



# ex-situ

UPDATES



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## BEST PRACTICES FOR Captive Animal Management

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Zoos of the twenty-first century have integrated the modern concepts of zoo biology and captive animal management into their design and daily practices as premier institutions for animal conservation and raising public awareness. From an overdependence on visitor-centric sterile enclosures, modern zoos have embraced naturalistic enclosure design and adopted best practices for captive animal management that are better aligned with the tenets of ex-situ conservation and animal welfare. Zoos today serve multifarious roles that go beyond the confines of visitor entertainment and aim to conserve global biodiversity by integrating both ex-situ and in-situ conservation under the umbrella of the "One-Plan Approach for conservation". Central

Zoo Authority's (CZA) vision and guidance has been pivotal to the redevelopment of Indian zoos. Greens Zoological, Rescue and Rehabilitation Centre has been established on the bedrock of animal welfare and biodiversity conservation in alignment with the goals of CZA.

Greens Zoological, Rescue and Rehabilitation Centre (GZRRC) aims to become one of the premier global institutions working towards animal welfare and global biodiversity conservation. In order to achieve these goals, GZRRC has implemented institution wide best practices that are crucial to its daily functioning and the achievement of its long-term goals. In this article, we discuss some of the salient features of the best practices implemented at GZRRC that has been instrumental to its past

and present success in captive animal management. The objective of this article is to establish a baseline for the adoption of universal best practices for captive animal management by initiating a dialogue for peers.

### BEST PRACTICES FOR ANIMAL WELFARE

Animal welfare is defined by Broom as the state of the animal as it tries to cope with internal and external environment. However, modern definitions of animal welfare also focus on providing opportunities to the animals to experience positive affective states. Animal welfare, in its present form, is a holistic concept delving deep into biopsychosocial facets of captive animal management. This entails a complete understanding of the species biology,



juxtaposed with an acceptance of unique welfare requirement of each individual animal in our care. Greens Zoological, Rescue and Rehabilitation Centre has a holistic animal welfare evaluation and monitoring programme that works across all verticals of the organization. Animal welfare considerations flow from all aspects of enclosure design and day-to-day operations of GZRRC.

GZRRC has a panel of subject matter experts who are assigned to the care and welfare of each animal group housed at the facility. This panel comprising of veterinarians, biologists, curators, animal-keepers meet every month to discuss about the extant and emergent welfare requirement of the species housed at GZRRC. The best practices for the upkeep and management of the species are identified and reviewed against the incumbent welfare and husbandry practices regularly. The same is compared to the physiological and behavioural welfare indices of the animals and based on the report, scope, methods, and strategy of welfare improvement for each species is delineated and communicated for compliance.

## **BAYESIAN FRAMEWORK FOR ANIMAL WELFARE IMPROVEMENT**

As compared to the empirical approach, GZRRC follows a Bayesian model for animal welfare assessment, and improvement. GZRRC, biologists and curators diligently follow the latest development in animal welfare research to guide its captive animal management programme. The captive management programme for each species is designed based on prior information available from available scientific literature for each species. The response of each animal to the extant husbandry, management and enrichment practices is collected. Based on the data collected, we create a likelihood function that quantifies the probability of observing the collected data given the welfare state of the animals. Based on the evidence available, we update the prior information about the species' welfare requirement. This updated information about the welfare requirement is updated iteratively as new evidence emerges about the welfare requirement of the species.

Applying Bayesian framework to animal welfare assessment is a flexible and adaptive method that allows for new information to be assimilated with established practices for refining the husbandry practices over time unconstrained by the frequentist approach. The updated information about animal welfare is used to inform the decisions pertaining to animal welfare interventions, resource allocation and policy development.

## **ENCLOSURE DESIGN AND ENRICHMENT INTERVENTIONS**

GZRRC has some of the finest enclosures for housing captive animals in near natural habitats, where they have the freedom to express species-typical behavioural repertoires. Unlike typical captive facilities, GZRRC enclosure design ethos is founded on the principles of integrating functional complexity in enclosure designs with a view to create a near natural experience for the housed species. Enclosures are designed to have equal or near equal functional complexity across each zone to maximize enclosure usage and encourage exploratory behaviour in animals.

The enclosures are designed to integrate a mosaic of substrates, and topographical features that recreates the natural habitat and promotes the expression of species typical behaviours. This translates into an interconnected canopy for brachiating macaques, hiding places and natural perches for leopard, as well as opportunities to express natural foraging behaviours. Species-typical vegetation representative of the niche of the species are planted at the enclosures to ensure that the animals can display the entire gamut of behaviour repertoire.

The biologists, curators, veterinarians, and subject matter experts collaborate with architects and the construction team from the planning phase till the animal is released at the enclosure to ensure that the enclosure designs cater to the need of each species. The post-occupancy evaluation of enclosures



## ENRICHMENT INTERVENTIONS

Enrichment brings novelty to the mundane captive environment and stimulates the expression of a diverse species typical behaviour repertoire. Animals exposed to regular, and tailored enrichment interventions are less likely to display stereotypic behaviours commonly associated with zoochosis.

At GZRRC, each individual animal is treated as a single welfare unit that requires a separate plan. Zookeepers are trained to monitor the behaviour of each animal under their care and understand their biological, behavioural and social requirement. An enrichment plan is created for every individual housed in and enclosure and based on the response of each animal, the intervention is modified to increase the chances of expressing species-typical behaviours.

Based on the feedback received from animal keepers and the research findings, biologists and curators create an enrichment plan for each individual and evaluate the efficacy of the same after implementation. In-house fabricators make the enrichment devices out of natural materials that are the animals should be more or less likely to encounter in the wild.

Several types of enrichment devices and their prototypes are manufactured at different scales and implemented as per the requirement of each animal. Most importantly, keeper training is prioritised, so that keepers are able to understand the biological and behavioural needs of the animals under their care and fabricate enrichment interventions accordingly. So that enrichment interventions are audited at multiple levels and monitored for efficacy. Keepers, along with biologists and curators, hold regular meetings to effectively design and modify enrichment interventions for each animal. Each enrichment intervention is carefully audited and vetted by the expert group for each of the species and monitored for species appropriateness. Once enrichment



interventions are finalised, the location and the number of the enrichments along with their types is decided based on the number of individuals in each enclosure and their enrichment preferences. Enrichments are placed to increase enclosure usage, reduce agonistic interactions, and increase the chances for the expression of exploratory species typical behaviours.

Safety is one of the most important aspect of any enrichment intervention. Therefore all staff members check the enrichment device prototypes for any design flaws that can lead to injury and stress to the animals. All enrichment interventions are designed to promote species-typical behaviours without causing any social disruption due to unnecessary competition for enrichment resources among individual animals housed in the same enclosure.

Documentation is a very important aspect of any enrichment intervention therefore, keepers are trained by the biologist and curators to effectively collect behaviour data as well as non-invasive faecal samples to better evaluate the efficacy of the enrichment interventions. This welfare audit is that the heart of the success of the enrichment intervention program of GZRRC. At GZRRC, animal welfare, enclosure design, enrichments, and veterinary health care are inter-connected to

one another and together to form the foundation of captive animal management.

## BEST PRACTICES IN ANIMAL NUTRITION

Animal welfare in captivity is linked to good nutrition and veterinary management practices. Similarly, animal nutrition is crucial to the welfare, behaviour patterns, and general health of captive animals. Greens Zoological, Rescue and Rehabilitation Centre lays a lot of emphasis on the integration all facets of captive management to achieve its long-term goal to provide excellent care and welfare to all animals.

GZRRC has a team of expert nutritionists from India and abroad. Animals housed at GZRRC are provided the best-balanced nutrition on the basis of species, age, sex, health, seasonal, time and behavioural requirements. The nutritionists make sure the keepers provide the food to all enclosures as per standard operation procedure. The nutritionists and biologists regularly train the keepers so that they have a complete understanding of the species biology of the animals under their care. Care is taken so that the daily food enrichment provisioning mimics that in the wild, leading to an increase in the expression of species-typical foraging and food processing behaviours. The animal keepers provide food-based enrichment in

each enclosure so that the animals can express their natural species-typical behaviour patterns.

The nutritionist team members record and study the food intake of each individual animal to know if the animals feed on a balanced diet as their favourite choice of food may not provide all nutrients. Feedback of animal caretakers, Veterinarians and Curators are taken on the intake of food, feeding behaviour, growth, weight, and general health condition in planning of diet for the animals. Dietary records are maintained everyday so that the history of feeding, food choice, feeding time, amount of food intake, amount of food uneaten, and supplements given are recorded. All food materials are fresh and tested by two independent laboratories for pesticide, harmful microbes, pests and any other contaminants before being prepared to be fed to the animals. GZRRC has a state-of-the-art utensil sterilisation facility where all utensils are sanitised regularly. Each facility has four sets of utensils that are rotated to ensure that all animals at GZRRC have access to clean and disease-free environment.

By ensuring that proper nutrition is provided to all animals based on their individual needs, GZRRC has adopted a proactive rather than a reactive approach to animal welfare and health management at its facility.

## **HOLISTIC VETERINARY INFRASTRUCTURE**

Greens Zoological, Rescue and Rehabilitation Centre currently has two modern veterinary hospitals at its facilities with one at Satellite Rescue Facility and the second at the Animal Quarantine centre. Both the hospitals have their associated laboratory facility and required personnel. These facilities are useful in routine check-up of animals and treatment of ailing, injured, sick, or senile animals. Medical and surgical procedures for animals are performed at the hospitals whenever required.

Each hospital has the following list of equipment:

1. Gaseous anaesthesia machines.
2. Portable X-ray scanners .
3. Operation Theatres (OT) room with OT lightning.
4. Ultra-Sonography machines .
5. Dental kits and dental surgery equipment.
6. Portable blood testing equipment.
7. Tranquilizing equipment.

## **STATE-OF-THE-ART VETERINARY HOSPITAL**

The Greens Zoological Rescue and Rehabilitation Centre (GZRRC) has built the largest veterinary hospital in India, a pioneering establishment dedicated to the comprehensive care and treatment of injured, distressed, and ailing wild animals. This state-of-

the-art hospital is at the forefront of wildlife healthcare, offering a spectrum of services and cater to the unique needs of a wide array of animals and a testimony to GZRRC's commitment to wildlife conservation. Spanning an area of 10,000sqm within the GZRRC premises, the veterinary hospital is equipped with cutting-edge infrastructure, advanced medical equipment, and a team of experienced veterinarians and wildlife specialists. It serves as a critical hub for the rescue, treatment, and rehabilitation of a diverse range of wildlife species, from birds and mammals to reptiles and amphibians.

The hospital includes specialized treatment units designed to cater to the unique needs of different species. From avian rehabilitation to large mammal care, each unit is equipped with facilities tailored to the specific requirements of its inhabitants. The animal hospital has advanced diagnostic tools, including advanced imaging equipment like Computed Tomography (CT), Magnetic Resonance Imaging (MRI), and on-site laboratories, enabling rapid and accurate assessments of the health conditions of admitted animals. This ensures timely intervention and appropriate treatment plans. The hospital boasts dedicated operating theatres equipped with modern surgical instruments, allowing for intricate and specialized procedures essential for the treatment of severe injuries or medical conditions of animals. In addition to medical treatment, the facility provides rehabilitation spaces for sick animals. These spaces are crucial for animals to regain strength and redevelop natural behaviours.

The hospital operates round the clock to provide emergency care for GZRRC animals and other wild animals. This continuous availability ensures that prompt attention is given to animals in critical condition. The hospital serves as a hub for research initiatives, contributing to a better understanding of wildlife health and conservation. The hospital collaborates with other governmental agencies, conservation organizations,





and wildlife experts to broaden its scope of operations. Additionally, outreach programs and workshops are being conducted to raise awareness about wildlife health and conservation issues.

The wildlife hospital at GZRRC stands as a symbol of its commitment to safeguarding wildlife. It will help to fulfil GZRRC mission to treat and rehabilitate native wildlife, improve its ability to act as first responders in emergencies and play a pivotal role in conservation programs for threatened wildlife. In essence, the wildlife hospital at GZRRC is not just a medical facility, but a sanctuary of healing, compassion, and dedication to the well-being of zoo animals and wildlife in general.

## HOSPITAL AT THE GZRRC SATELLITE RESCUE FACILITY FOR LEOPARDS

The facility has a dedicated veterinary hospital with all the necessary equipment along with a post-mortem room and an incinerator. The hospital is equipped with state-of-the-art facilities including CT Scanning machines, MRI scanning machines, ICU units specifically designed for animals, birds and reptiles, in patient ward rooms, operation theatre, gaseous anaesthesia machines, ultrasonography machines, dental kits and a highly developed diagnostic laboratory. The hospital has a fully furnished surgical theatre equipped with surgical suite and ceiling mounted lighting. The surgery suite includes a hydraulic surgery table and has enough room to work with all the large animals at the centre. Other than this, the hospital has endoscopy machine, low-level laser therapy, Ozone therapy, thermal scanner, nursery, pharmacy and pathology lab thus ensuring proper care and health of the animals. There is a dedicated clinical pathology laboratory for pathological research attached to the main hospital. Considering the biosecurity issues, the post-mortem room at the facility is isolated from the live animal area. The post-mortem room has its own rest room, equipment cleaning,



specimen preparation and storage/disposal facilities to prevent movement of fomites. A post-mortem examination in accordance with accepted veterinary procedures is performed in case of an animal death to determine the cause of death.

## BIOSECURITY BEST PRACTICES

Biosecurity at the Greens Zoological Rescue and Rehabilitation Centre stands as a paramount pillar in safeguarding the health and well-being of the resident animals, staff, and the surrounding urban ecosystem. This comprehensive approach encompasses a range of protocols, procedures, and preventive measures to mitigate the risks of disease transmission and maintain a safe environment for all inhabitants. The fundamental principle of biosecurity at GZRRC involves stringent measures aimed at preventing the introduction and spread of infectious agents, parasites, or diseases within GZRRC. Here's an overview of key elements and practices incorporated into biosecurity protocols at the centre to mitigate any spill over of pathogens.

**Quarantine Protocols:** Before any new animal enters GZRRC, it undergoes a thorough quarantine period. This practice serves as a critical first step in preventing the introduction of potential pathogens. During this time, the animal is monitored closely for

any signs of illness, and necessary health screenings and tests are conducted.

**Restricted Access and Controlled Movement:** Access to different areas/facilities at GZRRC is controlled and restricted, minimizing the chances of cross-contamination between different animal enclosures. Staff are required to follow strict hygiene protocols such as hand sanitization, foot baths and changing footwear.

**Hygiene and Sanitization Practices:** Stringent hygiene measures are enforced, including regular hand washing, use of disinfectants, sterilizing and cleaning of equipment and surfaces. Dedicated sterilization station is present at the centre to sterilize utensils and equipment used. The centre also encourages staff to adherence to sanitizing practices.

**Isolation Facilities:** In cases where animals display symptoms of illness or require specialized care, isolation facilities are in place to prevent the spread of disease to other individuals. These areas are equipped with separate ventilation systems and staff are trained in specific protocols for handling and caring for sick animals.

**Training and Education:** All staff members undergo thorough training on biosecurity measures and

protocols to ensure strict compliance and to minimize any inadvertent risks. Regular updates and refreshers are provided to keep everyone informed about the latest best practices. Other than this, mock drills with staff are done at regular intervals. Signages on biosecurity issues are placed at various locations to raise awareness about the importance of maintaining biosecurity within the premises.

#### **Collaboration and Monitoring:**

Collaborations with veterinary experts and periodic health assessments contribute to continuous monitoring and evaluation of the animals' health. The health committee of GZRRC meet periodically to access various biosecurity issues. This proactive approach helps in early detection and management of any potential health issues.

**Environmental Management:** The centre complies with all environmental regulatory compliances. The centre prioritizes maintaining a clean and healthy environment, including waste management and pest control, to further reduce disease risks.

The implementation of stringent biosecurity measures at GZRRC underscores the commitment to ensuring the highest standards of animal welfare, health, and conservation. By integrating these protocols into daily operations, the centre endeavours to create a safe haven for its residents while



contributing to broader wildlife conservation efforts.

#### **ANIMAL QUARANTINE FACILITIES**

Quarantine plays a major role in ensuring the health and welfare of animals housed at GZRRC. GZRRC has one of the largest modern animal quarantine facility that ensures the health and welfare of all animals that are brought to the facility. The animal quarantine facility is the place where new animals or animals that need to be isolated for various medical issues are usually housed. The quarantine facility is equipped with its own animal hospital and post-mortem room. The hospital is well furnished

and equipped as listed above. Animal holding/treatment and staff zones are positioned to minimize travel times and reduce animals stress levels during transport. The treatment and holding areas have open paddocks and night cells for observation. The paddock area incorporates daylighting to help preserve the species-typical circadian rhythm and circulate fresh air throughout the facility. The facility has dedicated tranquilizing equipment and associated drugs for any medical emergencies. This facility has its own infrastructure including its very own animal ambulances and staff transport vehicles to prevent any biosecurity lapses.

The State-of-the-Art Animal Quarantine Facility at Greens Zoological, Rescue and Rehabilitation Centre stands as a pioneering testament to GZRRC's commitment to wildlife care, setting new benchmarks in animal welfare, health management, and biosecurity. As the largest facility of its kind in the country, it epitomizes cutting-edge infrastructure and advanced protocols aimed at ensuring the optimal health and safety of its animal residents.

Spread across an expansive area of nine acres, this facility boasts a myriad of features and functionalities that define its stature and effectiveness:





**1. Extensive Capacity:** The facility has 170 enclosures of various dimensions designed to accommodate a diverse range of species, offering individualized enclosures tailored to suit the needs of various animals, from small mammals to large carnivores and herbivores, birds, and reptiles.

**2. Advanced Medical Infrastructure:** Equipped with state-of-the-art medical equipment, including diagnostic tools, imaging facilities, and on-site laboratories, the facility enables swift and precise health evaluations for incoming animals. The facility has its own Post-Mortem room.

**3. Segregated Isolation Units:** These units are meticulously designed to ensure strict segregation of incoming animals, preventing potential transmission of diseases or parasites between individuals.

**4. Rigorous Quarantine Protocols:** Every animal undergoes a comprehensive quarantine period upon arrival. This phase involves stringent health assessments, tests, and observations by a team of specialized veterinarians to detect any potential health issues.

**5. Expert Care and Observation:** A dedicated team of veterinary experts, animal biologist, and caretakers provides round-the-clock care and monitoring, ensuring

the physical and mental well-being of the animals.

**6. Biosecurity Measures:** The facility upholds stringent biosecurity standards, including regular disinfection protocols, controlled access, and waste management strategies, minimizing the risks of disease transmission. The facility maintains a change room with showers for the staff to maintain the highest standards of hygiene and biosecurity at the facility.

**7. Environmental Enrichment:** Enclosures are thoughtfully designed to mimic natural habitats, offering enrichment activities and elements that cater to the behavioural needs of the animals, promoting their overall well-being during the quarantine period.

**8. Continuous Improvement:** The facility operates with a commitment to continual enhancement, regularly updating protocols based on the latest scientific advancements and fostering ongoing staff training programs to maintain the highest standards of animal care.

As the largest and most advanced animal quarantine facility in India, this centre demonstrates GZRRC's dedication to wildlife conservation, setting a gold standard in animal care, health management, and biosecurity. It serves not only as a safe haven for animals in need but



also as a beacon of excellence in the field of wildlife rescue.

## SUMMARY

Greens Zoological, Rescue and Rehabilitation Centre has established the facility with the vision for long-term development of zoo biology as a rigorous scientific discipline that contributes to the conservation of biodiversity and the promotion of captive animal welfare. Since its development, GZRRC has focused on the creation and refinement of best practices for the standard operating procedures that lead to best animal welfare outcomes. Captive animal welfare deficits are rampant across most ex-situ establishments due to the lack of documentation and the implementation of standard operating protocols. GZRRC is ameliorating this problem by establishing protocols by collaborating with subject matter experts and following the Bayesian framework for tuning the best practices to meet the emergent requirement of a captive animal management facility. GZRRC is keen to partner with other Indian zoos to form a collaborative network built on a strategic partnership for capacity building, knowledge transfers and the development of zoo biology for the future of biodiversity conservation and animal welfare in the Indian Zooscape. With this article, we have tried to provide a glimpse of the established best practices of GZRRC. The objective is to initiate the conversation for adoption of universal best practices for captive animal management as a framework for Indian zoos as envisaged by the Central Zoo Authority.

