabs—easy to hose down, but unforgiving to joints and behaviour alike. Four years later, that hard surface has been traded for something far closer to forest soil. From the reptile wing to the great-ape paddocks, nearly every new or refurbished exhibit now sits on a "living floor" that smells of earth, moves underfoot and—even more importantly—cleans itself.

Figure 1 Bio Floor with substrate of Sand, Topsoil, hay, dried leaves, mulch and coco-peat.

A **bio-floor** is a layered substrate of sand, topsoil, hay, dried leaves, mulch and coco-peat. Its purpose is to cushion, drain and invite natural behaviour: dust-bathing for ostriches, scent-marking for leopards, digging for coatis.

Figure 2 Top left side is burrowing cockroaches (Pycnoscelus spp.) and right-side zebra isopods (Armadillidium maculatum) and below is Live bio floor.

A **bio-active enclosure** goes a step further. Keepers inoculate the soil with a miniature clean-up crew—springtails, zebra isopods (*Armadillidium maculatum*), burrowing cockroaches (*Pycnoscelus* spp.)—that breaks down faeces and food scraps, aerates the soil and keeps ammonia odour at bay. A healthy bio-active floor is recognised by three simple signs: a faint humus scent, active invertebrates in the top few centimetres, and almost no visible waste to remove.

Figure 3 Above is left Grey-crowned cranes nest, right is ostrich dust bath, below left is Black swan nest and left is pheasant having dust bath.

Aviaries: nests, dust-baths and spontaneous building

Ground-nesting birds are the first to benefit. Grey-crowned cranes shaped a loose straw-and-soil platform and reared a chick to fledging. Black swans gathered hay and twigs from the paddock floor to weave their own nest mound, while painted storks reinforced treetop platforms with the same material. Even ostriches—whose dust-baths help rid plumage of parasites—now sprawl comfortably in broad sandy stretches.

Figure 4 Coati enclosure has bio active flooring enhancing physical and sensory stimulation.

Small carnivores and capuchins

South-American coatis forage through a two-foot mulch alive with detritivores, rooting out meal-worms and house crickets scattered by keepers. Next door, tufted capuchins dig for the same invertebrates before clambering back to the canopy—a full-body workout that concrete simply could not provide.

Figure 5 Chimpanzee Enclosure which has bio floor inside night cells, kraals and display area.

Great apes on five feet of living soil

Chimpanzee and orang-utan paddocks were rebuilt from the ground up: one foot of drainage stone, another of charcoal for filtration, then three feet of hydrated coco-peat and leaf mould. High humidity guards against dry skin, and the soft floor absorbs the impact of terrestrial play. In 2024 chimpanzees began building night nests directly on the ground—behaviour rarely seen on hard bedding.

Figure 6 Reptile enclosures with Bio Active grounds

Reptiles: soil that sheds and burrows

The renovated reptile house follows best-practice guidance on live planting, UV-B gradients and bio-active grounds (Baines et al., 2016; Divers & Mader, 2005). Argentine black-and-white tegus burrow under dry leaf litter to brumate, green iguanas lay eggs in damp sand pits, and pythons choose between dry, humid and semi-moist hides for perfect shed cycles.

Figure 7 Above is Rhino enclosure with Wallowing and soft soil substrate below is sand substrate for Lion Enclosure

Carnivores, bears and hoofed stock

Night dens for lions and tigers now sit on deep sand and hay, easing pressure on ageing joints and preventing pressure sores. Sloth bears tear apart decaying logs pre-seeded with termites, while Indian rhinoceroses wallow in true mud baths that cool the skin and deter parasites. Hoofed stock from blackbuck to zebra enjoy soil and sand patches that promote natural dusting and hoof wear.

Figure 8 Spot cleaning and turning of Bio Floor

Keeping the ecosystem alive

Maintenance is surprisingly light. Each morning keepers spot-clean visible scraps and rake the surface to aerate it. Once a month the floor is drenched with sprinklers to recharge microbial life, then left to dry under sun and ventilation. During Gujarat's fierce monsoon, substrates are crowned and drainage ditches cleared; in winter, fresh leaf litter deepens the insulating layer.

Teaching beneath the feet

Interpretive signs now invite visitors to kneel, sift a handful of mulch and watch springtails vanish between fingers. School groups learn how the same organisms recycle nutrients in every healthy forest—turning waste into humus, carbon into soil and odour into nothing at all.

Conclusion

A floor that lives and breathes does more than look natural. It cushions joints, fuels instinctive behaviour, reduces chemical use and transforms a static paddock into a slice of functioning habitat. By replacing concrete with living earth, SPZP has found that animals dig, dust, browse and rest exactly as their wild cousins do—and keepers spend more time observing behaviour than scrubbing floors. In short, when the ground is alive, the zoo is too.

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Evaluation of Genetic Diversity in Captive *Bos Gaurus*

Text: K Sridhar and B Meghana Urs
Arignar Anna Zoological Park

The Gaur (*Bos gaurus*), is the largest (in terms of size) living wild cattle species belonging to the family Bovidae. More than 80% of the global population of *Bos gaurus* is found in India, distributed over three widely separated geographical regions: the Western Ghats, Central India, and Northeastern India. Arignar Anna Zoological Park housed around 35 Gaurs inn two clans during the study. Genetic diversity is a key factor in the long-term survival and resilience of any population. Comprehending the fundamental genetic diversity serves as a crucial baseline to guide informed conservation practices.

A reduction in genetic variability, often due to inbreeding, genetic drift, or founder effects, can result in inbreeding depression, characterized by reduced fertility, increased susceptibility to diseases, and lower survival rates. This issue is particularly concerning in closed or small captive populations, where limited gene flow and repeated breeding among related individuals can lead to the erosion of genetic diversity over generations. In the context of gaur conservation, understanding the genetic structure of captive populations is crucial for their effective management. Molecular techniques, such as DNA-based markers, have revolutionized the ability to assess genetic variability and provide detailed insights into the genetic health of populations. Techniques such as microsatellite genotyping, mitochondrial DNA analysis, and Single Nucleotide Polymorphism (SNP) genotyping enable researchers to quantify genetic diversity, identify population bottlenecks, and assess levels of inbreeding.

Microsatellites, which are short tandem repeated DNA sequences, are desirable in population and conservation studies because they show highly polymorphic codominant inheritance and abundant genomic distribution. They could be amplified using the polymerase chain reaction (PCR) from the samples obtained non-invasively, which is important for the study of endangered species.

A non-invasive technique for characterization of microsatellite markers utilizing faecal DNA to study the genetic architecture of the captive gaur was opted and in collaboration with Tamil Nadu Veterinary and Animal Sciences University, the study was carried out. Fresh dung samples of individual animals were collected by individually identifying animals with natural markings like horn shape, scars, etc. High care and measure was strictly followed and sampling of dung of same animal was avoided. Samples of 35 individual gaurs were collected and DNA is extracted. Analysis of parameters were done using POPGENE, Microsatellite analyzer and Cervus.

The gaur population at Arignar Anna Zoological Park showed moderate level of inbreeding which is expected for a small population in captivity. There is high level of genetic diversity shown by the high allele number. There is low genetic differentiation between enclosure 1 and enclosure 2. There was no evidence of bottleneck in the population.

A Decade of Veterinary Care and Welfare Management in Rehabilitated Sloth Bears (*Melursus Ursinus*): A Comprehensive Review of Clinical, Diagnostic, and Behavioral Interventions

Text & Photos: Srinu Srikanta Maharana, Agra Bear Rescue Facility

Abstract

The Sloth bear (*Melursus ursinus*), a vulnerable species native to the Indian subcontinent, presents unique challenges in captive management due to its history of exploitation, behavioral complexity, and tendency to mask clinical symptoms. This review consolidates over two decades of clinical and husbandry practices from Wildlife SOS Sloth bear rehabilitation centers, offering an evidence-based framework for veterinary care and welfare interventions. Common clinical conditions observed in rescued individuals include ocular pathologies, dental disease, and hepatobiliary disorders, often resulting from prior trauma and inadequate early-life care. Diagnostic protocols employing advanced imaging modalities (e.g., radiography, ultrasonography, CT, MRI) and hematobiochemical profiling have significantly enhanced disease diagnosis and therapeutic outcomes. Furthermore, the implementation of operant conditioning using positive reinforcement has facilitated voluntary participation in medical procedures, thereby reducing stress and improving clinical compliance. Welfare-focused enrichment programs and standardized husbandry practices have contributed significantly to psychological well-being and disease prevention. By integrating multidisciplinary approaches, this review aims to address best practices to promote long-term health and welfare standards for *Melursus ursinus* in captive settings.

Keywords: Sloth bear, captive management, veterinary care, operant conditioning, behavioral enrichment

1 Introduction

Sloth bears (*Melursus ursinus*) are myrmecophagous bear species native to the Indian subcontinent, classified as "Vulnerable" in the IUCN red list, and Schedule 1 of Indian Wildlife (Protection) Amendment Act, 2022 (Dharaiya *et al.*, 2016). Historically exploited in the "dancing bear" trade or orphaned due to human-wildlife conflict, rescued sloth bears often suffer from long-term physical and psychological trauma (Seshamani & Satyanarayan, 1997). Captive management of *Melursus ursinus* poses unique challenges due to their strength, behavioral traits, and the species' tendency to mask clinical symptoms (Maharana *et al.*, 2025). Veterinary interventions are crucial not only for medical conditions but also for improving quality of life through preventive care, nutritional support, and age-associated disease management. Furthermore, welfare management in captivity necessitates a multidisciplinary approach, integrating medical care with behavioral enrichment tailored to individual needs. Despite increasing numbers of zoological institutions, there remains a paucity of peer-reviewed literature detailing the clinical management protocols. This literature addresses this gap by presenting evidence- based veterinary and welfare interventions implemented at the Sloth bear rehabilitation centers of Wildlife SOS, with the objective of advancing health care standards and promoting the long-term well-being of Sloth bears in captive settings.

1.1 Clinical conditions

1.1.1 Ocular disorders

Ocular diseases are frequently observed in rescued sloth bears, often resulting from previous blunt force trauma, poor diet, and nutritional deficiencies (Hartley *et al.*, 2025). In a clinical study involving forty-three individuals (n = 43), ophthalmic disorders were documented in 41 bears, with findings including cataracts (28 eyes), retinal detachment (29 eyes), phthisis bulbi (19 eyes), and retinal degeneration (19 eyes). These conditions resulted in unilateral or bilateral blindness, significantly compromising animal welfare and natural foraging behaviors.

Figure 1: *Phthisis bulbi of the left globe (left), Hyper mature cataract with iris (right) (Source: Hartley et al., 2025)*

1.2 Dental pathology

Dental pathologies, particularly fractured canines and incisors, periapical abscesses, and gingivitis, are prevalent due to trauma, inappropriate diet, and stereotypical behaviour such as bar-biting. Radiographic and and microbial culture examinations revealed dental abnormalities in 62.5% of individuals studied, necessitating regular surveillance and veterinary intervention (Ilayaraja *et al.*, 2021).

Figure 2: *Different kinds of dental issues with bears (Source: Ilayaraja et al., 2021)*

1.3 Hepatobiliary diseases

Sloth bears often exhibit extrahepatic biliary pathologies. Diagnostic challenges arise due to overlapping symptoms such as inappetence, general weakness, bulged abdomen, icteric mucus membrane, and allergic dermatitis. Trans abdominal ultrasonography revealed bile duct obstruction and hepatic echogenicity changes, necessitating long-term hepatoprotective therapy (Ilayaraja & Sha, 2022).

Figure 3: *Bulged abdomen in Sloth bears due to ascitic fluid (Source: Ilayaraja & Sha, 2022)*

1.4 Leptospirosis

Leptospirosis is a major factor in the decline of sloth bears in India. PCR based serological tests (MAT and rLigBCon1-5 LAT), serum biochemistry, and tissue analysis to was used to detect the disease in captive sloth bears. MAT and LAT detected 87 and 78 positives, respectively, with Leptospira serovar Pyrogenes being most common. The rLigBCon1-5 LAT showed 89.66% sensitivity, 100% specificity, and 93.23% accuracy compared to MAT. PCR, gross lesions, histopathology, and elevated liver and kidney markers confirmed infection. The study supports rLigBCon1-5 LAT as an effective field diagnostic tool for leptospirosis in sloth bears (Mathesh *et al.*, 2021).

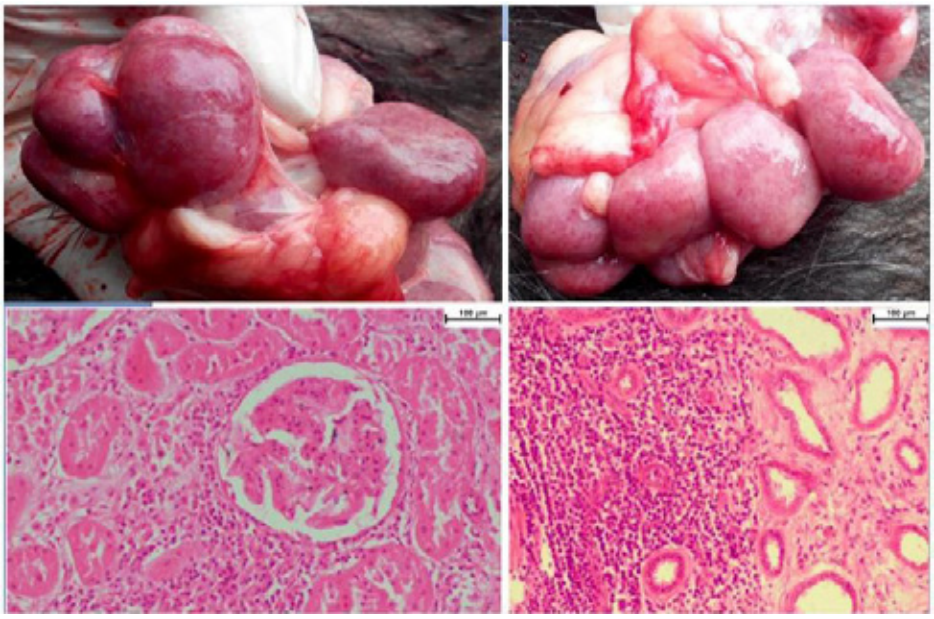

Figure 4: *Histopathology of kidneys in chronic case showing pronounced interstitial fibrosis and tubular atrophy with less severe inflammation (Source: Mathesh et al., 2021)*

1.5 Mucinous cholangiocarcinoma

A geriatric male Captive Sloth bear at the Agra Bear Rescue Centre passed away following symptoms of poor appetite, abdominal distension, and liver dysfunction. Post- mortem examination revealed pale mucous membranes, emaciation, and approximately two litres of serosanguinous fluid in the abdomen. The liver showed multiple mulberry- sized semi-solid nodules with adhesions to abdominal organs, which were coated in thick mucus. Histopathology revealed replacement of normal hepatic tissue by fibroadenomatous structures with irregular, neoplastic bile ductules showing nuclear atypia, mitotic figures, and mucin-filled lumina staining positive with PAS. Immunohistochemistry confirmed cytokeratin-positive neoplastic cells. The case was diagnosed as mucinous cholangiocellular carcinoma, a rare bile duct cancer variant in sloth bears. (Karikalan *et al.*, 2017).

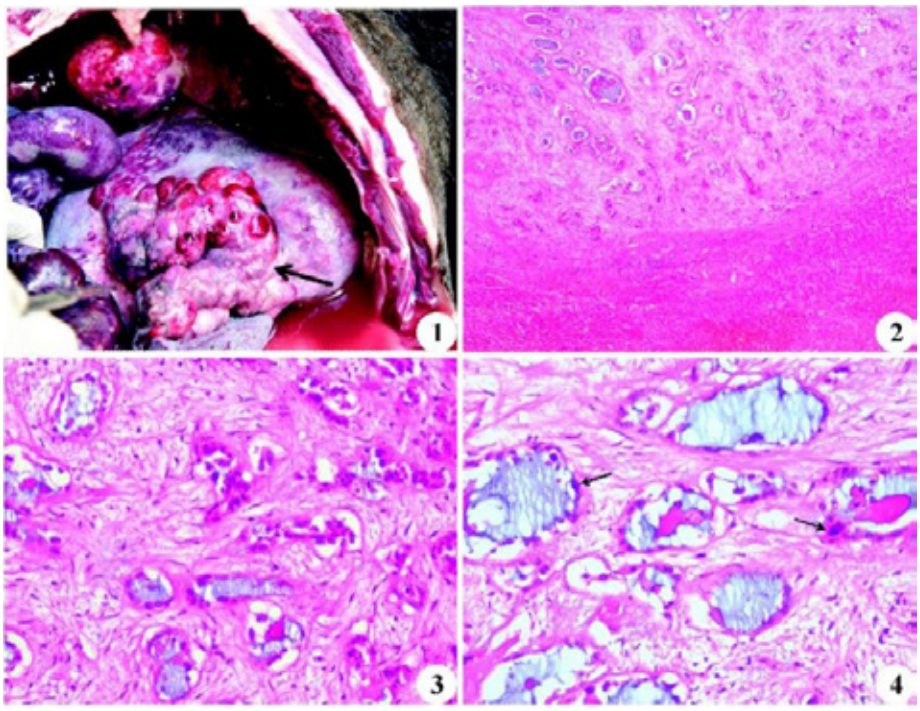

Figure 5: *Abdominal cavity showing multiple mulberries sized coalescing nodules elevated from the liver surface (arrow) with serosanguinous translucent peritoneal effusion (Source: Karikalan et al., 2017)*

1.6 Coxo-femoral osteoarthritis

A rescued adult female sloth bear at Agra Bear Rescue Facility showed lameness in the left hind limb due to chronic coxo-femoral osteoarthritis, confirmed via radiography. Likely caused by malnutrition and forced standing during its life as a dancing bear, the condition was managed with periodic pain relief, supplements, and weight control in isolation. Though full weight-bearing was not restored, mobility and appetite improved (Selvaraj et al., 2017) (Figure 6).

Figure 6: *Radiograph showing osteoarthritis of left coxo-femoral joint (Source: Selvaraj et al., 2017)*

2 Diagnostic and monitoring protocols

2.1 Diagnostic imaging

Advancements in noninvasive diagnostic imaging have revolutionized the field of wildlife medicine. The integration of imaging modalities such as radiography, ultrasonography, computed tomography, magnetic resonance imaging, and thermal imaging has proven crucial for clinical decision-making and species conservation (Sha & Ilayaraja, 2025) (Figure 7).

Figure 7: *Magnetic resonance imaging (MRI) of a sloth bear (Melursus ursinus) showing evidence of haemorrhage (Source: Sha & Ilayaraja, 2025)*

2.2 Haemato-biochemical and ECG profiling

Clinical baseline data are essential for the early diagnosis of cardiac and hematological disorders. In this context, comprehensive hematological, biochemical, and electrocardiographic evaluations conducted on apparently healthy individuals may serve as valuable reference standards for future assessments (Arun et al., 2022) (Figure 8).

2.3 Fecal observations

Fecal characteristics provide valuable insights into gastrointestinal health and dietary adequacy. In Sloth bears, variations in the gross appearance of feces including changes in color and consistency have been correlated with underlying digestive disturbances (Ilayaraja et al., 2022) (Figure 9).

Figure 8: *Electrocardiographic examination (Source: Arun et al., 2022)*

Figure 9: *Gross appearance of faeces for M. Ursinus diagnosed with verminous enteritis (Source: Ilayaraja et al., 2022)*

3 Husbandry and Management

Managing a large population of captive sloth bears requires a scientific approach and well-defined standard operating procedures. Over 15 years, Sha and Ilayaraja (2022) and Arun *et al.* (2020) have developed best practices and standardized veterinary protocols for hand rearing of Sloth bear neonates, effective husbandry and disease management.

Physiological Parameter	Method to Assess	Normal Range	Remarks
Heart rate (beats/min)	Manually with stethoscope Mechanically with the patient monitor	50–110	If heart rate goes away from the recommended range, respiratory function should be reassessed immediately and corrected. Reversal drug should also be another option if other signs point toward cardiovascular distress or collapse, i.e., blue or gray mucous membranes, prolonged capillary refill time (>2 sec), dilated pupils.
Respiratory rate (breaths/min)	Manually by visualizing chest excursion or with stethoscope Mechanically with the patient monitor	12 ± 6	Each breath should be quiet and characterized by full expansion and relaxation of the rib cage. If the respiratory rate is less than 6 breaths per minute, artificial ventilation (chest compressions, ventilation via endotracheal tube, and resuscitation bags) and administration of a reversal drug may help. Respiratory analeptics such as Doxapram can also be used.
Body temperature (rectal)	Manually by recording rectal temperature Mechanically with patient monitor	36°C–38°C (96.8°F–100.4°F)	Administration of a reversal drug is the most effective treatment if hyperthermia (>104°F) develops because it enables the bear to use its normal cooling mechanisms of panting. Other cooling methods include dousing with cold water and cold-water enemas, spraying with cold water/rubbing alcohol in the groin region.
Hemoglobin oxygen saturation	Mechanically with patient monitor or field pulse-oximeter	≥85%	Oxygen saturation, <85% with increasing pulse rate and bluish mucous membranes are typical signs of hypoxemia. Oxygen therapy, with a flow rate of 5–10 L per minute, is the most effective treatment for hypoxemia in sloth bears, and the efficacy of treatment should be monitored with a pulse-oximeter regularly.

Figure 10: Normal vital physiological parameters in immobilized adult Sloth Bears (Source: Sha and Ilayaraja, 2022)

Figure 11: *Hand-rearing of Sloth bear neonate (Source: Arun et al., 2020)*

4 Operant conditioning and welfare management

4.1 Voluntary participation in medical procedures

A transformative shift in Sloth bear care involves the implementation of welfare-oriented training programs based on operant conditioning through positive reinforcement. These programs are designed to train bears to voluntarily cooperate during medical procedures. The structured protocol has demonstrated successful compliance from Sloth bears in procedures such as phlebotomy, ultrasonography, electrocardiography, and thermometry (Maharana et al., 2025).

4.2 Behavioral enrichment

Welfare optimization includes environmental modifications, sensory stimulation, feeding puzzles, and novel objects encourage species typical behaviors, reduce stereotypies, and promote psychological well-being (Anderson *et al.*, 2010).

Figure 12: *Operant conditioning facilitated venipuncture in captive Sloth bears (Source: Maharana et al., 2025)*

Figure 13: *A multidimensional wooden puzzle feeder designed to promote cognitive engagement and stimulate natural foraging behavior (Photo: Srinu Srikanta Maharana, Wildlife SOS)*

5 Conclusion

The captive management of sloth bears in zoological settings is inherently complex due to a wide range of health challenges, often stemming from prior trauma and species- specific behavioral traits. The standardization of preventive care protocols, integration of advanced diagnostic modalities, and implementation of behavior-based training have significantly improved both prognosis and overall welfare. Given the high conservation value of the species, the development of evidence-based, species-specific guidelines is imperative. This review contributes to that goal by consolidating real-world clinical data and highlighting key advancements in sloth bear veterinary care and management.

6 Acknowledgments

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