सत्यमेव जयते

WORKING MANUAL

RED PANDA CONSERVATION BREEDING PROGRAMME

जहाँ है हरियाली ।
वहाँ है खुशहाली ॥

Ministry of Environment and Forests
Government of India

Central Zoo Authority

Padmaja Naidu Himalayan Zoological Park

WORKING MANUAL OF

Red Panda Conservation Breeding Programme

Alankar K. Jha

With inputs from

Purna Ghising
Upashna Rai
Bhupen Roka

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वहाँ है खुशहाली ॥

Ministry of Environment and Forests
Government of India

Central Zoo Authority

Padmaja Naidu Himalayan Zoological Park

Sanjay Mitra

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सत्यमेव जयते

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Message

The Padmaja Naidu Himalayan Zoological Park, Darjeeling has, since its Inception in 1958 paid special attention to the conservation of himalayan fauna. The Red Panda project has been the second oldest project in the country. With an experience of 24 years, it has been in fitness of fitness of things prepare a manual for the conservation breeding of these beautiful animals.

I hope that this shall help other zoos in the country to increase the breeding stock of the animal. This could be a gene bank for the reintroduction of this unique animal in the wild.

I wish the project all success.

Sanjay Mitra

(Sanjay Mitra)
Chief Secretary &
President, West Bengal Zoo Authority

GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT, FORESTS & CLIMATE CHANGE

Central Zoo Authority

FOREWORD

Animal Husbandry Manuals or captive management manuals are invaluable resources for those working in zoos and places where captive animals are housed. Most manuals reflect both natural history to give keepers a background of the animal, as well as their captive requirements. The compilation is done mostly througth research with the literatures available as well as through unpublished personnel experiences. Some manuals are even compiled through the running of workshop which gathers a number of people experienced with the species to discuss all options.

This manual is designed to provide husbandry guidance and advice about captive Red pandas (*Ailurus fulgens fulgens*) in zoos. This manual is an overview of captive management of Red Panda (*Ailurus fulgens fulgens*) in zoos. This manual is an overview of captive management of Red Panda (*Ailurus fulgens fulgens*) and has included all the major aspect of captive management.

The informations in this working manual would complement the fundamental captive wild animal husbandry guidelines, ultimately resulting in a comprehensive 'code of practice' guideline document for the welfare of captive Red panda.

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Dated: 29 September, 2014

Message

Padmaja Naidu Himalayan Zoological Park has reached new height, in all fields of Zoo management and have been focusing on better care of animals - not only physical, nutritional and general health care but better care of the animals' emotional well being. The Park in its period of existence has evolved into a modern ex-situ conservation facility.

Padmaja Naidu Himalayan Zoological Park is involved in the Conservation breeding of endangered and threatened high altitude species and plays a crucial role in reintroduction efforts. The Park has immense experience in successful captive breeding. The knowledge and expertise of zoo staffs have ensured the likelihood of having a stable, genetically diverse population that will not only exist into the future, but also will be capable of increasing in population size and to use some of these to reestablish populations in the wild.

A planned Conservation Breeding Project for the Red Pandas as a part of the Global Captive Breeding Master Plan was initiated in early nineties in the Zoological Park in response to the International Conservation efforts, through initiation in the form of a project before "Conservation Breeding Projects" formally started in India. The Park achieved the ultimate goal of the programme when in 2003-04 four red pandas were released at Singalila National Park, Darjeeling.

I am happy to note that Padmaja Naidu Himalayan Zoological Park, Darjeeling is coming out with Working Manual of Red Panda *(Ailurus fulgens)* which is a compilation of knowledge provided by expert staffs of the Park. The manual assembles basic requirements, best practices and animal care recommendations to maximize the capacity for excellence in animal care and welfare.

I wish the Zoo all success.

(Chandan Sinha)
Principal Secretary,
Department of Forest.

सत्यमेव जयते

Ujjwal Bhattachrya, IFS

Principal Chief Conservator of Forests,
Wildlife & Chief Wildlife Warden,
Govt. of West Bengal

FOREWORD

The beautiful Red Pandas have a very restricted distribution in the eastern himalays and hence are ecologically very important. The Padmaja Naidu Himalayan Zoological Park. Darjeeling has been successful in captive breeding of Red Pandas in the last two decades. The procedures have been standardized and well documented. Fresh blood lines have been introduced in the breeding population. Animal exchange programme with other himalayan zoos have also been undertaken. A very humble attempt was made for restocking of the animal in wild by creating soft release facilities in their natural babitat. This requires to be continued especially in low density areas. On DNA profiling from the samples of zoo-bred animals a majority have shown homozygosity. Hence more for fresh blood lines are required to be introduced in the breeding population.

I am sure that the efforts made by the zoo management and producing this manual will go a long way in the conservation of the vulnerable and photogenic Red Panda.

Date : 22.09.2014

(Ujjwal Bhattacharya, IFS)
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सत्यमेव जयते

PADMAJA NAIDU HIMALAYAN ZOOLOGICAL PARK

DARJEELING - 734101 (WEST BENGAL) INDIA

PREFACE

Padmaja Naidu Himalayan Zoological Park, Darjeeling was established in 1958 and has been a pioneer for conservation breeding of endangered Himalayan species in India. The first ex-situ conservation breeding programme in the Park was started in 1986 as Snow Leopard Conservation Breeding Project. Subsequently. Red Panda Project was started in the year 1990. Since then the Park also started Conservation breeding in Blue Sheep. Himalayan Thar, Tibetan Wolves, Himalayan Salamander, Himalayan Monal, Bhutan Grey Peacock Pheasant, etc.

Red Panda Conservation Breeding project has been a unique in its project due to the facts of its presence near in-situ conservation areas namely Singallila National Park and Neora Valley National Park being very near to the Park. Apart from this the neighbouring State of Sikkim also has Red Panda populations in its national park and sanctuaries.

The Park has since 1990 bred animals with proper record keeping. The Park has more or less standardized the health protocol, animal husbandry protocols as well as breeding protocol of the animal in ex-situ conditions. In 2003-04 the Park also released four female Red Pandas into the Singailila National Park as a pilot project for reintroduction of the species in its natural habitat which with its lacunae, is still being considered as a successful project. After that the Park has started more concentrated project as its two prime strategy, the first being the refinement of ex-situ conservation breeding by way of genetic analysis, hormonal analysis and standard animal husbandry protocol. On the other hand the park also started assessment in the National Parks viz Neora Valley and Singallila National Park, for their suitability for release of zoo bred animal in future. The population estimation of the Red Panda was done in the year 2012 in two National Parks with the help from experts from Zoological Survey of India, Wildlife Wing of Govt. of West Bengal LaCONES, and local NGO Groups. Efforts were also made to assess the impact of release of four animals on the wild population. The two National Parks are also in the process of being assessed for their vegetative component and presence of other species compatible and non compatible to the Red Panda population, as a part of population Habitat Viability Analysis.

In view of this Manual which has been prepared from all the efforts since 1990 till date, shall be base line data, as far as Red Panda Conservation Breeding is concerned. It is expected that this will guide the other high altitude Zoos in India in achieving their goal as participating zoo.

Complete perfection is a utopian theory hence suggestions from all are expected for further improvement of the project as well as publication.

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Acknowledgement

The Red Panda Conservation Breeding Program was initiated in early nineties. The present assemblages is an effort to documents the entire plus and minus points, our erudition and perception.

We are grateful to Late D.K. Dey and Sri V Rishi, IFS for giving the dawn to this concept. We are obliged to Mr N C Bahuguna IFS who had the critical task of taking care of the project at a time where it could have either faltered or have been destined to great heights.

We are thankful to the Directors of Rotterdam Zoo, Colonge Zoo, Madrid Zoo, Belgium Zoo, Holland Zoo and Auckland Zoo for providing us individual species for the Breeding Program.

We are thankful to Miss Angela Glatston for helping the programme all through from its primary days to right now.

We are thankful to Dr. B.R. Sharma, IFS who first reintroduced the captive born Red Panda in wild in year 2003. This was the pioneer work and was the first time in South East Asia that the captive born animal was reintroduced into the wild as part of a re-stocking project.

We acknowledge Mr Kiran Moktan, Purna Ghishing for taking utmost care of the animals and bringing it to its present form.

We offer sincere vote of thanks to all staff of PNHZ Park, Veterinary Officers, Zoo keepers, other Officers and all Ex Director whose ardour and hard labour has made the Project successful.

Lastly, we offer our gratitude and recognition to the public of Darjeeling for whom it is a project who have given them an identity, other than tea, timber and tourism.

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Chapter 1

1.1 Introduction

This husbandry manual provides knowledge on biology, behaviour, diet, health, breeding, restraint and transportation of animals held in captivity. This husbandry manual can be used as ready references tool for the Conservation Breeding of Red Panda. Information will also be useful for the researcher and for the education and training programme of zoo personals.

1.2 Background

Red panda is a unique carnivore that has adapted to the herbivore mode of life and is a resident of Himalayan and Hengduan mountain ranges (Roberts and Gittleman, 1984; Glatston, 1994; Wei *et al.*, 1999; Chowdhury, 2001). Red Panda is one of the flagship species in worldwide conservation. It is an interesting animal having adapted to a diet of bamboo leaves in nature. The animal shares its name with giant panda *Ailuropoda melanoleuca*. Despite their popular name the two species are not closely related and the Red Panda is now generally placed in monotypic family Ailuridae (Glatson, 1994). Anthropogenic activities and associated global climate change are threatening the biodiversity in the Himalayas and have led to the extinction of many species of flora and fauna. Rapid growth and expanding human population which depends on the forest for livestock grazing, timber extraction, food, fodder, fertilizer, fuel-wood are the causes for the erosion of the Himalayan forest and decrease in number of Red Panda.

Fig. 1: Red Panda (*Ailurus fulgens fulgens*)

1.3 Taxonomic classification of the Red Panda

Common name: Red Panda

Local Name: Habra, Pura kudo, Nighala Ponbo

Scientific Classification

Kingdom: Animalia

Phylum: Chordata

Class: Mammalia

Order: Carnivora

Suborder: Caniformia

Superfamily: Musteloidea

Family: Ailuridae

Genus: *Ailurus*

Species: *A.fulgens*

Species Authority: F. Cuvier, 1825

1.4 Conservation status

Like its phylogenetic position, status of the Red Panda in wild has also been a matter of great discussion and speculation for over a long period (Glatston, 1994). But recently **IUCN (International Union For the Conservation of Nature and Natural Resources)** has reassessed the global status of Red Panda and placed it under the **vulnerable category** and they presume that the global number of red panda across its range spanning from Nepal to Sichuan province of China through India (Sikkim, West Bengal-Darjeeling district only, Arunachal Pradesh and Meghalaya), Bhutan and Myanmar, could number to 10000 individuals (Wang *et al.*, 2008). In India too, though red panda is included under the **Schedule - I of Indian Wildlife (Protection) Act 1972,** very little is known about its status in the wild (Partha S. Ghosh, Basant K. Sharma, Rajarshi Chakraborty unpubished).

It is also listed in **Appendix** 1 of the Convention on **International Trade for Endangered Species of wild fauna and flora (CITES).**

1.5 Role in Ecosystem

- Red Panda is an ecological indicator will be used to assess the condition of the environment, to provide an early warning signal of the change in vegetation, ecology or

to diagnose the cause of an environmental problem. Inhaber (1976) states that biological indicator gives us information about the state of environmental quality not obtainable in other ways. In contrast, a measure directly quantifies the factor of interest. Thus an indicator species is an organism whose characteristics (Example- presence, absence, population density, and dispersion and reproduction success) are used as an index of attributes too difficult, inconvenient or expensive to measure for other species or environmental condition of interest. Red Panda (*Ailurus fulgen) is* a charismatic species in worldwide conservation, which can be used to identify the feasibility of the Parks for holding different threatened floral and faunal species.

- **Red Panda** is also a flagship species that have the ability to capture the imagination of the public and induce people to support conservation action and/or to donate funds. It is a species selected to act as an ambassador, icon or symbol for a defined habitat, issue, campaign or environmental cause. By focusing on, and achieving conservation of the species, the status of many other species which share its habitat or are vulnerable to the same threats - may also be improved.
- Red Panda serves as Primary consumer in the food chain. They mainly feed on bamboo, bamboo shoots berries, mushrooms and occasionally birds and insects. Red Panda helps in controlling of overgrowth of bamboo in the natural habitat.

1.6 Culture and Economic Significance

Despite the fact that procyonides and ailurids comprise a small number of very cryptic species in the procyonids and ailurid genera, they have achieved a small degree of cultural, if not economic significance. However, neither of this group can be said to play a major role in mankind's culture and economy. The Red Panda has recently been acknowledged as the state animal of Sikkim, and was the mascot of the International Tea Festival in Darjeeling, there is no mention of it in the culture or folklore of Nepal, and as yet information on these aspects has not been obtained for other countries within its range. However, the Red Panda has been recognized in eastern culture for much longer than in those of the west. For example, a Red Panda appears to be depicted on a 13th century. Chinese pen and ink scroll showing a hunting scene, so it may be that there is still information on cultural traditions associated within this species which has yet to

be found. *Ailurus* is not commonly kept as a household pet, although Hodgson (1847), one of the early observers of the Red Panda did note that they would make "charming pets for ladies." Nobody seems to have adopted his advice, although it has been said that Mrs Indira Gandhi did keep Red Pandas as pets when she was a child. The new world procyonids, with the exception of racoons and ringtails in the United States, have no commercial value except for occasional sales to zoos or the pet trade. As the only common species are normally caught and sold, this commercial traffic probably has no major importance except possibly for rare insular forms. Red Panda again do not seem to be traded commercially on a large scale, although their skins were much more readily available, and were used either as hats or their tails as dusters. In addition, in China a Red Panda skin may be worn by the bridegroom in the wedding ceremonies of one of the local indigenous peoples. The trade of live Red Pandas to zoos were formerly very prevalent. However, legislation has probably limited this practice in more recent year.

Fig. 2:- Red Panda, Mascot of Tea and Tourism Festival, Darjeeling

1.7 Need of Conservation Breeding of Red Panda

Conservation Breeding of the Red Panda will provide backup for the wild population. It will be helpful for maintaining genetically healthy population and will provide individuals for the reintroduction.

1.8 Threats

- Poaching and trade
- Habitat destruction
- Cattle grazing
- Collection of medicinal and aromatic plants
- Malingo (Bamboo) collection
- Flowering of bamboo
- Feral dog
- Expansion of tourism facilities
- Encroachment
- Conversion of natural high forest into plantation

Fig. 3:- Red Panda Poaching

Fig. 4:- Red Panda Hat

Chapter 2: General Ecology and Biology of Red Panda

2.1 Morphology

Red Panda is distinguished from other Carnivore in coat colour face predominantly white with reddish brown tear marks extending from the inferior region of the orbit to the corner of the mouth; post-cranial dorsal pelage reddish or orange brown and ventral pelage glossy black; legs are black and the soles of the feet are covered with dense white hair. This is the only Asian carnivore in which the plantar surface of the foot is completely covered with hair. The head is rounded, rostrum shortened and ears large, erect and pointed. The tail is comparatively long and marked with about 12 alternating red and buff rings. There is no sexual dimorphism in size and colour. Long coarse guard hairs cover the entire body and there is a soft, dense, woolly undercoat. Specimen from the eastern sector of the range of the species may be somewhat larger and darker in colour than those from western areas (Pocock, 1921). The number of mammae in females is eight arranged in two rows of four each (Davis, 1964; Mcgrew, 1938).

The dental formula is i 3/3, c 1/1, p 3/3-4, m2/2 total 36-38. The fourth upper premolar, a principal discerning dental character in Carnivora is large with five cusps as in Procyon and Ailuropoda (Davis, 1964; Mcgrew, 1938). By contrast in the Ursidae P4 have only three cusps which are degenerated. The second and third upper and lower premolars are large and robust. The large cheek tooth surface promotes meliolateral movement for a grinding action and correlates with a highly specialized diet of bamboo and fibrous plant material (Gregory, 1936; Hodgson, 1848; Scapino, 1981). The symphasis menti is relatively flexible with a moderate degree of independent movement of the hemimandibles (Scapino, 1981).

In general skull size is large compared with that of carnivores of similar body size such as proconidae. Relative brain size, measured from cranial capacity is comparable with that of Procyonidae. The auditory bulla is relatively small as indicated by the reduced caudal entotympanic elements, and may be correlated with reduced auditory sensitivity. In both juvenile and adult forms the bulla is formed almost entirely by the tympanic as in ursids and lutrinae and mephitinae mustelids. Rostral and caudal entotympanics form a small part of the medial wall of the bulla as in Ursidae but in contrast with that in Procyon which possesses a swollen caudal entotympanic (Hunt, 1974).

There are 6 lumbar vertebrae and 14 thoracics (Davis, 1964). The cervical region is short. Relatively proportions of the vertebral column are cervical (22%), thoracic (47%) and lumbar

(31%). Forelimbs and handlimbs are of roughly equal length (Davis, 1964). The five digits on each foot are in a strongly curved line and terminate with curved semi retractile claws, used effectively in climbing. The radial sesamoid bone of the wrist articulates primarily with the radial carpal bone, and is greatly enlarged but relatively less so that the sesamoid of the giant panda, Ailuropoda. Forepaws are frequently used to pick, manipulate, and pull apart food, particularly bamboo leaves and stalks. The post scapular fossa is moderately large and may be indicative of its arboreality where the forelimbs are more supportive while climbing that the hind limbs (Davis, 1949).

The left lung is divided into two lobes similar to Procyonidae, Mustelidae and Ursidae but contrasting with the remaining carnivore families that have three lobes. Reduction of lobes seems to be associated with a broadening of the thorax whose functional change is unknown. The right lung is divided into four lobes as in all fissiped carnivores.

The salivary glands are relatively large as in most omnivorous carnivores. The tongue is similar to Ursus being of moderate length and having numerous foliate papillae. The stomach is simple as in all fissiped carnivores with a spherical fundus no caecum and a cylindrical thick walled pylorus (Hodgson, 1848). The intestinal tract is simple and comparatively short (4.2 times body length). This characteristic is unusual considering the common association between herbivore and an extended gut in mammals.

Males possess a comparatively short penis, the prepuce closer to the scrotum than in Procyonidae (Flower, 1870; Pocock, 1921) the baculum is comparatively short only about 2 cm long (Davis, 1964; Pocock, 1921).

2.2 Distribution

The Red Panda is endemic to the eastern Himalayas, and with the exception of a small isolated tropical forest population in India, the species is confined to temperate conifer forest and adjacent broadleaf forest where it specialises on a diet of bamboo. Its distribution ranges from western Nepal into India, Bhutan, and northern Myanmar through to the Minshan Mountains and upper Min Valley of Sichuan Province in south-central China (Sangay Dorji, Karl Vernes, 2011). Globally, total potential habitat of the species is about 142000 sq km with China alone accounting for more than half of the area.

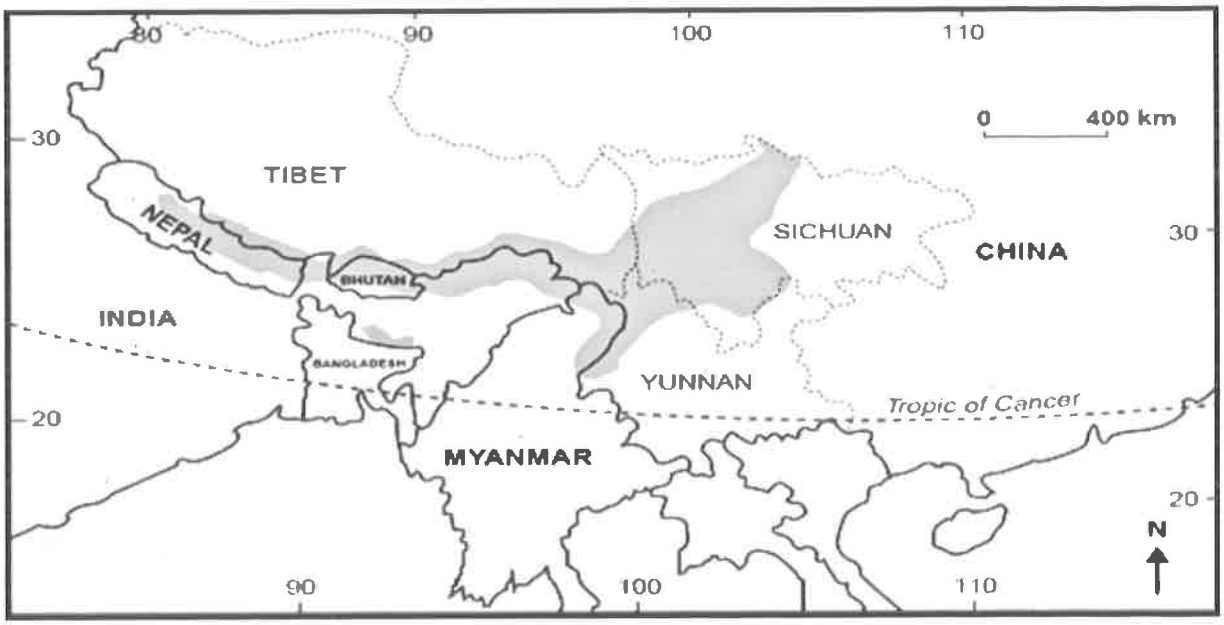

Fig. 5: Global distributions (shaded area) of the Red Panda *Ailurus fulgens* (Chaudhary 2001)

2.3 Behaviour

Captive Red Panda are nocturnal and crepuscular and exhibit a polyphasic activity pattern throughout the night. Activity patterns change throughout the year in response to temperature, feeding regimes, and presence of young (Keller, 1977; Roberts, 1981). In the wild red panda are reported to be most active at dawn and dusk and at night (Anon, 1978). Red Pandas are arboreal but forage primarily on the ground. The usual mode of progression on the ground is by a cross extension gait; faster movement is by trotting or bounding. A similar cross extension pattern is used to climb tree trunk, and animal descend head first by gripping the tree trunk medially with the hind feet. Movement on and between small terminal branches is facilated by a high degree of flexibility of the pectoral and pelvic griddles and limb joints (Keller, 1977; Roberts, 1981). The trail is not prehensile but is used as a support and counterbalance when climbing. In normal progression on the ground, the tail is carried straight out and horizontal to the ground (Roberts, 1981). Red Panda rest and sleep in trees or other elevation surface most frequently and in nature are said to use evergreens as nest sites (Anon, 1978). Sleeping and resting postures range from prone extension with legs straddling a branch to a tightly curled posture with the head tucked under a hind leg. Temperature and humidity influence the posture adopted, presumably to alter

heat conductance. Animals maintain a tightly curled posture during cold weather but stretch their bodies along branches with their legs dangling during hot weather. Adults rarely sleep in contact with one another; however, a mother and her young and nest bound sibling in the absence of their mother do frequently. Comfort behaviour include licking the body and limbs, face washing with one forepaw or hind paw, and stretching or rubbing the back, abdomen and flanks against a stationary objects. Virtually all comfort behaviour is conducted while in tree and shortly after awakening or eating. Particular attention is paid to maintenance of the forepaws. Discrete latrine areas are used for defecation but not urination and these areas generally are located at the periphery of enclosure (Keller, 1977, 1980; Roberts, 1981).

Food items are grasped in a single forepaw and brought to the mouth while sitting, standing or occasionally lying on the back. Bamboo is grasped by the Culm, and then bent down to bring the leaves within reach of the mouth. Food grasped in this fashion is inserted in the side of the mouth where it is sheared, then chewed extensively before being swallowed. Small food items such as blossoms, berries, and small leaves are nipped off with the incisors (Keller, 1977; Roberts, 1981).

Fig. 6: Red Panda using forepaw for holding the bamboo

Interactive social behaviour includes a variety of motor patterns that permit olfactory examination of conspecifics including naso-naso, naso-face, naso-torso, naso-flank, and nano anal contact (Keller, 1977; Roberts, 1981). Approaching, following, sniffing, striking, lunging,

biting and wrestling form a continuum of motor patterns observed in aggressive, play, and social contexts. Adults rarely interact with one another outside of the mating season and aggression is rare. Individual housed together maintain individual sleeping and resting loci and use a variety of the visual displays in maintaining individual distances (Keller, 1977, 1982; Roberts, 1981).

The vocal repertoire of the Red Panda is small but there is considerable variability within certain call types (Roberts, 1981). Tonal calls include an infant distress "wheet" which may persist in the adult as a "squeal" under conditions of great duress, and a high- pitched, modulated-frequency "twitter" heard as a contact call in young and adults. A harsh, broad band, polysyllabic "quacksnort" is emitted by young and adult under conditions ranging from mild annoyance to intense aggression. Non vocal sounds of communicatory function include exhalation of air through the nose and mouth (Puffing) while raising and lowering the head during mild threat displays and jaw clapping while turning the head towards a nearby individual during a low intensity aggressive encounter. Grunts and snorts also are produced by animals engaged in wrestling or fighting (Roberts, 1981).

2.4 Breeding Behaviour

- **Mating**

In captivity, mating is strictly seasonal with onset in the early winter, usually between January to mid-March. At the onset of the mating season a male and a female rest, move, and eat in close proximity. Scent-marking rates for both sexes increase, most notably in males and males spend significantly greater amount of time examining the trails and faecal and urine marking of females. Mating call was heard and allogrooming was observed. On the day of copulations, female scent marking increases markedly and male begins to pursue the female closely. Female precopulatory behaviour includes frequent stops during agitated, random movement about enclosure, tail flicking bounding gait. Copulation occurs on the ground following mount invitation by the female. The male clasp the female about the abdomen and immediately commences thrusting at a rate approximately 120 thrust/min. There is no neck bite although the male may lick the neck and shoulder of the female during copulation. There are extra vaginal ejaculations and multiple ejaculations per copulation. Copulation lasts 3- 10 minutes; there is no evidence of a copulatory tie and at the end of copulation, the male and female separate and engage in long bouts of genital autogrooming.

Fig. 7: Red Panda Mating

- **Gestation period**

Gestation in captivity ranges between 120 to 150 days after mating.

- **Birth**

In captivity pregnant females become noticeably heavy and lethargic after few weeks of mating. Before parturition a pregnant female begins to carry nest materials such as sticks, grasses, and leaves into suitable nest sites. Nest building may continue after young are born but the behaviour is highly variable among females. In the wild, animals may use hollow trees or rock crevices as nest sites but in captivity females readily adopt nest boxes placed on the ground or hollow logs. Parturition occurs rapidly, with females quickly cleaning the cubs and remaining with them for 60 to 90 % of the time during the first few days after birth. Mother move young frequently, presumably in response to nest disturbance; all active nest sites are kept clean by the mother. Within 10 to 14 days cub opens eyes and gains full colouration within 70 days of birth. Young remains within nest for approximately 90 days after which cub gradually rest outside the nest area with mother. Young attain adult size at approximately 12 months and gain sexual maturity at approximately 18 months.

Fig. 8: Red Panda Cubs

- **Litter size**

In captivity litter size ranges from one to four with a mode of two.

2.5 Factors of mortality

The mortality is similar to that of other mammals being highest in the youngest (1 to 7 years) and oldest (7 to 14 years) age which decreases during middle age (1 to 7 years). Litters of two and three young have the lowest juvenile mortality. Survivorship of the young dependents on the maternal age and experiences. Death of cub occurs due to ill nursing and frequent shifting of cub.

Fig. 9: Red Panda Cubs

Chapter 3: Mission, Vision and Objective of Red Panda Conservation Breeding Centre

3.1 Mission

To breed Red Panda in captivity and increase their number keeping in account the genetic viability in the stock and to release the captive breed Red Panda in its natural habitat.

3.2 Vision

To have a planned ex-situ conservation breeding program as a part of the Global Captive breeding Master Plan.

3.3 Conservation Message of Breeding Centre

To breed the species and develop methods to successfully re-habilitate back into their natural habitat. To create awareness of the importance of conservation of environment and provide the opportunity for volunteers to research on Red Panda.

3.4 Objective

- To increase genetically healthy population.
- To provide backup population for the wild.
- Captive population can used for reintroduction of the individual in the wild.
- To donate stock to other zoos which are not considered for re- introduction.
- Monitoring and modifying management practice to provide survival of Red Panda in captivity as well as in wild.
- For research, education and public awareness.

3.5 Age composition of Red Panda for captive breeding

Young gain adult size at the age of 12 month and gains sexual maturity at the age of 18 month. Individual of both the sexes have reproduced up to 12 years of age.

Chapter 4: Establishing Red Panda Conservation Breeding Centre

4.1 Site selection of Conservation Breeding Centre: Preparation for the selection of site for setting up a Conservation breeding centre for Red Panda

- The Conservation breeding centre should be established at a distance of 2-4 km away from human habitation.
- Should be close to the natural habitat of the species.
- Should be safe from natural calamities like landslides and earthquakes.
- Should have basic facility such as approach, electricity, telecommunication, regular supply of fresh water etc.
- Edible grasses, plants and fruits should be available in the vicinity of the breeding centre.

4.2 Considerations for enclosure design

While designing the exhibits for Red Panda careful consideration should be given so that the area meets the physical, social, behavioural and physiological needs of the species. The exhibit should be replica of the natural habitat. In captivity Red Pandas are nocturnal and crepuscular and exhibit a polyphasic activity pattern throughout the night. Their activity patterns change throughout the year in response to temperature, feeding regimes, and the presence of young (Roberts & Glatston, 1994). Behaviour of Red Panda includes scent marking, a tendency to maintain personal distance except during breeding season, the propensity to climb and hide from disturbing/frightening elements such as loud noises, natural foraging feeding activities, breeding associated activities, young rearing behaviours, and sleep. Enclosure should be designed to accommodate all the behaviours.

4.3 Topography

Exhibits may be terraced, sloped, and contain high or low spots. An exhibit with no change in elevation should be heavily planted or provided with other climbing structures to enable the Red Panda to utilize all areas of the enclosure to rest or find shelter.

4.4 Environment

Enclosures should have natural substrate planted with edible grasses and contain a variety of elevations. Red Pandas prefer to rest on elevated perches above the level of the viewing public, so attention should be given to furnishing the animals with this possibility by providing a variety of

climbing structures and resting perches at various locations and heights, in the enclosure. The environment should include rocks, trees, pools, logs, clumps of vegetation etc. These will provide both adequate shade and facilitate the animals' need to withdraw from the direct gaze of the general public at times (Roberts & Glatston, 1994). Public access should be restricted to one, or at most two, sides of the enclosure so that animals can retreat from public disturbance (Roberts & Glatston, 1994).

Fig. 10: Red Panda Enclosure at PNHZ Park

4.5 Temperature

Red Panda is a high altitude species. Temperatures at the upper range are of more concern with red pandas then thermal lows, therefore, some part of the enclosure should be in shade throughout the day, particularly when temperature is above 23.8 °C (75 °F) (Roberts, 1980). Indoor housing or access to an insulated nest box should be provided where winter temperatures drop below -6.6 °C (20 °F). In areas of extreme cold, supplemental heat should be provided in indoor housing and/or nest boxes. Ideally, these areas should be maintained between 1.6 °C (35 °F) and 23.8 °C (75 °F). Red Pandas should be given access to their outdoor exhibit at all times. Wooden nest boxes should be provided with some dry leaves inside it and should be placed in shaded area.

4.6 Light- Sunshine

Red Panda should be housed in outdoor exhibit therefore no artificial light is required as long as animals are provided with access to normal cycle of the outdoor environment.

4.7 Water

Fresh clean and boiled water for drinking should be provided all time. Water devices should be clean daily. Care should be taken so that sufficient water is available and freezing is avoided. Animals with restricted water intake will also decrease food intake, so the availability of fresh water is very important.

4.8 Pollution

Noise: It is unknown for Red Panda what the tolerance are for sound and vibration however disturbance should be kept to a minimum. Noise should be minimized before and after parturition.

4.9 Ventilation and Humidity

Relative humidity should be within the range of 30 - 70%. The roof of all night shelters to be provided with sky-lights so that fresh air and natural sunlight can get inside the room preventing dampness and growth of micro-organisms.

4.10 Sanitation

Hard-surface primary enclosures and food containers (if used) should be cleaned daily. Nesting boxes and feeding platform should also be included in this regime. Dirt substrates in outdoor-planted exhibits should be raked and spot-cleaned daily.

4.11 Enclosure Designing

- The enclosure should be well furnished and the animal should be given enough choices so as to carry out species specific behaviour.
- The exhibit should be designed to reflect as much as the natural habitat as possible. Enclosure should have natural substrate planted with edible grasses and trees.
- Red Panda prefer to rest and sleep at high elevation so attention should be given to furnishing the animals with this possibility by providing climbing and resting perches at various location and height in the enclosure.
- Weather considerations: rain cover, shade structure, sunny spots, wind breaks should be provided in the enclosure.
- Visual barriers like log piles, trees, bamboo should be provided.

- Scent marking is the important behaviour of the species; furniture/substrate should be allowed to build for the scent posts.
- Minimum of three nesting boxes should be provided to allow hiding and sleeping for the animal within the enclosure. These should be constructed of wood, covered by tin sheet from outside and should be placed at different shaded and elevated location of the enclosure.
- Enclosures should not be located near aggressive animals, which can disturb the Red Pandas: a distance of at least 50 m (164 ft) between a Red Panda exhibit and that of a large carnivore is recommended. Also, Red Pandas should not be situated close to busy traffic routes or noisy gathering places. (Roberts & Glatston, 1994).

Fig. 11

Fig. 12

Fig. 13

Fig. 14

Fig. 11-14: Red Panda enclosures at PNHZ Park

Fig.15 Shades for Red Panda

Fig.16: Feeding Enrichment

Fig. 17

Fig. 18

Fig. 17-18: Exhibit enrichment -Walking wooden poles

Fig. 19

Fig. 20

Fig. 21

Fig. 22

Fig. 21-22: Dietary enrichment by placing food items at different places.

4.12 Gates and Holding Areas

Each habitat should have separate "room" in which animal(s) can be kept while the main cage is being cleaned or otherwise serviced or to segregate an animal from others in the enclosure. The openings should be equipped with double doors for security reasons (the inner door is fenced, the outer door is closed).

4.13 Enclosure Specifications

Table 1: Minimum Prescribed size for feeding/ retiring cubicle for important mammalian species of captive animals

Name of the species	Size of the feeding cubicle/night shelter for each animal (meters)		
	Length	Breadth	Height
Red Panda	2.0	1.5	2.5

Table 2: Minimum prescribed sizes for outdoor open enclosures for important mammalian species in captivity

Animal/Species	Minimum size of outdoor enclosure (per pair) (Square meters)	Minimum extra area per additional animals (Square meters)
Red Panda	400	100

AZA Recommended enclosure sizes for Red Panda

Enclosures require a floor area of at least 40 m^2 (430 ft^2), preferably more, and should be at least 4 m (12 ft) high or have climbing structures of this height (assuming the enclosure(s) is not entirely open) as Red Pandas prefer to rest in elevated perches above the level of the viewing public.

Red Panda enclosure of PNHZ Park Breeding Centre

It is a circular enclosure with 6-7 feet high RCC wall with an inward bend at the top. The total area of the enclosure is 2925.00 sq. m of diameter 61.00 metre. The animal house has been provided with one night shelter with wooden breeding box. One keeper's gallery of 3.0 m X 2.10 m is also attached to the night cell for processing/ preparing food for the animal. The enclosed area is with many trees and lots of greenery. Nesting boxes have been placed at different places in the enclosure.

Fig. 23

Fig. 24

Fig. 23-24: Red Panda Enclosure at Conservation Breeding Centre & Nesting Boxes

4.14 Other Facilities Required

Veterinary section

Should have a well equipped laboratory with the following facilities:

X-Ray

- X–Ray (GM 100) to be used to detect cracks and fractures.
- The X-ray plates to be developed in a dark room.

Haematology

(a) Sample Collection Requirement: (i) Scissors (ii) B.P. Blade (iii) Betadine (iv) Cotton (v) sterile vial (2 nos).

(b) BA88A- Semi-Auto Analyzer.

(c) Blood to be taken from the tail vein using a syringe 10 ml and then the collected blood is put in a sterile vial for clinical Hematological test (5 ml) and the other 5 ml in the E.D.T (Ethylenediaminetetra acetic Acid) vial for biochemistry parameters. The following parameters to be determined:

Clinical Haematology

- Hb- Haemoglobin (Sahli method).
- R.B.C- Neubauer Counting Chamber Method.
- W.B.C- (i) total count- Neubauer Counting Chamber Method.
  (ii) Differential count by Leishman Staining Method.
- E.S.R- Westergren Method in 1 hour method.

Operation Theatre

- Room size: length: 11 ft/ Breadth: 9ft 5"/ Height-7ft 9". Facilities: OT complex should be isolated. The room should have an independent airflow mechanism to maintain theatre sterility. Should have a proper ventilation system.
- Requirements: Halogen lamps and spot lights.
- Operation table.
- Surgical Instruments.
- Disinfectants.
- Oxygen Cylinder with mask.

Post- operative Recovery Room:

- Room Size: Length: 11 ft /Breadth: 9ft 5"/Height-7ft 9".

Freezer:

- For sample storage.

4.15 Others

- **Solid and Liquid Waste sewerage**

Solid wastes: The left over feed should be disposed properly and the area specified for disposing.

Liquid wastes: The water from the enclosures, retiring rooms, laboratory, and veterinary section should go into soak away pits located outside the centre.

- **Water Supply**

Ground water tank: a lot of water will be required at the Centre. There should be enough water in all the facilities to drink and for cleaning. Constant supply of good water will be needed at the Centre. It would be good to construct storage tanks to store the water. The tanks should be big enough to hold the requisite amount of water. The tanks could be of appropriate size. The water could be filled up by municipal supply or by water tankers. The tank should be cleaned and painted with lime every month.

- **Electrical Room**

The centre should have a dedicated electrical room of dimensions. The centre should have a three phase power connection. There will be a need for an 8KV generator (silent) and two invertors for back-up power. The power break downs are usually frequent but the back-up support should be enough to tide over the situation. All night shelters need to have electrical connections. There should bulbs inside the night shelters as well as in the passage. This is also a requirement according to Central Zoo Authority guidelines.

- **Perimeter fence**

The entire land should be surrounded by 8' high chain link fence to keep trespasser, domestic animals and stray dogs away.

- **Closed- Circuit television Camera (CCTV)**

The animals should be observed on the CCTV that would be placed in a room of dimension 10 X 10 X 10 ft. Most of the observation on the animal should be carried out through camera monitors, especially during breeding events like birth, nursing behaviour, mother-cub interaction, feeding of the cubs etc can be monitored in details with minimal disturbance to the mother and the cubs.

Chapter 5: Husbandry and Care

5.1 Housing Requirement

❖ **Exhibit designing and topography**

- Should be designed with the animal's natural habitat and behaviour in mind.
- Safety and security should be of utmost importance.
- Ideally to have an open aired exhibit allowing them to climb and rest at various heights and well above their keepers and the viewing public.
- Exhibit should have an undulating topography and preferably heavily vegetated.

❖ **Position of enclosures**

- Enclosure should allow viewing from one side only, with the other side being solid, permitting the animals to be very safe and secure.
- The enclosure should be in a shady area which shall aid in cooling the enclosure and any natural structure around the exhibit utilized by them.
- All enclosure should have a portion of the total area that is protected from the weather and shade.

❖ **Substrate**

- Earth with rich vegetation.
- Substrate should be natural.
- Other substrates can include sand and leaf mulch as food items can be hidden under the leaf mulch, or buried in the sand.

❖ **Enclosure furnishing**

- Furnishing should firstly provide the animals with their basic needs as well a enabling them to display natural behaviours.
- Nest boxes should be provided to provide shelter and breeding at different heights. The height of the breeding box should be 3 ft and the circumference should be 6.5 ft. During the non breeding period dry leaves and twigs should be provided. CCTV camera should be installed inside nesting box.

- Resting platforms at different heights should also be provided throughout the enclosure allowing the animals to climb and utilize all the space that the enclosure has to offer.
- Complicated aerial walk ways interconnected to the platforms at different heights.
- Edible grasses and plants species to be planted that can act as an alternative source of feed.
- Visual barriers should be provided- by planting bamboos.

❖ **Night Quarters**

- Internal measurement should not be less than 2.1m X 2.10 m with a ceiling height of 1.67m (5.5 ft).
- The night shelter should be connected to the main display by vertical or horizontal sliding doors operating from the keeper's area.
- Artificial lightening is not required as the animals should not be housed in the night shelter for a longer period of time.
- Lightning to be required only during routine health check up and other purposes. Humidity to be maintained at appropriate levels for the species.
- Rodent proofing is required.

Fig. 25. CCTV Camera inside Night Shelter

Fig. 26: CCTV Camera inside Enclosure

Fig. 27: CCTV Monitor inside Conservation Breeding Centre

5.2 General Husbandry: Routine observation and routine data collection

- Each individual animal should be observed for any changes or problems daily twice a day. If any notable events have been observed these should then be recorded.
- Recording of data should be a routine in the workplace and a timetable to be set for observations and data collection.
- Records to be collected from the field concerning health problems, veterinary procedures, treatments administered growth and development, breeding, feed and feeding patterns and other aspects of husbandry.

5.3 Hygiene and Cleaning

Good hygiene is an important part of maintaining healthy animals (this does not mean maintaining a sterile, barren environment). In order for adequate hygiene and welfare standards following are the measures.

- Considerations should be given to ease of cleaning when designing enclosures.
- Cleaning of the night shelters should include dry cleaning to physically removing waste matter, followed by wet cleaning, involving soaking, washing, rinsing and drying.

N.B. leaving surfaces wet may allow bacteria to multiply to levels higher than they were before the cleaning started.

- Faecal deposits and uneaten food must be removed daily.
- Water troughs and feeding trays need to be cleaned daily.
- Water sources, including storage facilities and distribution channels, need to be checked periodically.
- Enclosure cleanliness, provision and routine use of hand washing and foot-dipping facilities to reduce the transmission of infectious agents from one area or enclosure to another.
- Equipments (e.g. brooms, wheel barrows, etc) should be used in a single enclosure/block of enclosures, or to be cleaned and disinfected before being moved to another area.
- Zoo keepers should be given training so that they can understand the importance of basic hygiene measures in preventing disease transmission.
- Disinfecting agents to be used- Phenyl, Common salt (NaCl), lime powder, Bleaching powder, tincture iodine, formalin, Potassium permanganate (KMno4), Copper sulphate (CuSo4), Khrosolin (Virbac).

Fig. 28

Fig. 29

Fig. 28-29: Preventive measures taken for Red Panda at PNHZ Park

5.4 Record Keeping

- Maintenance of keeper's diary with information on animal's behaviour, feed, enrichment, health etc.
- Feed chart to be maintained regularly about the animal's feed, type of feed, feed timings and feed rejection (quantity).
- Separate register's to be maintained for recording temperature, humidity and amount of water obtained from the dehumidifier.
- History sheets of individual animal to be maintained with information's on health problems, veterinary procedures, treatments administered growth and development, feeding patterns among many more aspects of animal husbandry.
- Records also to be maintained in ISIS/ZIMS.

Fig. 30 : Red Pandas of Darjeeling Zoo.

Chapter 6: Health Requirement

6.1 Known Health Issues

In Indian Zoos captive Red Pandas are usually free from any diseases except for parasitic infection at times. Red Panda are also prone to Canine Distemper, Canine Parvo Virus, Infectious Canine Hepatitis and Heart worm but so far there are no records of occurrence of such diseases.

Red Panda are uncomfortable in hot weather and deaths have occurred.

Infant mortality is high at the age less than one year due to ill nursing, parasitic load.

6.2 Daily health checkups

- Each individual animal should be checked first thing in the morning and then checked again thoroughly while contained in the off limit area.
- A general assessment of their movements, feeding habits and general demeanor can take place while they are off display and then another assessment should take place once out on display to confirm they are in good health.
- Individuals which appear to be "not quite right" should be observed carefully but unobtrusively: an animal which knows it is being watched will try to appear "normal", as a defense against predators. If in doubt, the identity of the individual should be noted to ensure that individual is specifically checked later that day or on the following morning. **NOTE**: The regular caretaker of the animal is more likely to spot subtle behavioural signs indicating that an animal is "not right" than is the veterinarian, since the veterinarian is perceived as more of a threat, therefore animals will try to hide "signs of illness".
- Several observations throughout the day will provide information pertaining to the health of the animal and provide staff with an opportunity to monitor the animal at active and rest periods for an overall assessment.
- Unexplained loss of weight should be investigated even if the animal appears otherwise normal.

6.3 Routine treatment:

- Regular TB testing (yearly).
- Blood iron levels tested for haematochromatosis.
- Blood sugar level for obesity.

Regular faecal floats for worm egg floats:

- *Toxocara sp, Ascaris sp, Echinococcus sp, Trichomonas sp., Schistosoma sp* are the most common parasite found in captive Red Panda.
- Faecal examination includes a direct smear, flotation and sedimentation method.
- Examination of faeces for an adult parasite, parasitic egg or ova should be done on a regular basis and when positive deworming should be taken up.
- Parasite detection and control should begin before animals enter the collection, i.e. during quarantine, to prevent contamination of the enclosure and population.
- The required frequency of testing should depend on the species and the past history of parasite types and levels of infection. **NOTE:** regular faecal worm egg counts shall also be useful to detect any development of resistance to anthelmentic.
- Records should be kept of the results of systematic faecal examination and of anthelmentic treatments given.
- Checking microchips and locations (as they can move over time).

6.4 Some of the important factors to be considered during Restraint

- Thorough knowledge about the species to be handled, including its behaviour, reaction to stress, ability to defend, and the appropriate physical and chemical restraint procedures;
- The equipment and facilities needed-everything should be checked and made ready before the animal is captured.
- The restraint procedures to be adopted. Need to know whether physical restraint or chemical restraint is required for that particular animal.
- Best time to undertake the procedure (morning or late afternoon).
- To monitor the recovery conditions.

6.5 Restraint should be done during the following situations

- Shifting of animals from one housing facility to another.
- Treatment of disease or illness, regular vaccinations, etc. Unscheduled treatment, such as for injury etc.
- Animal escape.

6.6 Pre-anaesthesia considerations

Environmental considerations

- Anaesthesia in Red Pandas should not be prolonged.
- The animal should be moved to a safe, quiet, well-controlled situation such as indoor den with good lightning and ventilation, to allow a quiet induction and recovery.
- Immobilizations should be planned to occur during the coolest part of the day if done in a region or time of year where the ambient temperatures are high and the procedure must be done outside in an uncontrolled environment. If high temperatures are expected, ample cool water should be on hand to help to prevent or manage hyperthermia.
- Supplemental oxygen always should be provided, regardless of anaesthetic used (Fowler & Miller 2003).
- Most of the drugs used for carnivore immobilization may be administered intra muscularly.
- A portable pulse oximeter is invaluable for monitoring respiratory efficiency.
- Body temperature.

6.7 Sites for Darting intra muscular injections

- For intramuscular injections it is important to be aware of the animals anatomy.
- Give xylazine and ketamine by intramuscular injection, mixed together in one syringethrough dart syringe.
- A needle length of at least 35 mm is required.
- A preferred site is the triceps muscle area of the forelimb, femoral thigh muscle, neck muscle and shoulder muscle are most preferred.

- Hand-injection can be used for additional doses in recumbent individuals.

6.8 During Induction

- Once the animal is immobilized make sure that the body is positioned correctly to insure that nothing interferes with respiration. Make sure the nose and mouth are clear, and the neck is straight. Keep the animal on a flat surface; this prevents occlusion of the trachea, pressure neuropathy, or circulation impairment.
- The animal should be left undisturbed during induction but monitored: Keep light noise and movement around the animal to a minimum during induction.
- If the initial anaesthetic dose fails to adequately immobilize the animal, a top-up dose is required. It is suggested that if the animal is able to sit up or move substantially, a second dose should be administered.
- Assess the depth of anaesthesia before entering the enclosure.

6.9 Anaesthetic Monitoring and Support

- Monitor body temperature, respiratory rate (depth and regularity), heart rate, blood pressure and eye reflexes.
- Monitor rectal temperature.
- Cover the eyes once the bear is unresponsive to tactile and auditory stimuli. A blindfold reduces visual stimulation and helps to protect the eyes.
- Monitor the depth of anesthesia; do not approach the animal if it is showing signs of very light anesthesia- head-lifting or limb movement.
- Give fluids: During prolonged surgical procedures, fluid should be given intravenously.

6.10 During Recovery

- The animal should be left undisturbed in a cool, dimly lit area in which it can be kept under observation.
- The animal's mouth and airways must be clear and its respiration monitored.
- The animal should have no access to food, water or other animals, until it is fully recovered.

6.11 Behavioural aspects

- Know your animal well.
- Cubs can be carried or lifted by grasping the loose skin at the back of the neck; this stimulates the way in which the mother carries her young and the cubs will just curl up.

6.12 Chemical Restraint

- All chemical sedatives are potentially dangerous; the chemical used in restraint should be used in moderation.
- Chemical restraint drugs should only be administered by qualified veterinarians.

Table 3: Anaesthetic Dosages

Anaesthetic agent	Dosage (mg/kg)
Ketamine	5-10 mg/kg body weight
Xylazine	0.2-0.4 mg/kg body weight

Reverzine- 0.25mg/kg for neutralization of both above anaesthetic drugs (1 ml/40 kg body weight)

6.13 Anaesthetic Cries

- Respiratory problem if any, terminate the immobilizing procedure, administer appropriate antagonistic.
- Oxygen to be provided.
- Dexamethasone to be used in case there is rapid fall in the respiratory rate of the animal.

6.14. Post Mortem Report of Red Panda in P.N.H.Z Park

Necropsy (Post-mortem examination) is an excellent diagonastic tool that should be performed on all zoo collection animals. When it becomes necessary to euthanize any animal the method of euthanasia should cause the least amount of artifactual changes in

the tissues and leaves the animal as intact as possible. The course of a disease can be better understood if necropsy is performed when animals die unexpectedly. In addition, the knowledge gained from a necropsy can be applied to future circumstances involving similar conditions or disease processes (Pratt, 1998).

Histopathological examination of tissues is mandatory and should be done in a timely manner to make those finding relevant to the health care of the collection. Concurrent cultures may be indicated for bacteria, fungi and viruses. Appropriate tissues not formalin fixed may be frozen for viral, toxology and genetic studies. Besides determining the cause of death, a complete post-mortem examination allows review of anatomical structure, assessment of nutritional status and parasitic load of the animal. (Rai, 2014)

Case Report

Padmaja Naidu Himalayan Zoological Park has well established Veterinary Hospital with all the basic facilities. Laboratory post mortem facilities with separate room are available with adequate water supply and draining floor. Equipments like Weighing scale, measuring devices, suitable dissection instruments (a curved knife for skinning, a straight pointed knife for dissection, a pair each of 25 cm rat toothed forceps, 15 cm pointed forceps, 15 cm dissecting scissors, sterile scalpel and blades etc), knifes, lamp, matches, sterile syringes and needles, sterile swab with transport media, microscope, clean slides and coverslips, stain kits for cytological, bacteriological and fungal examinations etc. are present in the park. During the PM it was found that most of the Red Panda died due to Respiratory failure due to old age, Broncho-pneumonia, cardiovascular arrest, Ill nursing, Nephrities and subsequent old age, Chronic pneumonia and liver cirrhosis etc.

Fig. 31

Fig. 32

Fig. 33

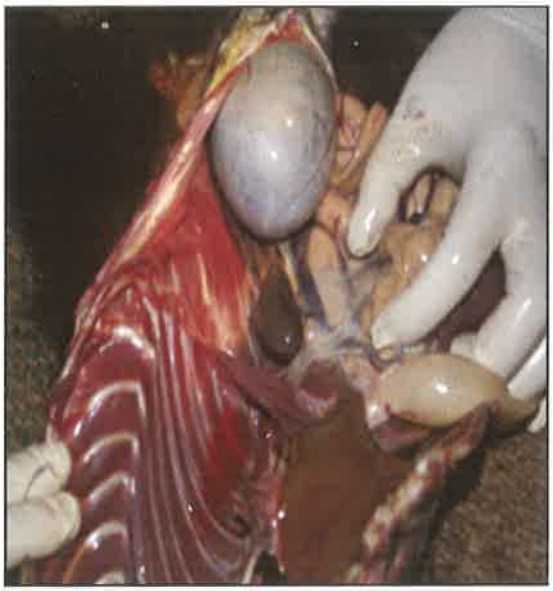

Fig. 34

Fig. 31-34: Post Mortem of Red Panda in P.N.H.Z. Park

Chapter 7: Captive Diet Requirement

Proper Feeding management of wild animals in captivity incorporates both husbandry skills and applied nutritional sciences. As a basic foundation of animal management nutrition is integral to longevity, disease prevention, growth and reproduction.

7.1 Feed and feed presentation

- One piece of egg, one piece of banana, 200 gm of apple, 20 ml of honey, 200ml of milk, 4 kg of fresh bamboo and 1000ml of water should be provided to animal every day.
- The feed items should be regularly changed to avoid monotony and at different circumstances such as during breeding and sickness.
- Feed to be provided at different times of the day.
- Feeding method to be changed at times such as the feed can be hung or hidden in the enclosure. Cut feed items can be replaced by whole feed.

7.2 Water

- Filtered water to be provided to the animal both in the enclosure and off exhibit area.
- During winter water to be boiled and made luke warm.
- Record of water consumption to be maintained in a prepared sheet to know the quantity of intake in various seasons.

7.3 Supplements

- Supplements to be provided for seven days every month and the supplements are cod liver oil 1 cap daily, calcium 2 tabs daily, revital 1 cap daily, astymin- 1 cap daily, evion 400 1 cap daily, Liv-52 2 caps daily for seven days.

7.4 Record keeping of feed and feeding

- Preparation of Diet chat consisting of species, home id, age and sex, date of birth, date, time , diet given, total feed consumed, remarks (whether consumed or any items left over).
- Entry of the feed item as prescribed in the format to be recorded.
- Submission of diet chart to the animal supervisor at the end of every month duly signed by respected keeper.

7.5 Feeding errors

Overfeeding can lead to obesity. Excessive body weight can increase the risk of liver and heart disease including respiratory problems and constipation. Over weight individuals are not feet for breeding.

7.6 Staff training and safety precautions

- Personal hygiene and the use of clean surfaces when preparing food are paramount when preparing food for the animals.
- All staff working with carnivores should be vaccinated against Q fever, with a vaccine that was developed in Australia. Q Fever is a zoonotic disease resulting from infection with a species of bacteria, *Coxiella burnetii,* whose primary reservoir is found in placental material, birth fluids, milk, urine and faeces of infected sheep, cattle and goats. It is transmissible to humans by the inhalation of organisms through air born particles.
- Provision must be made for disposal of food wastes to minimize their attractiveness to vermin as well as production of odours and disease hazards.

7.7. Central Zoo Authority, New Delhi and Indian Veterinary Research Institute suggested guidelines for Red Panda feeding

SSP guidelines for feeding of Red Panda are followed worldwide. For the benefit of the readers the guidelines is reproduced,

1. SSP recommendation is mostly followed in Western Zoos, where, bamboos are not readily available. In this regards, both our zoos keeping Red Pandas are located in areas where bamboo is readily available. Nevertheless, we do use produces and concentrates. Moreover, the basic principle of SSP guidelines may be followed.
2. Feeding of milk is not recommended under normal circumstances. Milk/sweetened gruel could be used for younger animals who refuse to take their normal diet. Milk/gruel can be used for medication.
3. All ingredients should be fresh. Spoilage of food should be avoided. Feeds should be inaccessible to vermin. Feeding inside the feeding cubicle is appreciated. They should be provided at least 2 meals. Old food may be removed before offering fresh food.

4. Food consumption should be monitored closely. Wild panda weight 4.3 kg but in most of the captive facilities they weigh much higher. Red Panda require more energy during winter and lactation. The feed left over should be at least 5% for those categories of animals.
5. When animals are housed in pair or in group several feeding stations should be provided in the feeding cubicles to avoid over/underfeeding.
6. Use of fruits and produces should be restricted. They can be used for medication.
7. Drinking water should be always available. When water is deprived food intake will also decrease.
8. Young Red Pandas at the time of weaning, at 5-7 months of age are susceptible to death due to starvation. Such cubs could be fed with sweetened gruel/milk.

Fig. 35

Fig. 36

Fig. 35-36: Red Panda's feed

Chapter 8: Red Panda Trapping and Transporting Techniques

8.1 Importance of Red Panda capture from the wild

The Red Panda needs to be captured from the wild to establish a founder population for a captive breeding programme and later to maintain a genetic variability in the established stock.

8.2 Methods of trapping

Red Panda can be safely captured using a net.

Fig. 37: Red Panda handling

8.3 Legal considerations and requirements for Red Panda capture

The Red Panda (*Ailurus fulgens*) have been listed under the Schedule I of Wildlife (Protection) Act, 1972. Under the rules of this Act, nobody can, catch, keep or transport the species without permission from the competent authority, Chief Wildlife Warden of the State. It is a non- bail able offence under the Wildlife (Protection) Act, 1972 to catch, keep or kill an animal listed in this Schedule. Animals listed under this Act remain the property of the Govt of India and nobody can own them.

❖ **The following documents of approval will be required from competent authorities prior to capturing a Red Panda.**

- Permission from Chief Wildlife Warden for capturing the Red Panda.

- Intimation and involvement of the local forest officers during the capture of the Red Panda.
- Intimation to and approval from Central Zoo Authority for keeping Red Panda in captivity.
- Considerations: The Central Zoo Authority and IUCN guidelines for transportation are taken into consideration. Following are the findings that includes the crate size, veterinary care and feeding during transportation.

8.4 Legal requirements for transportation of Red Panda:

For export and import following methodology is involved

- The Zoos involved are to agree for exchange.
- Opinion and consent of International Stud Book keeper is taken to enter into exchange proposal.
- Next step is to take permission from CZA, who shall also intimate the Ministry of Environment of Forest and Director General of Foreign Trade as to exchange taking place.
- The MoEF gives their permission and asks the Regional CITES officer to issue CITES permit.
- The Director General of Foreign Trade has a committee, consisting of CZA and Animal Quarantine Authority. The DGFT gives permission to import /export the animal and concurrently Animal Quarantine Advisory is issued.
- The Condition laid down by DGFT and Animal Quarantine Authority is sent for compliance to Donor Zoo for strict compliance.
- Dates of exchange is fixed as per terms and conditions mutually agreed.
- The animals after reaching is kept in Quarantine for observation, usually for 30 days, as per condition laid by Animal Quarantine Authority Govt of India, in one of the Quarantine centres under their control or as advised.

The Central Zoo Authority and IUCN guidelines, IATA guideline for transportation are taken into consideration, during such exchanges. Following are the findings that includes the crate size, veterinary care and feeding during transportation.

8.5 Species specific consideration

- Preferably only one animal should be transported in each crate/container. When more than one animal have to be transported in a crate, it is preferable to have animals from the same enclosure or those that have lived together.
- Male need to be transported separately in individual crate.

Table 4: The specifications of the transportation cage regularly used by PNHZ Park is as follows

Species	Length (cm)	Width (cm)	Height (cm)
Red Panda	2. 6 feet	1.8 feet	1.10 feet

❖ **Material to be used for cage design:**

Transportation cages are made up of ply wood with netted ventilator on both the side.

Fig. 38 **Fig. 39**

Fig. 38-39: Transportation Cage

❖ **Veterinary Consideration:**

- A valid health certificate by a qualified veterinary surgeon to the effect that the animal is in a fit condition to travel by a rail, road, inland waterway, sea or air and are not showing any sign of infectious or contagious disease including rabies, shall accompany each consignment and the certificate shall be in the form specified.

- The undersigned official veterinarian should certify that the animals described above and examined on the day shows no clinical signs of diseases including Rabies, distemper, influenza and other contagious as well as infectious diseases.
- During transportation by air: (a) The cages shall be properly cleaned and disinfected before the animals are put in the cages. (b) Sufficient paddy straw or saw dust or paper cuttings shall be provided in the cages as resting material.
- For international transport, the animals shall be kept in pressurized compartment with regulated temperature.

❖ **Equipments required**

- Sirens and dart.
- Injection Ketamine.
- Injection Xylazine.
- Injection Reverzine.

8.6 Modes of transport

Selection of the mode of transport depends on the length /duration of the journey. While transporting a Red Panda, prime importance should be given to its safety, ensuring that the animal is transported as quickly as possible. Two modes of transport are available.

- **Road transport**

Suitable for short distances.

The vehicle must be air conditioned.

- **Air transport**

Fastest and ideal for long distance travel.

Can be transported unattended.

Transport by road from the airport to the airport quarantine facility.

8.7 Feed and behaviour monitoring

- The animal during transportation should be ensured with proper feed at regular intervals.
- Behaviour of the animals to be monitored.
- The animal to be provided continuously with ORS.
- Stoppages to be made during the journey for the animal to rest and sleep.

8.8 Quarantine requirement

Proper quarantine of newly arrived animals is an essential part of a preventative medicine program. Although the animal may have been considered free of transmissible diseases at the previous facility, it may have been exposed during transport. Alternatively if a disease is slowly progressive (such as tuberculosis) or subclinical (such as the early stages of many parasitic diseases), the facility shipping the animals may not realize a health problem exists.

- The new animals should be housed in separate quarters from those of the resident animals for a predetermined length of time. While this length of time depends on several factors, the usual length is for 30 days for transport within state, 45 days for transport interstate and up to 6 months for transport between countries.
- The new animals should be cared for by keepers who have no contact with the resident animals, and the air and waste disposal systems should be isolated from resident animal systems. However these stringent requirements are not always feasible.
- Cleaning and feeding of the new animal should be done after the resident group's to avoid carrying material back and forth, and with separate tools assigned for use only with the new animal.
- A disinfectant footbath, in conjunction with coveralls and rubber boots will also minimize transfer through dust and manure.

8.9 Health check in Quarantine

- Periodic check up to assess the health status of the animal to ensure that it is not suffering from any infectious diseases.
- Blood for hematology should be taken.

- Treatment to be commenced immediately if an animal is found to be sick during the quarantine period.
- It should also be noted that quarantine may not be the best time for vaccinations. This is because the efficacy of a vaccine depends on the animal's immune competence. The most beneficial response to the vaccine develops in a healthy animal under minimal stress. Transport to a new facility and the subsequent period can be stressful; therefore, necessary vaccines should be administered at least weeks before shipment, or two to four weeks after.
- Regular stool test for any parasitic infection.

8.10 Release of the animal into the enclosure

Animal to be released in the enclosure after 30 days of its quarantine.

Fig. 40, Release of animal into the enclosure.

Chapter 9: DNA profiling of Captive Red Panda at PNHZP, Darjeeling

Blood and faecal samples of all the captive individuals were sent to Center for Cellular and Molecular Biology at Laboratory for the Conservation of Endangered Species, Hyderabad for species identification and for genetic variability in the captive stock.

9.1 Description of Samples Analysed

Table 5: Sample Analysed

Sl. No	Zoo Name	Sample
1	Ram	Blood
2	Durga	Blood
3	Sakya	Blood
4	Shainee	Blood
5	Janaki	Blood
6	Sheetal	Blood
7	Sahadev	Blood
8	Shaan	Faecal Sample
9	Rigsel	Faecal Sample
10	Rahul	Faecal Sample
11	Siddharth	Faecal Sample

Additionally we also analyzed two faecal samples labeled PNZP4a and PNZP4b from enclosure 4 which houses Samridhi and Kaijalee.

9.2 Methodology

Genomic DNA was isolated from above mentioned blood samples by phenol-chloroform extraction method and from fecal samples with Qiagen stool kits. These samples were amplified at nine microsatellite loci and analyzed with Genemapper 3.1. The genetic status of each individual was accessed in terms of its being homozygous/ heterozygous at each locus and results are given in next page.

Fig. 41 Red Panda and its cub.

Fig. 42, Red Panda and its cub.

Table 6: MICROSATELLITE-BASED GENOTYPES OF RED PANDA SAMPLES FROM PNHZP, DARJEELING

Animal id	L1a	L1b	L2a	L2b	L3a	L3b	L4a	L4b	L5a	L5b	L6a	L6b	L7a	L7b	L8a	L8b	L9a	L9b
Ram	**128**	**142**	**241**	**249**	**212**	**228**	**236**	**244**	**196**	**200**	**114**	**130**	232	232	200	200	**155**	**157**
Durga	**132**	**136**			236	236	**236**	**248**	**200**	**208**	**114**	**126**	**228**	**236**			155	155
Sakya	136	136	**233**	**249**	**212**	**228**	**236**	**240**	**196**	**204**	**114**	**122**	**228**	**232**			155	155
Shainee			233	233	**228**	**236**	236	236	**196**	**204**			**228**	**232**	**196**	**208**	155	155
Janaki			**233**	**241**	**228**	**236**	**236**	**244**	**200**	**204**	**114**	**130**	232	232	**196**	**202**	**155**	**157**
Sheetal	**136**	**142**	**233**	**249**	**212**	**236**	**232**	**236**	**196**	**204**					**196**	**208**	155	155
Sahdev	136	136	**249**	**253**			**236**	**240**	**192**	**196**	**122**	**130**	**208**	**232**	208	208	**155**	**155**
Shaan	142	142			**212**	**228**	**240**	**244**	200	200	**114**	**130**			**200**	**202**	157	157
Rigsel	**136**	**142**	**237**	**261**	**212**	**228**	**236**	**240**	**196**	**200**	**114**	**122**	**224**	**236**	**200**	**202**	155	155
Rahul			**253**	**261**	**212**	**228**			200	200	**114**	**122**	**232**	**236**	200	200	155	155
Siddharth			**233**	**241**					**188**	**192**	**134**	**158**					155	155
PNZP4a	120	120	**233**	**249**	228	228			**196**	**200**			**228**	**236**				
PNZP4b	120	120			228	228			**180**	**192**			**232**	**236**	202	202		

Table 7: MEASURES OF GENETIC VARIATION AT STUDIED MICROSATELLITE LOCI IN CAPTIVE RED PANDA

Locus	Sample size	Observed number of alleles	Effective number of alleles*	Shannon's information index[!]	Observed heterozygosity	Expected[a] heterozygosity	Nei's heterozygosity	Heterozygote deficiency[b]
L1	9	5	3.5217	1.3785	0.4444	0.7582	0.716	–0.4139
L2	12	7	4.8	1.7235	0.9167	0.8261	0.7917	0.7582
L3	12	3	2.6667	1.0397	0.75	0.6522	0.625	0.8261
L4	12	5	2.4828	1.166	0.75	0.6232	0.5972	0.6522
L5	16	8	4.3761	1.7104	0.8125	0.7964	0.7715	0.6232
L6	11	7	4.4815	1.6682	0.9091	0.8139	0.7769	0.7964
L7	11	5	2.9512	1.2743	0.7273	0.6926	0.6612	0.8139
L8	11	4	3.9032	1.373	0.5455	0.7792	0.7438	0.6926
L9	14	3	1.7818	0.7589	0.1429	0.455	0.4388	0.7792
Mean	12	5.2222	3.4406	1.3436	0.6665	0.7107	0.6802	0.455
St. Dev		1.7873	1.0329	0.3273	0.2496	0.1199	0.114	0.7107

*Effective number of alleles (Kimura and Crow, 1964)
[!]Shannon's Information index (Lewontin, 1972)
[#]PIC (Polymorphic Information Content)
[a]Expected heterozygosities were computed using Levene (1949) and Nei's (1973) expected heterozygosity
[b]Heterozygote deficiencies were expressed as D= (Ho He)/He

9.3 Results of the examination

All samples listed in the table, except Siddharth, PNZP4a, PNZP4b, could be genotyped at seven or more loci out of nine loci. All animals exhibit good genetic variability and the overall observed heterozygosity of the captive population is 0.67. All animals are homozygous at only three or lesser number of loci. Shainee (3/7), Sahdev (3/8), Shaan (3/7) and Rahul (3/7) are the only animals found to be homozygous at three loci.

9.4 Conclusions

Following genetic analysis of blood and faecal samples, we observe that captive Red Panda at PNHZP, Darjeeling are genetically vibrant and can be used selectively for conservation breeding.

Fig. 43, Red Panda

Chapter 10: Reintroduction

"Re-introduction": an attempt to establish a species in an area which was once part of its historical range, but from which it has been extirpated or become extinct. The principle aim of any re-introduction should be to establish a viable, free ranging population in the wild, of a species, subspecies or race, which has become globally or locally extinct, or extirpated, in the wild. It should be reintroduced within the species' former natural habitat and range and should require minimal long-term management. (Re-introduction Specialist Group of the IUCN's Species Survival Commission)

10.1 Pre-Release Activities

i. Background research

- An assessment should be made of the taxonomic status of the individual to be reintroduced.
- Status and biology of the wild population should be studied.
- Habitat preference, intra specific variation and adaptation to local ecological condition, social behaviour, group composition, home range size, shelter and food requirement, foraging and feeding behaviour, predator and diseases should be studied.
- A Population and Habitat Viability Analysis are required.

ii. Selection of Release Site

- Selection site should be with the range of the species.
- The re-introduction area should have assured, long term protection.
- Availability of suitable habitat: reintroduction should only take place where the habitat and landscape requirement of the species are satisfied.
- The area should have sufficient carrying capacity to sustain growth of reintroduced population and support a viable population in long run.
- Identification and elimination, or reduction to a sufficient level of previous causes of decline.

iii. Available of suitable release stock

- The source population should ideally be closely related genetically to original native stock and show similar ecological characteristics (morphology, physiology, behaviour, habitat preference) to the original sub-population.

- Removal of individual for reintroduction must not affect the captive population.
- Individual should be in healthy condition.

iv. **Legal Requirement**

- Re-introduction must take place with the full permission and involvement of all relevant government agencies of the recipient or host country.

10.2 Post Release Activities

- Post release monitoring is required of all (or sample of) individuals.
- Demographic, ecological and behavioural studies of released stock must be under taken.
- Habitat restoration.
- Regular publication in scientific and popular literature.
- Collection and investigation of mortality.

10.3 Case study

Reintroduction of Captive-Breed Red Panda in Singalila National Park:

By 2003, the Indian Zoo population of Red Panda had increased substantially and there were 22 Red Pandas living in the PNHZ Park in Darjeeling. The population was therefore considered to be well enough established to be able to take the next step in the programme, namely to release two zoo-born red pandas back into the wild.

Communication

- Communication for permission for release of captive born Red Panda in Singalila National Park was made with Principal Chief Conservator of Forest (Wildlife & Biodiversity) & Chief Wildlife Warden, West Bengal vide letter No. 843/TECH/PRCM/OTHER/PNHZP dated 5-10-2001.
- Permission was received from PCCF (Wildlife & Biodiversity) & Chief Wildlife Warden, West Bengal for release of Red Panda vide letter no. 5778/WL/2W-117/2K/PART II dated 5-10-01.

- XXVIII Governing Body Meeting of the Padmaja Naidu Himalayan Zoological Park Society held on 22-2-2002 at Chief Minister's Conference Room at Writer's Building, Kolkata approved the release of two pairs of Zoo bred Red Panda in Singalila National Park.
- Memorandum of understanding was signed between Central Zoo Authority and Padmaja Naidu Himalayan Zoological Park, Darjeeling on 22nd of March 2002. CZA approved creation of intermediate release facility for Red Panda in Singalila National Park for adapting the animal prior to its eventual release in the area.
- Communication from Member Secretary to PCCF, Government of West Bengal for Training of personnel and to deputes Dr. B.R. Sharma, Director, Padmaja Naidu Himalayan Zoological Park, to Jersey for about fortnight to get some experience for release operation vide letter no. 19-20/92-CZA (325).
- Communication was made with Angela Glatston, International Studbook Keeper of Red Panda vide letter no. 261/TECH/PRCM/PANDA/PNHZP dated 25/4/2002.
- Communication with Member Secretary, Central Zoo Authority was made for the Assessment of Taxonomic Status and Genetic Variability of Captive animals in the Zoological Park, Darjeeling vide letter no. 413/GENL/CZA/PNHZP dated 8-07-2002.
- Communication with the Director, Centre for Cellular and Molecular Biology, Hyderabad was made for the genetic analysis of Captive Red Panda vide letter no. 725/6ENL/CZA/PNHZP dated 29-10-2002.
- Communication with Anna Kabatay, Telemetry Systems Coordinator through email dated 11th July 2003 for Radio Telemetry equipments.
- Communication with DFO, Wildlife Division I, Darjeeling for the Construction of Intermediary release for Red Panda at Gairibans in the Singalila National Park, Darjeeling vide letter no. 402/TECH/PROJECT/R-PANDA/PNHZP dated 10-4-2003.

Selection of Animal and acclimatization of the animals

- Two young females, Sweety (Born 25 June 1997) and Mini (Born 17 June1998), were selected for release as it was felt that females would be more likely to contribute to the wild population through giving birth.
- After their selection, the acclimatization process began; their diet was slowly changed from the zoo diet which includes milk, sugar, fruit and eggs provided at regular intervals

to a more natural diet based largely on bamboo which was provided at more irregular intervals. This change in their diet took about 6 months and meant that, when the animals arrived at the release facility, they were ready for total dependence on a natural diet of wild fruits, bamboos and berries.

- In the meanwhile, during this acclimatization process, the required health checks of the two females were undertaken so that the necessary clearances from the Government of India and Central Zoo Authority could be obtained. In addition, genetic studies were undertaken by the Centre for Cellular and Molecular Biology, Hyderabad, India to confirm the taxonomic status of the Red Pandas and to record their genetic fingerprints.

Selection of Gairibas for release.

- The choice of Gairibas as the release site was based on an earliest pre-release survey conducted by the Wildlife Wing of the Forest Department, Government of West Bengal, in collaboration with the staff of the PNHZ Park.
- It was the area with the highest density of the red pandas in the region. This was deemed to be important factor as it increased the likelihood that the two female would find mates.
- Moreover, the forest there had a dense vegetation of maling bamboo (*Arundinaria maling*), the red panda's preferred diet, adequate water.
- In addition, the location of an office of the Forestry Service in the vicinity and the presence of very small villages were also important factors in the decision as they were considered to provide both accessibility and thus constant monitoring.

Soft Release facilities in Gairibas

- The soft release had an area of 5 hectares and was situated at 27°03'N and 88°01' E, at an altitude of 2626 m.
- The flora of this area comprised *Castanopsis hystrix, Quercus lamellate, Machilus odoritissima, Michelia sp, Rhododendrons, Euria sp, Arundinaria maling, Rubus sp, Daphne cannabina.*
- The females were first transferred to a special soft release facility that had been constructed in the Gairibas area of the Singalila National Park.

- Sufficient care was taken to watch and protect this facility against predators.
- Straight iron sheets surrounded the areas, and the shrubs and trees near the parameters fence were removed to prevent any accidental escape by one of the animals.
- The two females were brought to the facility in mid-April. During the first month they were housed in a small enclosure ($10m^2$) situated within the soft release facility and then gradually released into the whole area.
- The animals were kept in the facility for a period of 7 months where they were observed and acclimatized prior to their final release on 14th November 2003.
- By the time of release the animals were completely dependent on the natural food available in the enclosure.

Fig. 44: Red Panda

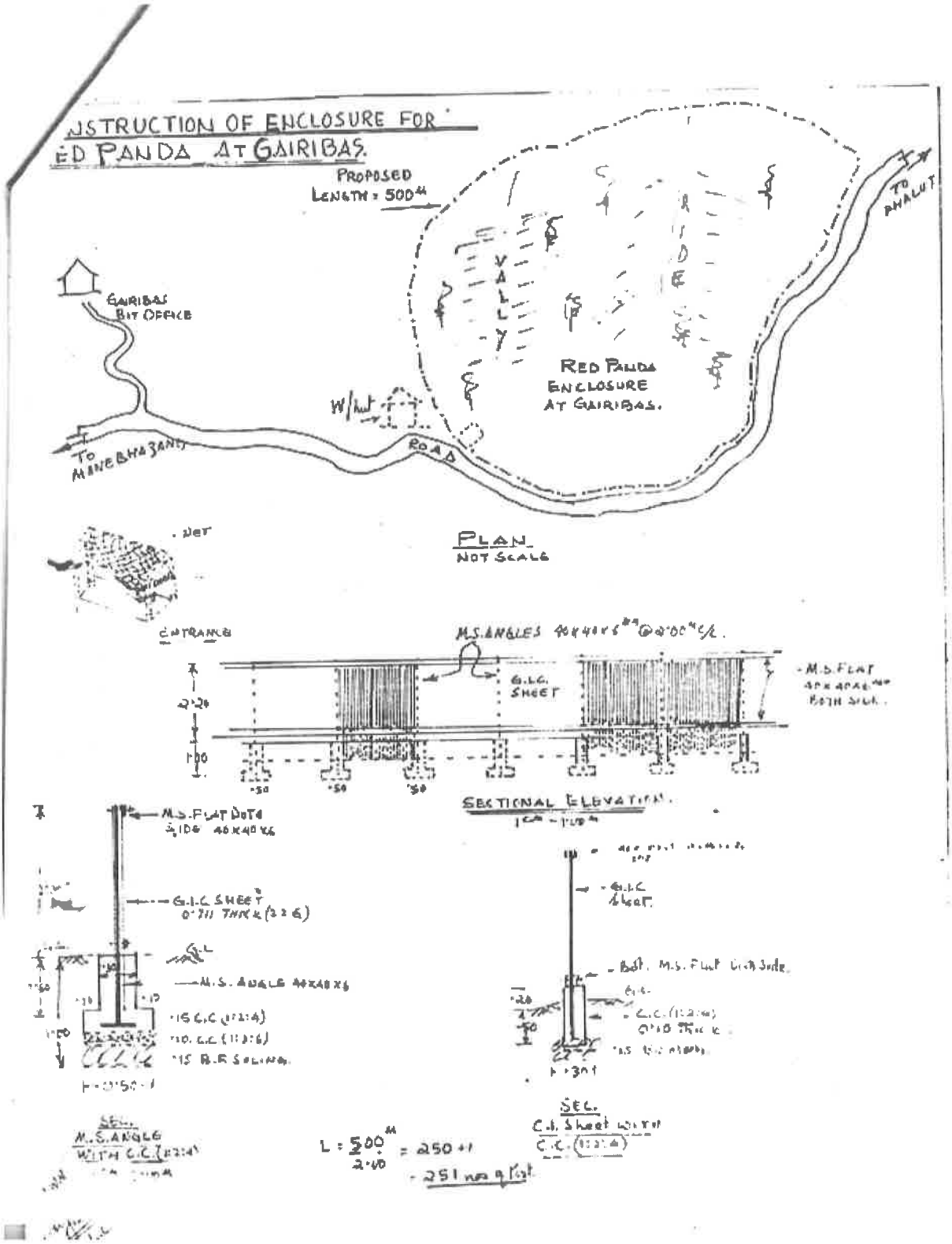

Fig. 45: Layout map of soft release facility in Gairibas

Methodology

- The release of the red panda into the Singalila National Park confirmed to the reintroduction following Guidelines of IUCN SSC Reintroduction Specialist group 1998.
- The panda were monitored using the non-triangulation location techniques known as "Homing in-on the Animal Method".

Red Panda Radio-tracking Used during the release

The transmitter used in this project weighted approximately 95 g which was considered as an acceptable weight for an animal of the size of a red panda (correspondence with Telenoics). Indeed, during the project, the animals gave no indication that they were hindered in any way by the radio collars. This was further confirmed by Sweety's survival and the successful reproduction.

Transmitter

MOD 205, Mortality Motion Sensor S6A, 75 BPM active BPM inactive, TA -5LT Antenna, CB2-Break- away collar, CMM 9-14 inch neck, Cast- 1 with antenna existing out end of collar, brown colour, 150-152 MHz. Quality of transmitters and CC1(2 black & 2 red).

Receiver

TR-5 (KIT) with RC7, Option 020RP-210, with a standard alkaline battery pack (comes with all TR-5 Receivers) and an additional optimal rechargeable battery pack and its charge cord (PS-006475 with RP-2-220 AC Power Cord).

Headphones

RH-1 Headphones.

Receiving Antenna

150-152 MHz, RA 14.

With Coaxial cables.

Final Release and Monitoring

Prior to release each female was fitted with a radio collar (Telenoics, USA).

- After release the Red Panda were monitored using the non-triangulation location techniques known as "Homing in-on the Animal Method". The method is simple and the positional data are obtained by the following the transmitted signal's increasing strength until the radio-collared animal is seen.
- The Wildlife Wing of the Forest Department of Government of West Bengal monitored the females on alternate days. This method provided a good overview of the movements of the released Red Pandas as well as information on their behaviour, breeding and eventual death.
- The two females behaved quite differently, one female, Mini, remained close to the release site and settled in an area referred to here as the Middle Area (Average altitude 2800m) which lay between PWD road and the Nepal Border. Although she did explore the adjacent areas (Pulkhola and Plantation area) in the weeks following her release, however, she spends 80% of her time in the Middle Area.
- Sweety, on the other hand, was considerably more mobile than Mini.
- Mini also started interacting with the wild pandas much earlier than did Sweety.
- The first wild panda sighted in her area was on 18th November, just 4 days after the release.
- She was sighted again with wild pandas in the middle area on 4th December 2003 and then on December 13, 21 and 31. The sightings were repeated on three dates in January; 1, 16 and 23 and a further six dates in February 9, 11, 13, 20, 23 and 25 of 2004.
- Despite all these positive indications of Mini's adjustment and survival in the wild, the project lost her in March when she was predated, probably by a leopard. Her remains, the skull, part of her tail and a paw, were found together with the radio collar by a member of the monitoring team on 15th March 2004.
- Sweety, on the other hand, as mentioned earlier, was very mobile. She remained close to release site for 6 days and then travelled a distance about 2 km to reach Kaiyakatta beat 4. Her relocation over this distance from the release site, to a comparatively unknown area, made tracking and monitoring her difficult initially.
- In December, she settled in an area about 1-1.5 km from Gairibas known locally as MR Road. She remained there throughout January but, from February, she started moving further exploring the areas towards Kaiyakatta.

- Time spent at Kaiyakatta area was 61% in February, 95% in March, 50% in April, 54 % in May and 45% in June 2004.
- She spent a lot of her time in this area between February and June. The first wild red panda was seen in the MR road area on 4th December.
- However, Sweety was not seen with a wild panda until 17th February. She was seen with wild pandas again on 26th February, 11 March, 1 April and 3rd April.
- Mating was recorded on 12th March 2004. The courtship and mating with the wild male were successful.
- Sweety became pregnant and, on 7th July 2004, she gave birth to a single cub in a tree hollow nest.
- Presence of cubs was checked on regular intervals.
- It was last seen in the tree hollow on 10th August 2004.
- On 12th of August 2004 the cub was not found in the tree hollow.
- It was initially speculated that Sweety had changed the place of the cub, as the field staff, following the radio signals on 14th August 2004, had found Sweety in a hollow of a tree base, approximately 30 mts from the site of the birth of the cubs. The cubs was, however not found in that tree hollow, as well.
- An intensive search was carried out w.e.f. 15th August 2004, in and around the areas where the mother, Sweety was tracked. Her movement and activity was recorded to be within 30-450 mts of the site of the birth of the cub. However, neither the cub not its remains could be found indicating that it might have been killed and taken away by some predators.

Fig. 46: Red Panda

Fig. 47: Red Panda released in Singalila National Park

Behaviour observation:

- Behavioural observations of the collared animals showed that Sweety was not only more mobile than Mini but she also urinated more frequently.
- This could indicate that she was putting substantially more effort in establishing herself in the wild and in an area of habitat where she would not encounter other pandas as easily as Mini.
- The high frequency of Urination and Movement seem to indicate that Sweety needed to scent mark to communicate her presence to conspecifics in and around the area more vigorously than Mini did.
- The behaviour of these pandas and the eventual birth of a cub clearly demonstrate that zoo-born female pandas were capable of surviving in the wild despite their captive origin.
- Behavioural observations conducted in the pre-release facility showed that Sweety was more active than Mini even prior to actual release. If this activity is predictive of exploratory behaviour after release, observations of behaviour in the pre-release facility could be used to select which individuals are better suited behaviourally for release back into the wild. In addition, tests and stimulations to evaluate and train anti-predator behaviour could be used to improve post release success.

Fig. 48: Schematic representation of area covered by released Red Panda in Gairibas, Singalila National Park

Outcome of the Project:

- Guidelines for reintroduction prepared taking into considerations all the norms concerning the authorities.
- The park accredited in a global arena for its conservation breeding work.
- The concept of Zoological Park merely as a place of amusement to conservation breeding research institute.
- It is assumed that the restocking of four females and the witness of birth have added to an increase in the population and genetic diversity of the red panda in the Singalila National Park.
- Conservation education became an active tool towards the species protection.
- Management strategies refined for Singalila National Park.

Problem faced during release

- Difficult terrain during animal tracking.
- Climatic consideration Heavy snowfall and drop in temperature.
- Animal straying to border country i.e. Nepal.
- Limitations in assessing the success of program due inability of long term monitoring of the released animal mainly due to consistent funding and technical support.
- The expenses for the construction of soft release facility rose due to the distance from the main town.

Second reintroduction of two females Neelam and Dolma took place in shortly afterwards. These animals were taken to the soft release facility in November 2003 and were released in wild in August 2004. They were monitored after release but no mating and breeding were observed.

Fig. 49: Red Panda

Chapter 11: Disaster Management Plan:

11.1 Objective

- Preparation for disasters, not only for the animals housed inside, but so that the facility will be viable in the aftermath.
- Decreasing the loss with quick action and in coordinated method.
- Developing resources and infrastructure to deal with the crisis.
- Less stress to animals as well as Keepers.

11.2 Line of command during a calamity

- The crisis should immediately be informed to the Supervisor, who ideally should reside close to the centre.
- The Supervisor should immediately reach the centre to assess the damage or problem and inform the director who should take the necessary actions.
- The supervisor should immediately start the rescue work according to the protocol.
- The mock drill should be done every three months when all the staff should participate in full preparedness.

11.3 Probable Calamity

Earthquake

Although it is not possible to predict earthquake, appropriate knowledge and preparation can help to minimize damage in an emergency.

- The enclosures should be made earthquake proof.
- Each enclosure should be equipped with instruments to cut open the wire and break the brick wall to remove the animals like a set of wire cutters, spade, hacksaws, hammers, pliers of different sizes and screw drivers.
- The first aid box should also be kept handy close to the enclosures.
- The electricity connections should immediately be disconnected.
- Transfer cages should be kept ready.

Landslide

- Avoid building enclosures in the slopes that are prone to landslide. Do not remove vegetation and large trees while constructing.
- Fill areas constructed above lacking appropriate slope retaining structures, as rock debris or boulders can move into your land.
- Avoid dropping rock pieces, boulders, loose earth etc. down the slope during construction. Introduce a retaining structure to prevent movement of cut or filled slopes, if you need to cut or fill your land located on a slope.
- Replant trees where they have been removed on slopes and slope base to prevent erosion.

Fig. 50: Red Panda

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Fig. 51: Red Panda

1. FORMATS (ANNEXURE I)

Daily Report

_____ Zoological Park

Day and Date:

Sl. No.	Section/Beat	Species and House Name	Observations	Action Taken

Sickness (Out patient)

Sickness (In patient)

Signature of Reporting officer

General Remark of Director

Signature of Veterinary officer

Signature

(Director)

Action taken

SO/EO

Signature (Dy. Director)

KEEPERS DIARY **(ANNEXURE II)**

Name of the Zoo keeper_____

Beat No_____

Day and Date_____

Sl. No	Enclosure No./Type	Species/Individual/Sex/Age	Observation

Dy. Director

Signature of keeper

Signature of Asst. Animal Supervisor

Signature of Animal Supervisor

2. ANIMAL HISTORY SHEET **(ANNEXURE III)**

_____ Zoological Park

Common Name	Scientific name
Local ID# & House name	Sex
Distinguishing natural mark	Type of marking Date:
National Stud Book No.	Global Stud Book No.
Sire National Stud Book Number. International Stud Book No. Local ID#	Dam National Stud Book Number. International Stud Book No. Local ID#
Date of Birth	When and from Where acquired
If acquired from another institution its Local Id# in that institution	Date of Death /Cause of Death/ Mode of Disposal
Breeding History	Remarks

1. MEDICAL RECORDS

ANIMAL TREATMENT CARD (ANNEXURE IV)

Species: **House name:** **Date of Birth:** **Beat No.**

Transponder No:

Date	Symptoms	Treatment	Clinical Note/s

ANIMAL DEWORMING CARD **(ANNEXURE V)**

Species: **House name:** **Date of Birth:** **Beat No.**

Transponder No:

Date	Findings	Medicine used	Remark/s

ANIMAL TRANQUILISATION CARD **(ANNEXURE VI)**

Species: **House name:** **Date of Birth:** **Beat No.**

Transponder No:

Date	Medicine Used	Time at which given	Time of Recovery	Remark/s

POST MOTERM REPORT **(ANNEXURE VII)**

_____ **Zoological Park**

Date

Species: Scientific name: Sex: House name: Age: Size: Weight

Time, date and Place of Death:

Time of post moterm examination:

A. Short history of illness, if any:

1. Organ wise description of lesions: _____

A Head and neck.....

B Thorax.....

C. Abdomen.....

D. Pelvic Girdle.....

E Limbs.....

2 Any other special features

(a) Skull

(b)Cervical vertebrae

(c) Lungs

(d) heart

(e) Ribs

(f) Liver

(g) Stomach

(h) Intestine

(i) Kidney

(j) Spleen

(k) Uterus and ovaries

i) Biological tests done (if any)

(l) Bladder

ii) Blood

(m) Genital passage)

iii) Urine

(n) Forelimbs)

iv) Discharges

(o) Hindlimbs

v) Biopsy

3. Opinion (cause of death)

4. List of organ preserved for confirmatory tests:

Sent to:

5. Instruction for disposal

6. Name of the officer present during disposal:

Fig. 52: Red Panda

PADMAJA NAIDU HIMALAYAN ZOOLOGICAL PARK (ANNEXURE VIII)

DARJEELING

NAME:

SEX:

REFERRED BY:

DATE:

STOOL EXAMINATION REPORT

PHYSICAL EXAMINATION

Color: Mucus:

Consistency: Blood:

Worms:

CHEMICAL EXAMINATION

Reaction;

Occult blood:

MICROSCOPIC EXAMINATION

Pus cells:

R.B.C:

Undigested starch:

Ova of

Cyst of

Others

(Vet attendant)

(Veterinary officer)

PADMAJA NAIDU HIMALAYAN ZOOLOGICAL PARK (ANNEXURE IX)

DARJEELING

NAME:

SEX:

REF.BY : DATE:

.....

EXAMINATION OF BLOOD

BLOOD COUNT			Reference value
Hemoglobin:	Gm/dl	.....	10.4-14.5
RBC:	Million/cu.mm	.....	6.3-9.0
WBC:	Million/cu.mm	.....	8,100-15,700

DIFFERENTIAL COUNT

Neutrophil:	%	.....	48-82
Lymphocyte:	%	.....	11-48
Monocyte:	%	.....	0.1-0.8
Eosinophil:	%	.....	1.0-6.0
Basophil :	%	.....	0.0-2.0

E.S.R (Weastgreen Method): (first hour)

(Vet attendant)

(Veterinary officer)

FEED CHART OF Red Panda (*Ailurus fulgens*) **(ANNEXURE X)**

NAME OF THE SPECIES: **HOUSE NAME:**

AGE: **SEX:**

Date	Time	Apple	Banana	Boiled egg	Honey/ Sugar	Milk	Bamboo leaves	Remarks

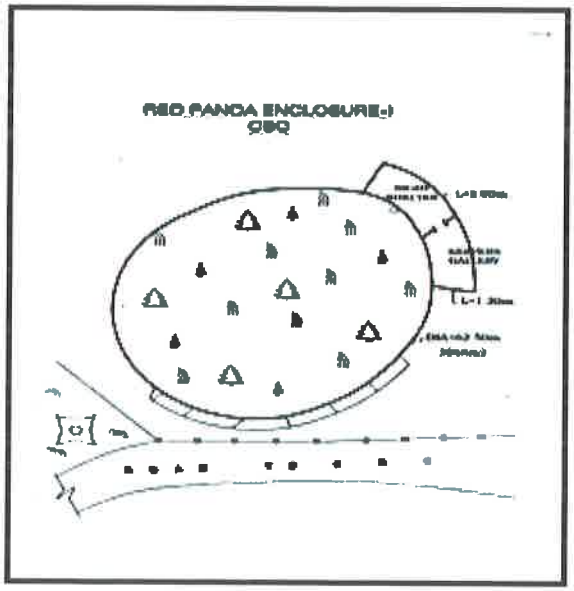
WATER COMSUMPTION BY Red Panda (*Ailurus fulgens fulgens*) (ANNEXURE XI)

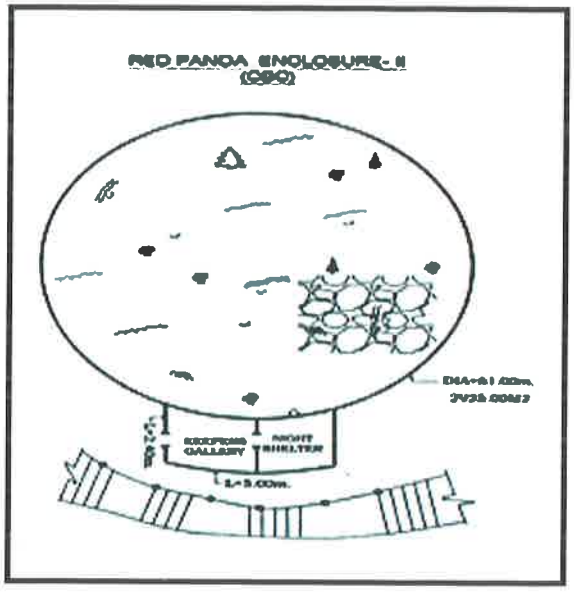
NAME OF THE SPECIES: **HOUSE NAME:**

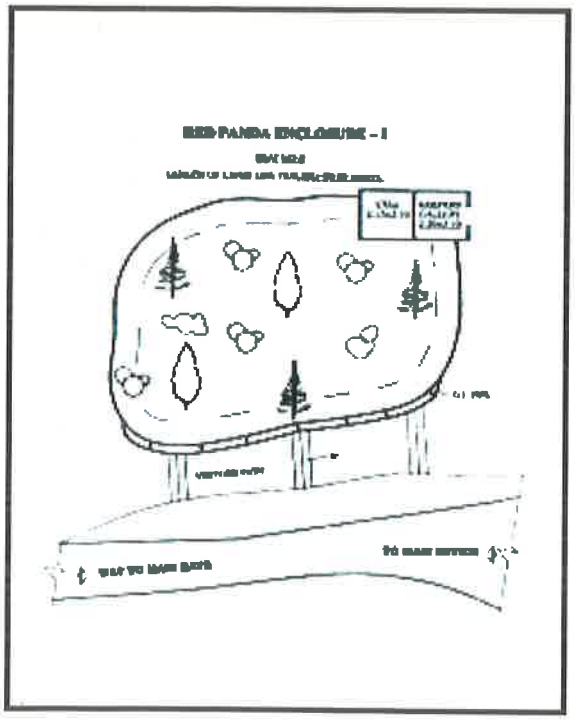
AGE: **SEX:** **MONTH:**

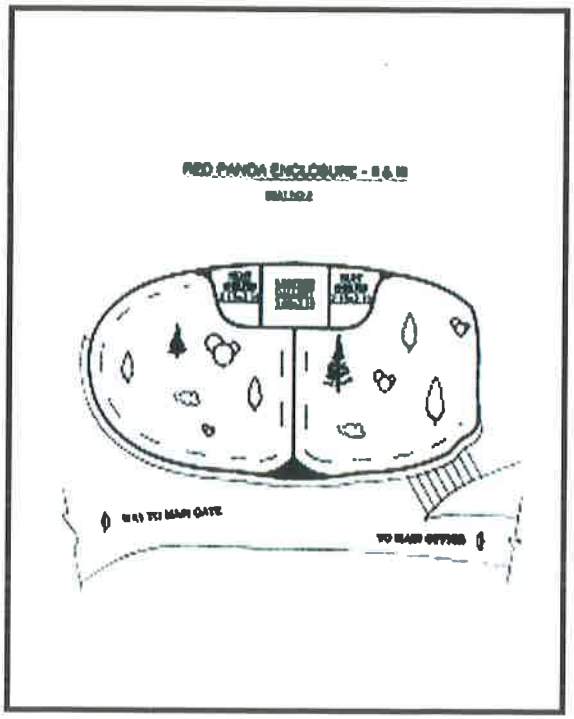
Sl. No.	Name of the Animal	Total water given (in lts.)	Water consumed (in lts.)

MAPS:


RED PANDA ENCLOSURE-I
CBG


RED PANDA ENCLOSURE- II
(CBG)


RED PANDA ENCLOSURE – I


RED PANDA ENCLOSURE – II & III

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