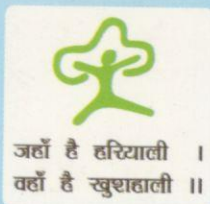


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WORKING MANUAL SNOW LEOPARD CONSERVATION BREEDING PROGRAMME



Ministry of Environment and Forests
Government of India



Central Zoo Authority



Padmaja Naidu Himalayan Zoological Park

WORKING MANUAL OF Snow Leopard Conservation Breeding Programme



Alankar K. Jha

With inputs from

Purna Ghising

Upashna Rai

Bhupen Roka



जहाँ है हरियाली ।
वहाँ है खुशहाली ॥

Ministry of Environment and Forests
Government of India



Central Zoo Authority



Padmaja Naidu Himalayan Zoological Park

Sanjay Mitra

মুখ্য সচিব
পশ্চিমবঙ্গ
Chief Secretary
West Bengal



পশ্চিমবঙ্গ সরকার

নবান্ন

হাওড়া-৭১১১০২

**GOVERNMENT OF WEST BENGAL
"NABANNA"**

325, SARAT CHATTERJEE ROAD
HOWRAH- 711102

Tel. : 033-2214-5858, Fax : 033 2214-4328

e-mail : cs-westbengal@nic.in

No. 129-CS/2014

September 15, 2014

Message

The Padmaja Naidu Himalayan Zoological Park, Darjeeling has, since its inception in 1958 paid special attention to the conservation of himalayan fauna. The Snow Leopard project has been the oldest conservation project in the country. With 28 years of experience, the park is best placed to prepare a manual for the conservation breeding of these beautiful animals.

I hope that this manual 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 apex predator 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 The compilation is done mostly through research with the literatures available as well as through unpublished personnel experiences.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 Snow leopards (*Uncia uncia*) in zoos. This manual is an overview of captive management of Snow leopard and has included all the major aspect of captive management.

The informations in this 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 Snow leopards.

B.S. Bonal, IFS
Member Secretary
Central Zoo Authority

Chandan Sinha, IAS
Principal Secretary



Department of Forest,
Government of West Bengal,
Aranya Bhavan,
Salt Lake City, Kolkata - 700 098
Phone : 033-2335-4030
Tele-Fax : 033-2335-4020
e-mail : secforest@w.b.gov.in

Dated: 29 September, 2014

Message

The Padmaja Naidu Himalayan Zoological Park, Darjeeling is dedicated to conservation of Wildlife. It started work on captive breeding project of this rare species in the year 1983. This was the first instance of an Asian Zoo participating in the Snow leopard Master Plan which was conceptualized by Mrs Helen Freeman, President of the International Snow Leopard Trust. This programme has helped to manage species between different zoos as self-sustaining populations whilst maintaining genetic diversity. This is important for species that are very close to extinction in the wild, and provides an "insurance" population. Research and study are also being undertaken so that this very special and sensitive project can become a model for other Conservation Breeding Projects in suitable locales. The Park has developed and utilized the best techniques and employs highly trained staff, which has resulted in successful breeding of this species in captivity.

I am happy to note that Padmaja Naidu Himalayan Zoological Park, Darjeeling is bringing out this Working Manual of Snow leopard (*Uncia uncia*) - a compilation of knowledge provided by expert staff members of the Park. The manual includes 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.



Ujjwal Bhattacharya, IFS

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

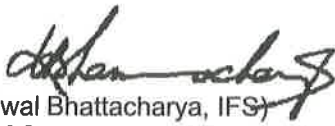
FOREWORD

Conservation breeding of Snow Leopards with success has brought many laurels to the Padmaja Naidu Himalayan Zoological Park Darjeeling. This is one of the rarest Zoo in India which has attained success in; the captive breeding of this elusive big cat which is highly endangered in the wild.

The Zoo has a vast experience of captive breeding of the Snow Leopards for about 28 years since 1986. Apart from providing the animals and technical inputs to other high altitude zoos in India, the Padmala Naidu Himalayan Zoological Park has also obtained new blood lines for the purpose of bringing heterozygosity in the breeding population. In order to continue the good work and improve upon the techniques based on the modern innovations, a manual for conservation breeding of the Snow Leopard is very crucial. This would help the zoo management to continue the programme in a professional regime.

I wish success to the zoo management in furthering this programme for restocking in the wild.

Date : 22.09.2014


(Ujjwal Bhattacharya, IFS)
Principal Chief Conservator of Forests, Wildlife
& Chief Wildlife Warden,
West Bengal



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 Tahr, Tibetan Wolves, Himalayan Salamander, Himalayan Monal, Bhutan Grey Peacock Pheasant, etc.

The ex-situ conservation of Snow Leopard in Darjeeling started well before the in-situ conservation project or specifically project Snow Leopard was conceptualized with the help of experts from Snow Leopard Trust viz Dr. Helen Freeman and Rodney Jackson. The programme was started with a very dedicated efforts from the then Director and the Animal Supervisor. Not of the species was known but even then the Director and the staff of the Park started the breeding of the animals. Valuable records have been maintained by them which has served as guideline for further conservation breeding. In year 2000 a pair of wild female Snow Leopard was brought from Ladakh with efforts from Smt. Maneka Gandhi, out of which one house named "Neeta" has contributed immensely to the gene pool of the captive snow leopard. In 2009 when the project was about to be closed specially for want of new animals and new blood lines, help was received from Ms. Sally Walker. The Park procured animals from European and American Zoos and the breeding programme started again. The Park also gave a pair of snow leopards each to Shimla, Nainital and Gangtok Zoos, however, they could not survive. A new effort has been initiated and it is expected that very soon a pair of animal shall be sent to the Nainital Zoo.

The management of captive snow leopard has in recent years, played a crucial role in enabling the recovery of this endangered populations, aiding conservation-related research and founding new wild populations as well as raising public awareness of these issues.

This working manual has been produced for as a guideline as to these animals may best be managed to promote the conservation goals contained in the Snow Leopard Recovery Plan.

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

(A.K. Jha, IFS)

Director,

PNHZ Park, Darjeeling.

Tel.: 91-354-2254250 (C), 2253709 (O), 2252522 (Fax)

Acknowledgements

The Snow leopard Conservation Breeding programme was conceptualized in 1980 and was given form in 1986. The present assemblage is an effort to documents all the plus and minus points, our erudition and perceptions.

We are thankful to Mr B S Bonal, IFS Member Secretary CZA , who caused us to prepare this Manual, which we hope shall be a beacon for Snow Leopard Conservation Breeding in India.

We are thankful to Mr Sanjay Mitra IAS Chief Secretary and President WBZA, Dr S K Das, ex Additional Chief Secretary Forest GOWB and Vice President WBZA, Sri Chandan Sinha IAS Principal Secretary and current Vice President WBZA, for giving us all help, insight and appreciation to prepare this Manual.

We are grateful to Late Dr D K Dey and Late Dr R K Lahiri for giving the dawn to this concept. Appreciation to Dr Hari Dang of St Paul's School, Mr Ingo Reiger and Mr D. Walzthoney of Snow Leopard Trust, Ms Helen Freeman the then President of Snow Leopard Trust, Mr Rodney Jackson, who helped in conceptualizing the project.

We are thankful to Ms Maneka Gandhi, who very kindly helped us in procuring two female wild Snow Leopard from Ladakh.

We are gratified to Mr Vinod Rishi IFS who nurtured this model and saw its growth in its adolescent days. He had a difficult task of giving form to the animal husbandry, and zoo management to a species to an animals for which little was known at that time.

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. He saw to it that it soars to highest summit.

We are thankful to Mr Leif Blomqvist for helping the programme all through from its primary days to right now.

We are appreciative to Ms Sally Walker to come as a seraph when we thought that programme shall close for want of new individuals.

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

We offer our sincere vote of thanks to all staff of PNHZ Park, Veterinary Officers, Zoo keepers, other officers and All Ex Directors, whose ardor and hard labor has made the Project successful. We are also thankful to Scientists of IVRI and CCMB in guiding us for certain chapters.

.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 has been developed to serve as a source of reference on the biology, maintenance, housing health, behaviour, diet, breeding, restraint and transportation of animals held in captivity. They act as the major source of information for the species. This working manual presents information and experiences (both published and unpublished) together so that the knowledge of the species can be passed on, which in turn allows for techniques to develop rather than be reinvented, thus resulting in the overall improvement in husbandry for that particular species. The goal of this Snow leopard (*Uncia uncia*) husbandry resource manual can be used as a reference tool for the zoo industry gained from the Conservation breeding of the Snow leopard (*Uncia uncia*) established by Padmaja Naidu Himalayan Zoological Park in collaboration with Central Zoo Authority.

1.2 Background

Snow Leopards, in a genus of their own, are endangered big cats. They inhabit rugged, mountainous terrain, in 12 range States - ***Afghanistan, Bhutan, China, India, Kazakhstan, Kyrgyzstan, Mongolia, Nepal, Pakistan, the Russian Federation, Tajikistan and Uzbekistan.*** Inaccessible and difficult terrain with the secretive nature of this rare cat helps account for the fact that large parts of its range have yet to be surveyed, or have been surveyed only on rare occasions. Much of the Snow leopard's distribution is located along contentious international borders, adding to the difficulty of reliably establishing the species current status and distribution. In addition many surveys were conducted over a decade ago so that the existing database may be seriously outdated. There is now a general agreement that population estimates of around 2,000 made in the early 1970's when the endangered species regulation were enacted, are too low. (Fox 1989) placed the total snow leopard range at 1.23 million square km with a world population of 3,350-4,050 animals. These figures were updated to between 4,510-7,350 snow leopards with a total potential habitat of 1,835,000 square km (Fox 1994).

1.3 Threats to Snow leopard Survival

1. Habitat and Prey Related

- ❖ Habitat Degradation and Fragmentation
- ❖ Reduction of Natural Prey due to illegal hunting
- ❖ Reduction of Prey due to legal hunting
- ❖ Reduction of prey due to competition with livestock
- ❖ Reduction of prey due to diseases.
- ❖ Fencing that disrupts natural migration.

2. Direct Killing or Removal of Snow leopard

- ❖ Killing of snow leopards in retribution for livestock depredation.
- ❖ Poaching Snow leopards for Trade in Hides and Bones.
- ❖ Museum collection of live animals.
- ❖ traditional Hunting of snow leopards.
- ❖ Secondary poisoning and trapping of snow leopards.
- ❖ Diseases of Snow leopard.

3. Policy and Awareness

- ❖ Lack of appropriate policy
- ❖ Lack of effective enforcement
- ❖ Lack of Trans-boundary cooperation
- ❖ Lack of institutional capacity
- ❖ Lack of awareness among local people
- ❖ Lack of awareness among policy makers.

4. Other issues

- ❖ War and related military activities
- ❖ Climate change
- ❖ Human population growth and poverty (indirect threats)



Fig1: Threats to Snow leopard

1.4 Conservation Status:

Snow leopards are classified as Endangered in the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species since 1988. Snow leopards have been included in Appendix I of the Convention on International Trade in Endangered Species of Fauna and Flora (CITES) since 1975, and hence all international commercial trade in the species, its parts and derivatives is prohibited.



Fig 2: Snow leopard

1.5 Role of snow leopard in the ecosystem

As a 'flagship' species the mystical snow leopard can be a unifying biological icon that can rally the regional players in the conservation arena, and become a symbol for international cooperation in regional conservation. As an 'umbrella' species the ecological and behavioural of snow leopard will also help to conserve the other facets of biodiversity in the alpine eco regions of the highest mountain range in the world.

The snow leopard can be a focal species for landscape conservation planning in the montane areas of the Himalayas as elephants, rhinos and tigers have done for other landscapes elsewhere in South and Southeast Asia and in the lowlands of the Himalayas as well.

1.6 Snow leopard Recovery Plan

The Central Zoo Authority has prioritized the Snow leopard as a species to be taken up for conservation breeding based on **the distribution of the species in India and globally, status of the species as per the IUCN and Wildlife (Protection) Act, 1972, availability of founders in wild and in captivity including availability of information on breeding biology and husbandry protocol and threat to the population.**

In a workshop held in Bhubaneswar from 16th-19th September 2013 on "Conservation breeding of endangered species in Zoological Gardens", Species Survival Plan was formulated for the Snow leopards concerning - Enclosure designs, capacity and scope for future expansion, Environmental enrichment required/ proposed, Availability of founders, Physical health of the founders, Genetic health of the founders, Recordkeeping identification/ marking of animals, animal history cards, treatment cards, national/ international studbook details. Membership of ISIS/ ZIMS etc, Availability of technical manpower like veterinarian, biologist etc., Facilities for health/ behavioural observations, CCTV etc, Regional cooperation with universities, other institutions and zoos, International cooperation GSMP, WAZA, CIBSG, RSG, foreign zoos, breeding centres, institutions, individuals etc. linkage with protected area network or wild habitats of the species. Names, areas, conditions, management, threats, future plans and possibilities, Public/ political support and legal requirements. The plan has been submitted to Central Zoo Authority and is yet to be finalized.

1.7 The need for conservation breeding of Snow leopards.

The endangered snow leopard (*Panthera uncia*, also *Uncia uncia* Schreber, 1775) continues to decline across nearly all of the 12 Central Asian Countries it inhabits due to poaching for its valuable pelts and bones, from retributive killings and from widespread depletion of its natural prey base. The wild population is roughly estimated to be 4,510-7,350. The species also exhibits many characteristics associated with extinction-prone species including its sparse and fragmented distribution, the declining populations, and relatively high vulnerability at the hands of humans, often the end result of persistent

livestock depredation. Hence Conservation Breeding of Snow leopards is a “need based activity”

Padmaja Naidu Himalayan Zoological Park, dedicated to the Conservation of Himalayan Wildlife, took a serious note of the present position of Himalayan Wildlife, particularly on the rare species and examined possibilities of upon a captive Breeding programme pertaining to Snow leopard, with an objective of establishing and maintaining a breeding centre at a suitable location in the park and to acclimatize, rear, breed and multiply the endangered species and then make an effort to establish subsidiary breeding centres in suitable locations in Himalayas.



Fig 3: Snow Leopard

CHAPTER 2: GENERAL ECOLOGY AND BIOLOGY OF SNOW LEOPARD

2.1 Classification:

Classification of Snow leopard (Toriello 2002)

Kingdom - Animalia

Phylum - Chordata

Subphylum Vertebrata

Class - Mammalia

Order - Carnivora

Family - Felidae

Sub Family - Pantherine

Genus - Uncia

Species - *Uncia uncia*

Taxonomically the Snow leopard (*Panthera uncia*) is considered a member of Felidae subfamily Pantherinae (Blomqvist 1978, Nowak and Paradiso 1983). However on the basis of morphology and behaviour, some authors place it alone in a separate genus *Unica unica* (Pocock 1917, Peter 1980, Rieger 1978b, Hemmer 1967, 1972, Anonymous 1987c).

2.2 Status:

Snow leopards are classified as Endangered in the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species since 1988. Snow leopards have been included in Appendix I of the Convention on International Trade in Endangered Species of Fauna and Flora (CITES) since 1975, and hence all international commercial trade in the species, its parts and derivatives is prohibited. Have been included as a Schedule I species according to the Indian Wildlife Protection Act 1972.

2.3 Morphology

Males are larger than female, with average weights between 45-55 kg as opposed to 35-40 kg for females (Jackson 1992, Fox 1994, Jackson 1996, Yaksha 1998, Shah 1998, WWF 2001, Theile 2003). The pugmarks of adults are 9-11 cm, in length and 7-9 cm in width, but varies in cubs (Jackson 1996, WWF 2001; Shrestha 2003).

The Snow leopard exhibit superb camouflage for its mountain environment of bare rocks, mosses and snow, being whitish-gray (tinged with yellow) in color and patterned with dark gray rosettes and spots. Further adaptations for high altitude life includes an enlarged nasal cavity, shortened limbs (adult shoulder height is about 60-70cm); well developed chest muscles (for climbing); long hair with dense, wooly under fur (belly fur grows as long as 12 cm) and a tail up to one meter long, 75-90% of head m body length

(IUCN/SSC Cat Specialist Group 1996, Jackson 1996, WWF 2001, Shrestha 2003). These adaptive features not only assist balancing in steep terrain movement but the thick tail can be wrapped around the body to protect the animal from the cold (Theile 2003).

Sexual Dimorphism: There is sometimes little difference in the sizes of adult male and adult female snow leopards making it difficult to distinguish between the two sexes.

2.4 Distribution of Snow leopard

World wide distribution

The Snow leopards (*Uncia uncia*) range crosses several central and South Asian countries including Afghanistan, Bhutan, China, India, Mongolia, Nepal, Pakistan, Russia, Kazakhstan, Kyrgyz Republic, Tajikistan and Uzbekistan.

Distribution in India

A number of population estimates for the snow leopard have been made earlier in various geographical regions of India. There are possibly 400 snow leopards in the entire Himalayas (Dang, 1967). Mallon (1984) estimated about 200 individuals in Ladakh alone. Whereas Fox *et al.* (1991) arrived at about 400 individuals in the North West India and about 100 in Sikkim and Himachal Pradesh. Later on the basis of the habitat availability in India i.e., 75,000 sq.km Chundawat *et al.* (1988) & Fox (1994) arrived at a range of 200-600 individuals. Snow leopard distribution is found in open, rolling habitats where, shrubs and outcrops offer cover for stalking in as the Tibetan plateau (Mallon, 1984; Schaller *et al.*, 1988; McCarthy, 2000). Snow leopards are present on the Southern slopes of Great Himalayas & their range in India falls in Trans-Himalayan region. In India the states of Jammu & Kashmir (8,521 sq.km), Himachal Pradesh (3,429 sq.km), Sikkim (850sq.km), Arunachal Pradesh (2,589sq.km), Uttaranchal (3,238sq.km) are having habitat suitable for the snow leopard under the protected areas (Chundawat *et al.*, 1986). Of these protected areas two are National Parks (NP) and three are Wildlife Sanctuaries (WLS) in the Trans -Himalayas that are Hemis High Altitude National Park (4,100sq.km) of Jammu & Kashmir and Pin Valley National Park (675sq.km) of Himachal Pradesh and Karakoram Wildlife Sanctuary (5,000sq.km) of Jammu & Kashmir, Changthang Wildlife Sanctuary (4,000sq.km) of Jammu & Kashmir, Kibber Wildlife Sanctuary (1,401sq.km) of Himachal Pradesh. There are nine National parks and Eleven Wildlife Sanctuary in the Greater Himalayan Zone which are as follows Gangotri National park (2,390sq.km) of Uttranchal, Kanchendzonga National Park (1,784sq.km) of Sikkim, Great Himalayan National Park (754sq.km) of Himanchal Pradesh, Nandadevi National Park (630sq.km) of Uttranchal,

Govind National Park (472sq.km) of Uttranchal, Kishtwar National Park (400 sq.km), and Dachigam National Park (141sq.km) of Jammu & Kashmir, Valley of Flowers National Park (88sq.km) Uttranchal, Namdhapha National park (1,985sq.km) of Arunachal Pradesh and Wildlife Sanctuaries being Kedarnath Wildlife Sanctuary (957sq.km) Uttranchal, Sangla Wildlife Sanctuary (650sq.km) of Himanchal Pradesh, Askot Wildlife Sanctuary (600sq.km) Uttranchal, Govind Pashu Vihar Wildlife Sanctuary (481sq.km) of Himanchal Pradesh, Lipa-Asrang Wildlife Sanctuary (31sq.km) of Himanchal Pradesh, Dibang Wildlife Sanctuary (4,149sq.km) of Arunchal Pradesh, Sechu Tuan Nala Wildlife Sanctuary (103sq.km) of Himanchal Pradesh, Sainj Wildlife Sanctuary (90sq.km) of Himanchal Pradesh, Kanawar Wildlife Sanctuary (54 sq.km) of Himanchal Pradesh, Manali Wildlife Sanctuary (32sq.km) of Himanchal Pradesh may have snow leopards. Many of the Protected areas in the Greater Himalayas are having very small areas as snow leopard habitat and to such extent that they are not yet documented. And three National Parks and Five Wildlife Sanctuaries are such that presence of snow leopard is very doubtful because of small amounts of alpine habitat present in these protected areas is separated by snow leopard range by extensive forest cover (Jackson, 2002).



Fig 4: Distribution of Snow Leopard

2.5 Behaviour of Snow leopards

Snow leopards are crepuscular in nature and tend to spend the middle of the day and night bedded on cliffs, in rocky outcrops or other secluded and protected areas. Snow leopards display flexible behaviour and are active in early morning and late evening and at night. Other prominent behaviours are marking territories with scent marks, urine spraying and faeces and by making scrapes. Walking, running, leaping and climbing movements as are in the other members of the family Pantherinae. Postures are basically the same as in the other Pantherinae. Sleeping positions depends on the temperature that varies from stretched to rolled up. Snow leopards wash the face with their licked fore paws. Eating usually is done in squatting posture. Normal excreting and urinating is usually accompanied by scraping with the hind paw.



Fig 5: Snow leopard

2.6 Food and feeding behaviour

Snow leopard is the chief natural predator of Bharal (*Pseudois nayaur*), Marco polo sheep, Shapu, ibex, Markhor (*Capra falconeri*), Musk deer (*Moschus moshiferus*), Cape hare (*Oistulus roylei*), Woolly hare (*Oistulus lepus*). Reports of the scat analysis from the wild consisted of 50% of domestic goat and sheep, 31% Markhor. There have also been reports of the presence of Dzo (yak+cow), Pony, Donkey, Sheep and Dog. Many

investigative data reveals that snow leopard also attacks yak. It is also reported that Takin (*Budorcas taxicolor*) and Serow (*Capricornis summatraensis*) are rare victims. Snow leopards are opportunistic hunters and also hunt snow cock, monarch pheasants, and red-legged partridge.



Fig6: Snow leopard hunting in the wild

2.7 Breeding Biology

The female Snow Leopard reaches sexual maturity in captivity at around 2-3 years while males take around 4 years. The age of specific fertility rate for captive snow leopards increases with age until six years for females and eight years for males. After these peaks, fertility decreases until the end of the life span. Although 5 % of both sexes start to reproduce before they have reached their third year of age, the main reproductive life span is from three to twelve years. Males have a longer potential reproductive life than females with 11 % successful breeders at the age of sixteen to seventeen years (Blomqvist 2002) Snow leopards are unusual among other large cats in having a well-defined birth peak. Wild breeding season is early January to mid- March, a time when vocalisations can most commonly be heard (Jackson and Ahlborn 1988). Captive reproductive season is nearly the same; most births occur in May-June (Freeman 1975, Blomqvist and Sten 1982). Unlike common leopards and many other cats, captive snow leopards rarely recycle and re mate if a litter of cub's dies.

At PNHZ Park the age of first reproduction is known of in the cases of seven different females. It ranges from twenty four months of age to seventy eight months of age with an average of fifty two months (4.4 years). Longevity is also important to the management of feral and captive population, in so far , it relates to the length of reproductive life. The age of birth, death and time of last reproduction are known of in the cases of six females. The average last reproduction being at ninety eight months (8.2 years) of age. Last recorded

reproduction in captivity was fifteen years (Nowell & Jackson 1996). However, the International Pedigree of Snow Leopards 2003 report notes post reproductive females at 15-16 years and males at 17-18 years of age. Analysis and study of the records of Snow Leopard from the initiation till date (1987-2011) of Padmaja Naidu Himalayan Zoological Park, Darjeeling, the only two year old female which has given birth in captivity is the Female "Ramba" which gave birth to her first litter with two male cubs at the age of twenty four months sixteen days. Unlike female Snow leopard, sexual maturity of male Snow Leopard is quite delayed. The male Snow leopard reaches their sexual maturity at around four years. As per the record of PNHZ Park, the age of sexual maturity ranges from forty four months of age to hundred and ten months with an average of seventy three months (six years).



Fig7: Breeding behaviour in snow leopard

2.8 Survival

Analysis of the global population of snow leopard have shown that there are very few individuals that have survived after crossing the age of 17 years. Snow leopards in captivity are known to live up to 21 years (Blomqvist and Sten 1982, Wharton and Freeman 1988) but are unlikely to reach half their age in the wild (Blomqvist and Sten 1982, Theile 2003). The longevity can be credited to proper husbandry, regular health monitoring including research on the biology of the species to cater to their needs.

2.9 Factors of mortality

Literature review shows that the factors of mortality for Snow Leopards at different captive facilities are Mycotic pneumonia due to *Aspergillus terreus* in a neonatal cub, Lymphoid interstitial pneumonia and other different forms of pneumonia. Some of the major diseases of Snow Leopards reported in different global captive conditions are ovarian dysgerminoma, pancreatic carcinoma, Demodicosis in juveniles, feline panleucopenia virus, canine distemper virus, veno-occlusive disease, coxofemoral dysplasia, multifocal osteomyelitis caused by *Klebsiella oxytoca*, cerebral or extramedullary spinal fungal abscesses. *Scopulariopsis* sp, a common saprophytic fungi, was isolated from a spinal abscess. A further myelitis case caused by a phaeophomycete (*Cladiophalophora bantiana*), Multiocular coloboma which are congenital malformations in which a portion of the structure of the eye is lacking, oral and cutaneous number of papillomavirus infection sometimes associated with malignant transformation (squamous cell carcinoma), Septicemia, brittle bone disease especially in cubs have proved to be fatal, with minor ailments like parasitic load and loose stools are also observed in captive snow leopards.

Limping of hind limb and fore limbs including accidental external injury like tearing of skin etc. Old age related problems include urinary tract infection and inappetence.

2.10 Identification of Individual Snow leopard

Male Snow leopards are larger than females but apart from that they are visually difficult to tell apart. The fact that Snow Leopard are usually solitary and are not kept together in large numbers means that the physical differences are usually enough for keepers to identify individuals and records of their individual markings are usually kept. It is standard procedure though for a permanent method of identification to be used and in the case of the Snow leopard the methods of identification usually employed is electronic transponders. The electronic transponders are small microchips which are placed under the Snow leopard skin as a permanent identification marker. Zookeepers can then use a scanner to read the unique twelve digit number that identifies the Snow leopard. They are easier to use since with a scanner they can be read quickly and easily without immobilizing the animal. Though it is painful and they can migrate throughout the body the patient does not need to be sedated and the wound is not large, visible or as prone to infection.

Beside transponders individual Snow leopards can be identified by their physical characteristics. For that purpose photographs of individual Snow leopard housed at

PNHZPark was taken and variation in the pelage pattern was taken into consideration. Snow leopard pelage patterns vary between individuals with respect to the size, shape, orientation and coloration of individual spots and rosettes. Each snow leopard's coat patterns are unique like our fingerprints. Pelage patterns are asymmetrical, often varying significantly between the sides, lower limbs and tail. Blomqvist and Nystrom (1980) used the leopard's highly distinctive spotting pattern on the forehead to distinguish individual snow leopards in captivity. Areas used for identification included uniquely shaped or arranged rosettes, spots or groupings thereof, located on the lower limbs forequarters, dorsal tail marking, front, and right and left facial markings. Identification of one different feature was considered sufficient to determine that two photographs depicted different animals. Areas such as the lower limbs proved the most useful in identification due to the short fur and clearly defined spot shapes; however, even Slight rotation in body orientation can influence the ease with which patterns can be identified.



Fig8: Snow leopard

CHAPTER 3: MISSION, VISION AND OBJECTIVE OF A SNOW LEOPARD CONSERVATION BREEDING CENTRE

3.1 Vision

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

3.2 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 Snow leopards. .

3.3 Objectives

- ❖ Conservation breeding of Snow leopards (*Uncia uncia*) as an insurance against possible early extinction of species in wild.
- ❖ To study breeding behavior of the Snow leopards (*Uncia uncia*).
- ❖ Re-introduce viable numbers of animals for their long term survival in wild.
- ❖ To donate stock to other zoos which are not considered for re- introduction.
- ❖ Monitoring and modifying management practice to provide survival of Snow leopards in captivity as well as in wild.
- ❖ Research and education

3.4 Targets for Captive Breeding Programme

- ❖ Sufficient number of founders
- ❖ Carefully managed pair combinations.
- ❖ Not merely produce larger numbers of individual's but also aim to maintain a high proportion of the gene diversity that is present in the wild population. A 90% gene diversity retained can be expected to correspond to an average level of inbreeding of 10% in the next generation if the current generation were to randomly breed and if no new founders are added
- ❖ Large captive populations.

3.5 Age composition of snow leopards for captive breeding

- ❖ The female Snow Leopard reaches sexual maturity in captivity at around 2-3 years while males take around 4 years.
- ❖ For Conservation Breeding animals suitability to be checked for genotype and phenotype fitness. Animals should be healthy and free from diseases.
- ❖ The animals should have minimal human imprint.

3.6 Number of Snow leopards for Conservation breeding

The age of specific fertility rate for captive snow leopards increases with age until six years for females and eight years for males. After these peaks, fertility decreases until the end of the life span. Although 5 % of both sexes start to reproduce before they have reached their third year of age, the main reproductive life span is from three to twelve years. Males have a longer potential reproductive life than females with 11 % successful breeders at the age of sixteen to seventeen years (Blomqvist 2002)

3.7 Proposed time-table for Conservation Breeding

The Park has been involved in the captive breeding of snow leopard since 1986 and have recorded a total of 56 births till 2013. In 2003 the park had a total population of 18 individuals (9:9) where 6 individuals were transferred to tree high altitude zoos in India to start with a similar breeding programme.

None of the Park was able to breed the species. Currently PNHZ park holds 14 individuals. Through exchange programme 2 females were included in the captive stock for further breeding. In the next two year i.e. 2016 the park shall have a total population of 20 individuals. The Park shall be in a position to send 1:1 snow leopards to other high altitude zoos in India.

The park proposes to send a pair each to the other high altitude zoos in India prior to which the biologist and the veterinarian should be trained at Darjeeling Zoo. Before the shifting of the animals the Central Zoo Authority shall carry out appraisal of the housing facilities, enrichment etc. One female captive born snow leopard shall be brought back from Himalayan Zoological Park, Sikkim as per the committee's decision in a coordination meeting on Snow leopard Conservation" held on 6th June 2014 at New Delhi.

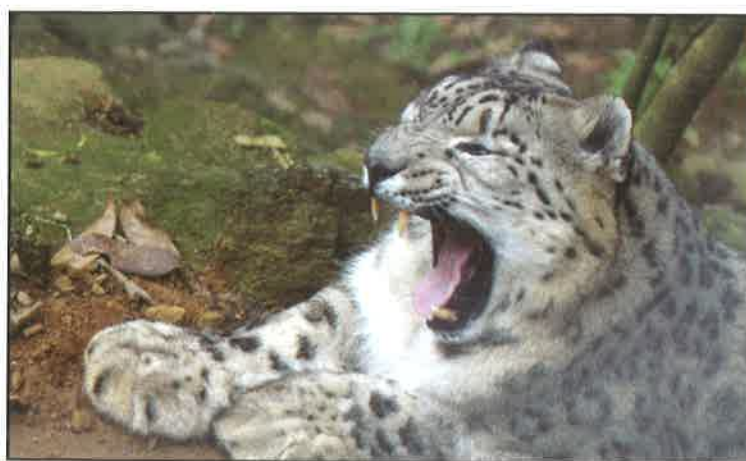


Fig9: Snow leopard

CHAPTER 4: ESTABLISHING SNOW LEOPARD 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 Snow leopards.

- ❖ The Conservation breeding centre should be established at a distance of 20-25 km away from human habitation.
- ❖ Should be close to the natural habitat of the species and the aspect should be western southerly.
- ❖ Should be safe from natural calamities like landslides and earthquakes.
- ❖ Should have an undulating topography, rocky terrain, maximum sunlight and windy spot.
- ❖ Should have basic facility such as approach, electricity, connectivity etc.
- ❖ Should be an open area and not heavily forested.
- ❖ Area should be moisture and frost free.



Fig 10 : Conservation Breeding Centre

4.2 Considerations for enclosure design

When designing housing areas for Snow leopards some important factors to consider are their shy, elusive, reclusive nature and the reputation of aggression between individuals of same sex. Wild Snow Leopard typically live a solitary existence, occupying home range of 12-39 km² (Jackson and Ahlborn, 1988) and travel an average straight line of 0.8 km². The longest distance moved in one day is 7 km² (Jackson and Ahlborn, 1988). In captivity, however they are often housed with, or in close proximity to, other Snow leopard (as well as other species), and spatial and financial constraints restrict enclosure size, resulting in insignificantly smaller territories. Thus in designing the housing, it is important to consider the animal's natural habitat and the behavioural needs. The other considerations during designing an enclosure are

Topography-Exhibits may be terraced, sloped, and should 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 snow leopards to utilize all areas of the enclosure to hide or find shelter. The enclosures should be situated in an area that allows maximum flowing fresh air inside the night shelter and artificial dens/caves as it assists to increase appetite and metabolism of newborn cubs.



Fig 11 : Exhibits with slopes

Temperature-The animal should be provided with dry and airy night shelters including enclosures furnished with shades and rocky substrates especially during warmer months of the year. During extreme winter when temperature reaches below minus to 1 degree Celsius moderate temperature of about 13 degree Celsius should be maintained inside the night shelter. Although large felids may originate from all manner of climates, most are tolerant of wide temperature extremes, at least during daylight hours. Animals kept outside should always have access to shade, especially during warmer months of the year. When acclimated, most species without young require only minimal unheated

shelter at night. When kept indoor year around, animals should be protected from temperature above 26.5 degree Celsius. Snow leopards do not need additional sources of heat or cold if exhibits are designed to include access to a shelter from inclement conditions in the winter and access to shade.



Fig12: Rocky and shady areas in the enclosures

Lighting - For Snow leopards no special light requirements are needed as long as the animals are provided with access to the normal cycles of the outdoor environment. Flowing fresh air through the dens will help to increase appetite and metabolism of newborn cubs. It is important that ventilation is monitored closely as respiratory tract infections have been known to occur in cubs with little access to fresh air.



Fig 13 : Skylight

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.

Water - Fresh clean water for drinking should be available at all times. Watering devices should consist of either exhibit built-ins Regardless of size, water containers should be cleaned daily.

Sanitation - Hard-surface primary enclosures and food containers (if used) should be cleaned daily. Wooden platforms where animals climb and sit should also be included in this regime. Dirty substrates in outdoor-planted exhibits should be raked and spot-cleaned daily.



Fig 14 : Cleaning of wooden platforms with disinfectants.

4.3 ENCLOSURE DESIGNING:

- ❖ Keeping in view the topography and the area of the Zoo, the enclosure size for felids as per prescribed by CZA cannot be strictly followed up. Hence regardless of the enclosure size, 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. Since the habitat is a stark vista of rock, snow, and little vegetation an exhibit heavy in rock work with shallow cave retreats and ledges would be reflective of the natural environment in the winter. In the summer they descend below the tree line. Added trees can reflect that fact.
- ❖ Devoting a percentage of the exhibit to vertical space is also important. Snow leopards often live and hunt in very steep rock habitat and thus like high places in their enclosure.
- ❖ It is necessary that the exhibit be fully enclosed as their climbing ability and agility would allow them to escape from any form of open top exhibit.
- ❖ In captivity it is strongly encouraged that there are both indoor and outdoor enclosures. Additional exhibit components may include caves, logs for scratching, and some type of natural substrate (mulch, turf, sod, etc.) for digging and making scrapes.
- ❖ For snow leopards, having an overhang under which they can scent mark is very important. In the wild, upper surfaces are often covered with snow and using the underside of a ledge helps to preserve the scent message a much longer.

- ❖ Additional square footage, whether indoor or outdoor is highly desirable for introductions and breeding pairs. Small or poorly furnished enclosures can lead to problems such as agitation, boredom, self-mutilation, weight problems, and lethargy.
- ❖ Attached squeeze cage in the night shelters are a necessity especially during the treatment of the animals either during physical or chemical restraint.

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)



Fig 15 : Transfer cage in between the two

ENCLOSURE SPECIFICATION:

TABLE I:

Minimum Prescribed Size for feeding/Retiring Cubicle for Snow Leopard prescribed by CZA

Name of the Species	Size of the feeding cubicle/night shelter for each animal (meters)		
	Length	Breadth	Height
Snow leopard (<i>Uncia uncia</i>)	2.00	1.80	2.5

TABLE II:

AZA Recommended enclosure sizes for Snow leopards

Exhibit type	Size range	Recommended size
Outdoor	25-190m ²	Maximum
Indoor	6-50m ²	Maximum
Off-exhibit dens	2-6m ²	Maximum

Table III depicts the Size of Enclosure and holding area of different Indian Zoos housing Snow leopard.

Sl. No.	No. OF ENCLOSURE	NAME OF THE ZOO	
		PNHZPARK DARJEELING	HIMALAYAN ZOOLOGICAL PARK GANGTOK
1	Enclosure area (in sq mt)	Enclosure no.1 (CBC)- 207.98	1800 sqm
		Enclosure no. 2 (CBC)- 230.00	
		Enclosure no. 3 (CBC)- 230.00	
		Enclosure no.4 (beat 4) 107.11 sq mt.	
		Enclosure no. 5 (CBC) Topkedara- 45 X 30 mt	
2	Enclosure dimension	<p>Enclosure no.1 (CBC)- L: 8.90 mt., B: 2.15 mt., H: 2.89 mt</p> <p>Enclosure no. 2 (CBC)- L: 8.90 mt., B: 2.15 mt., H: 2.89 mt</p> <p>Enclosure no. 3 (CBC)- L: 8.90 mt., B: 2.15 mt., H: 2.89 mt</p> <p>Enclosure No 4 (Beat .4) L: 6.65 mt. B. 2.11 mt. H: 2.61 mt</p>	
3	Enclosure substrate	Earth and cemented flooring	Earthen with much vegetation
4	Type of enclosure barrier	Chain Link mesh	Chain link mesh
5	Substrate of retiring cells	Cemented flooring: All the retiring cells for the snow leopards have cemented flooring where wooden platforms are provided to the animals in each retiring cells for warmth. The wooden planks are removable.	Cemented flooring
6	Availability of squeeze cage	Squeeze cage should be attached for the treatment of the animals with the enclosures.	
7	Vegetation type in the enclosure	Mixed type	
8	Kraal dimension		12.2m X 12.2 m X 2.7 m



Fig16: Snow leopard enclosures at the Breeding Centers.



Fig17: Keepers gallery and night shelter of snow

4.4 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.

Hematology:

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

(b) BA88A- Semi-Auto Analyzer

(b) 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"
- ❖ 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"

- ❖ Facilities: OT complex should be isolated. The room should have an independent airflow mechanism to maintain theatre sterility. Should have a proper ventilation system.

Freezer:

- ❖ For sample storage.

4.5 OTHERS:

- ❖ **Solid and Liquid Waste sewerage:**

Solid wastes: The major solid wastes would be the left over bones of the feed provided to the animals. The bones could be collected and put in a 10 X10x10' depth pit outside the boundary of the Centre. The other way to do is by incinerating them which will be expensive and polluting.

LIQUID WASTES: The water from the enclosures, retiring rooms, laboratory, 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.

❖ **Food section:**

The Snow Leopards should be fed on the freshly slaughtered meat. It should be ensured that the animals to be slaughtered are healthy. An individual snow leopard should be fed with 2.5 kg every day with one day fasting.

❖ **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'. 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.



Fig18: Enclosure and holding area at the new Conservation Breeding Centre for Snow Leopard

CHAPTER 5: SNOW LEOPARD TRAPPING AND TRANSPORTING TECHNIQUES

5.1 Importance of Snow Leopard capture from the wild.

The Snow leopard 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.

5.2 Methods of trapping:

Through physical or chemical restraint.

5.3 Timing of capture and Handling

Animal should be caught away from the heat of the day and very cold conditions as they can overheat and chill very easily.

5.4 Legal considerations and requirements for snow leopard capture

The Snow leopard (*Uncia uncia*) 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-bailable offence under the Wildlife (Protection) Act, 1972 to catch, keep or kill an animal listed in this Schedule. Animals listed under this Act remains the property of the Govt of India and nobody can own them.

5.5 The documents of approval required from competent authorities prior to capturing a snow leopard or retaining after rescue.

Permission from Govt of India and Chief Wildlife Warden for capturing the Snow leopard.

Active involvement of the local forest officers during the capture of the snow leopard.

Approval from Central Zoo Authority and Chief Wildlife Warden of the State for keeping Snow leopards in captivity.

5.6 Import and Export of Animals

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 Forest AND Climate Change, and Director General of Foreign Trade as to exchange taking place.
- The MoEF and CC 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 centers 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.

Species specific consideration:

- ❖ Only one animal should be transported in each crate/container.
- ❖ Male/Female need to be transported separately in individual crate.
- ❖ The width of the cage should be such so as to not allow the animal side maneuverability.
- ❖ Proper aeration must be there in each crate.
- ❖ The indicative dimensions of crates for leopards as per Central Zoo Authority Guidelines.

TABLE IV:

Species	Length (cm)	Width (cm)	Height (cm)
leopard	120	60	90

Frame: MS angle 40mm X 40mmX6mm.

Sides: 12 mm thick waterproof plywood with cover of 3 mm thick iron sheet.

Floor : 19mm thick waterproof ply on MS flat 35mm × 4 mm @ 350 c/c floor, two sides also covered from two sides also covered from inside with 2mm thick iron sheet .Holes on floor 20 mm in diameter .Whole crate should rest on 50 mm × 50mm iron pegs. Two removable trays of depth 25 mm to be provided below the floor to receive urine and excreta.

Roof: 12mm thick waterproof plywood.

Doors: 12mm diameter MS bar @50mm c/c should be welded with frame and covered with 5mm thick plywood. Bolt and chain system for closing and opening the doors.

The specifications of the transportation cage regularly used by PNHZ Park is as follows.

TABLE V:

Species	Length (cm)	Width (cm)	Height (cm)
Snow leopard	180	51	76

5.7 Material to be used for cage design:

Ply wood, MDF board are usually used for making transportation cages.



Fig 19: (A-H): Transport box

5.8 Animal per cage:

One snow leopard per crate.

5.9 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, Feline enteritis, Feline Pan Leucopenia, Leptospirosis, Distemper, Scabies, Aujeszky's disease, *Toxoplasmosis*, *Babesiosis*, *Anaplasmosis*, *Trypanosomiasis* etc.
- ❖ 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.
- ❖ A model Quarantine condition is enclosed in Annexure.

5.10 Equipments required for tranquilisation:

- ❖ Gas Pistol Mod 35 with std kit , Art No. 4006, Dan Inject CO2 (Pistol) and Long range Rifle.
- ❖ Dart
- ❖ Injection Ketamine
 - ❖ Injection Xylazine
 - ❖ Injection Reverzine
- ❖ Clean cloth for covering the eyes of the animal.
- ❖ Water for cooling body temperature
- ❖ Thermometer
- ❖ Gloves for handling the animal
- ❖ Stretcher for lifting the animal.

5.11 Modes of transport:

Selection of the mode of transport depends on the length /duration of the journey. While transporting a snow leopard, 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.

Care should be taken to avoid transportation in summer, and on dirt roads.

Air transport

- ❖ Fastest and ideal for long distance travel.
- ❖ Can be transported unattended.
- ❖ Transport by road from the airport to the airport quarantine facility-- temperature regulation is must in the vehicles

5.12 Feed and behaviour monitoring:

- ❖ The animal during transportation should be ensured with proper feed and ORS water 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.

5.13 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.
 - ❖ Close physical contact should be prevented between the animals, such as an empty den between the new tiger and the resident group.

- ❖ 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

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

5.14 Release of the animal into the enclosure.

- ❖ Animal to be released in the enclosure, duly sanitized and cleaned after of its quarantine.
- ❖ Release must be done during evening, after fall of darkness to take care of excitement to the animal in new environment.
- ❖ Food and water must be kept beforehand inside the release cage. Stool test must be done after the animal has defecated first time.



Fig 20: Transportation method

CHAPTER 6: HUSBANDRY AND CARE

6.1 Housing Requirements:

EXHIBIT DESIGN

- ❖ Careful consideration should be given to exhibit design.
 - ❖ The terrain should typically be extremely rugged, having cliffs and areas with slopes in excess of 40 m and areas with 25 m of edges with good view for the animal to move, bed and mark along linear topographic features such as ridgelines, bluff edges, gullies, and the base or crest of broken cliffs.
 - ❖ Bedding sites should be situated on or near ridges, cliffs and other sites with good views.
 - ❖ Should enable the animal to move freely and engage in a wide range of natural behaviours, including foraging, socializing, climbing, and digging, resting and sleeping.
 - ❖ Physical barriers, including walls and fences, should be designed and constructed to minimize traumatic injury to animals.
 - ❖ Visual barriers should be included in enclosures, allowing animals to avoid each other or to retreat from public viewing.
 - ❖ Additional holding areas should be available for the separation of animals as required.

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 snow leopards to utilize all areas of the enclosures to hide or find shelter.
- ❖ Rocky/slate outcrops and ledges provide contrast and viewing vantage points that are also suitable features for Snow leopards which they will actively utilize and rest on the elevated areas.



Fig 21: Exhibits of Snow leopards at PNHZ Park

POSITION OF ENCLOSURES

- ❖ Living in the Southern Hemisphere, enclosures built facing north are able to utilize full sun for most of the day.
- ❖ Multiple holding of the species requires that the majority of the enclosures must be out of visual range of any neighboring enclosures to minimize visual, olfactory, auditory and antagonistic behaviour developing between individuals.
- ❖ Where visual contact is available, the group should be monitored for signs of stress and actions taken to alleviate this distress.
- ❖ All enclosures should have a portion of the total area that is protected from the weather and offers some shelter and shade.

OFF-EXHIBIT DENS

- ❖ Off-exhibit dens to be provided to Snow Leopards to allow them privacy and shelter from the elements.
- ❖ In facilities with breeding programme maternity dens (containing breeding boxes) should be provided.
- ❖ Holding areas for the snow leopard should all contain some type of furniture to allow the cat to lie above the floor as this is preferred by them in most situations.

WEATHER CONSIDERATIONS

- ❖ Exhibits are required to provide the animals with access to shelter from climatic extremes.
- ❖ A sheltered area is required to provide an environment with air temperature ranging between to
- ❖ The shelters need to be of sufficient size.



Fig 22: Natural plantation and artificial caves

SUBSTRATE:

- ❖ **Rocky substrate**

6.2 ENCLOSURE FURNISHING

- ❖ Snow leopards are amazing climbers and should be kept in enclosed exhibits, which should be well drained; offer, climbing structures: trees, wooden poles, ropes, logs and rocks, weather considerations: rain cover, shade structures, sunny spots and wind brakes, substrate for lying : grass, hay, straw, dry leaves, wood chips etc, Substrate for scraping: soil, sand, grass, mulch, rotten logs, options for hanging and high raised platforms. Options for hanging and high raised platforms.
- ❖ Visual barrier should be provided rocks, logs for scratching for wear maintenance on nails i.e. to help reduce ingrown claws and suitable plants will also create a naturalistic environment for these animals.

NIGHT QUARTERS

- ❖ Internal measurements should not be less than 3 X 2.5 meters with a ceiling height of 2.1 meters.
- ❖ The night shelters should be connected to the main display by vertical or horizontal sliding doors operable from the keeper's area. Doors into the den should be constructed of steel/Iron/Aluminium
- ❖ Wooden platforms should be provided to allow animals to lie off the concrete floor.
- ❖ Lightning to be of a level to mimic natural lightning of the wild.
- ❖ The lightning is to be adequate to allow routine health checks and to allow ample fresh air to circulate.
- ❖ Humidity to be maintained at appropriate levels for the species.
- ❖ The night quarters should be used for the shortest possible time, as a holding facility or with the exception of when the night quarters meet the requirements of an off exhibit facility.
- ❖ Floor require a slope to the drainage area situated on the outside of the night quarters to prevent the pooling of water.
- ❖ Rodent proofing is required.
- ❖ Separate ventilation systems should be maintained between exhibit and visitor areas to reduce the potential of disease transmission from the public as well as complaints from odour. If possible, separate systems also should be maintained for individual exhibits.
- ❖ Relative humidity should be within the range of 30%-70%.



Fig 23: Night shelter with wooden platform and bedding

BREEDING ENCLOSURES:

- ❖ Wooden parqueting of the night shelter.
- ❖ While parqueting , and fixing plywood, rods must be towards outside.
- ❖ Dehumidifiers to be installed to absorb the moisture coming from outside.
- ❖ UV- light to be installed to sterilize the room and make it free from micro-organisms.
- ❖ CCTV to be installed inside the breeding room to monitor and record each and every event without disturbing the animal.
- ❖ Bedding of room with dry leaves and dry wood shavings which aid in absorbing the urine and fecal matters keeping the room clean and dry.
- ❖ Installation of thermometer and hygrometer to keep the record.
- ❖ Rods of breeding room to be shielded with ply board from inner side in order to prevent any form of casualties in the cubs.
- ❖ Floors of the enclosures to be kept dry.
- ❖ Avoid using blowers.
- ❖ Turmeric burning and sprinkling be done as anti bacterial precaution.



Fig: 24 (A)- Wooden parquetting (B) Dehumidifiers (C) UV- light (D) CCTV (E)Fixing Plywood (F) Burning Turmeric

6.3 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.

6.4 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. Slope of floor and drain be maintained accordingly
- ❖ 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.***
- ❖ ***The wooden platforms must be taken out, cleaned and dried everyday.***
- ❖ Fecal 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).
- ❖ The rods must be cleaned once every three months with blow torch. The rods that are painted must be allowed to dry, and then rubbed with soil etc to check against any lead poisoning.
- ❖ The walls of the room must be whitewashed with lime every three months.



Fig 25: Cleaning of the wooden Platform

6.5 RECORD KEEPING

- ❖ Maintenance of keeper's diary with information's 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.

6.6 METHOD OF IDENTIFICATION

- ❖ Use Passive Integrated Transponder tags in the thigh region of the left hind limb.
- ❖ A transponder reader is run on the region where the microchip is inserted to identify the animal.



Fig 26: Snow Leopard of Darjeeling Zoo

CHAPTER 7: HEALTH REQUIREMENTS

Carnivores are susceptible to a wide variety of infectious diseases. Felids are also hosts to a large number of parasites in the wild and to a lesser extent in captivity.

7.1 Known Health Issues:

Ailments of Snow leopards in different captive facilities are Mycotic pneumonia due to *Aspergillus terreus*, Lymphoic interstitial pneumonia, ovarian dysgerminoma, pancreatic carcinoma, demodicosis, feline panleucopenia virus, canine distemper virus, veno-occlusive disease, coxofemoral dysplasia, multifocal osteomyelitis, cerebral or extramedullary spinal fungus abscesses, oral and cutaneous number of papillomavirus infection sometimes associated with malignant transformation.

The frequently occurring cases in Indian zoos are as follows:

❖ **RESPIRATORY TRACT DISEASES:**

(a) PNEUMONIA:

Pneumonia is common mostly in new born cubs and sometimes in adults. The causative agent of Pneumonia is bacteria *Streptococcus pneumonia*. It is characterized by fever with chills (rapidly rising) cough characterized by rusty sputum, chest pain- stabbing aggravated by respiration and coughing, sniffing, runny nose.

(b) PIEURISY:

Pleurisy (also known as pleuritis) is an inflammation of the pleura, the lining surrounding the lungs. There are many possible causes of pleurisy but viral infections spreading from the lungs to pleural cavity are the most common. A pleural effusion is an abnormal collection of fluid in the pleural space resulting from the excess fluid production or decreased absorption. It is the most common manifestation of pleural disease, with etiologies ranging from cardiopulmonary disorders to symptomatic inflammatory or malignant diseases requiring urgent evaluation and treatment.

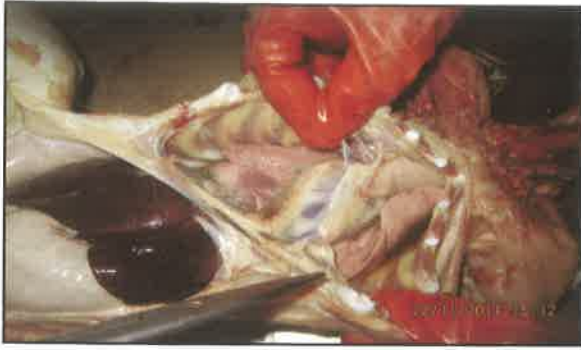


Fig 27 : Accumulation of Pleural fluid

❖ SKELETAL PROBLEMS

As mentioned by the veterinarian Consultant of PNHZPark Dr. Sanjiwan Ray in 1999, rickets (brittle bones) is a chronic malady amongst the new born resulting in stress fracture, ultimately leading to lameness, crippleness and death. It is a rare, usually inherited disorder that causes bones to break easily due to the body's low production of collagen. Main causes of Rickets are Calcium (Ca): Phosphorus (P) imbalance in the diet. Low exposure to UV-light, malabsorption of essential food constituents due to enteritis, worm infestation.



Fig 28 : Fig. : Rickets (Brittle bone)

❖ MULTIPLE OCCULAR COLOBOMA

Multiple ocular coloboma in Snow leopard, is a specific clinical entity different from the coloboma complex and so far unknown outside the felid group (Walhberg ,1978: Walhberg and Tarkkanen,1980 et al.)This entity consists of a coloboma of the upper eye lid and its complete form of a bilateral microphthalmia with uveal retinal and optic nerve coloboma, persistent primary hyper plastic vitreous and retinal dysplasia. The upper lid coloboma is the only constant feature in affected animals associated with or without any

of the ocular signs. Lid colobomas are generally regarded to be of nonhereditary origin. They may result from a localized failure of adhesion of the lid folds externally caused during the late phase of embryonic development.

❖ HEAD INJURY

In Traumatic Brain Injury (TBI) external force traumatically injures the brain. The prominent cause may be due to accidental hitting of head on some hard surface. TBI mostly affects the new Borns.

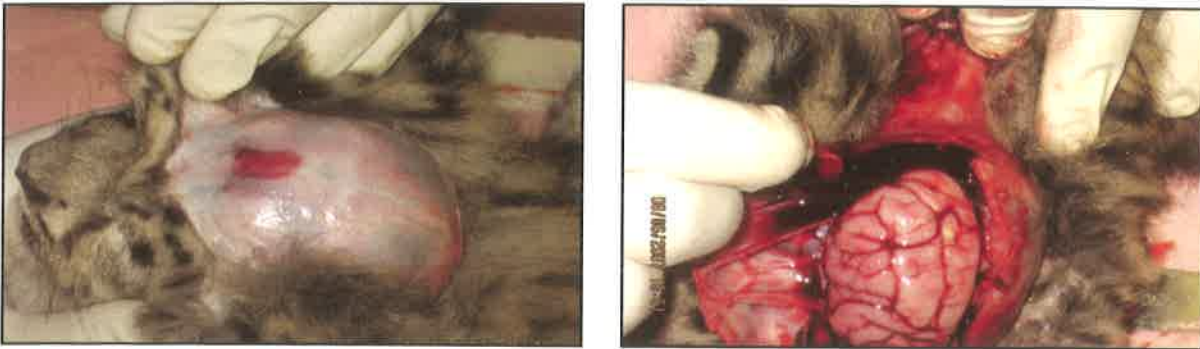


Fig 29 : Brain Injury

❖ FOOT ROT



Fig 30 : Healthy paw of Snow Leopard



Fig 31 : Foot Rot in Snow Leopard

7.2 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.

7.3 Detailed Physical Examination

- ❖ Animals immobilized for any reason should be given a general physical examination.
- ❖ Fur- check for alopecia, ectoparasites, fungal infections, trauma or evidence of fighting.
- ❖ Nose and nostril- should be clean. If discharges are present swab for test.
- ❖ Injuries.
- ❖ Dental examinations should be carried out routinely on all animals during physical examinations, as well as on individuals known to have dental problems.
- ❖ Temperature Rectal temperature can be taken through the cloaca.
- ❖ Weight- To be taken and compare to the previous weights taken
- ❖ Respiratory Rate- Normally 19-21. Per minute but panting (rapid, shallow breathing with the mouth closed) is normal in stressed or excited animals.
- ❖ Limbs- check paws and claws, Particularly treat nail infections seriously.
- ❖ Eyes- Should be clear, bright and alert, normal bilateral papillary light response, normal corneal reflex and discharge if any.
- ❖ Check pinnae for signs of fighting.
- ❖ Confirm identity via transponder reader.

- ❖ Mouth- check lips, cheek pouches, abnormal swellings, mucous membrane colour.
- ❖ Abdominal palpitation- to assess gut fill.
- ❖ Abdominal Auscultation should reveal occasional peristaltic sounds.
- ❖ Thoracic Auscultations of ventral and ventrolateral aspects of thorax usually yields clearest sounds.
- ❖ Cloaca- should be clean, check for presence of cystitis which may be associated with stained, wet, matted fur around the cloaca and check for faeces around the cloaca. This may indicate diarrhoea.



Fig 32: Detailed Physical examination

7.4 Routine Treatments:

- ❖ Regular TB testing (yearly)
- ❖ Blood iron levels tested for haemochromatosis.
- ❖ Blood sugar level for obesity.
- ❖ **Regular faecal floats for worm egg floats:**
 - *Toxocara sp* and *Ascaris sp* are the most common parasite found in captive snow leopards.
 - 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 anthelmintic.
 - Records should be kept of the results of systematic faecal examination and of anthelmintic treatments given.
- ❖ Checking microchips and locations (as they can move over time).



Fig 33: Fecal examination. Ova of Toxocara sp. and an adult Ascaris sp.

7.5 Vaccination

- Details of any vaccine given, including date of use, type, serial number and source, should be noted in the records of each individual animal.
- Vaccines must be properly stored and handled prior to use, administered correctly, and not mixed with inappropriate medications.
- Before any vaccine is given, check that the animal's ability to mount an immune response is not impaired (e.g. by malnutrition, concurrent disease, severe physiological stress, immunosuppressive drug therapy).
- The snow leopard should be vaccinated against diseases like Feline panleucopenia, feline rhinotracheitis, feline calicivirus, rabies, canine distemper, canine parvovirus and Herpes virus.
- Vaccines used are Inj. Fel-o-vac PCT (Inj TT), Biofel- PCHr and Feligen- CRP.

7.6 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.

7.7 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.

7.8 Pre-anesthesia considerations:

Environmental considerations

- ❖ 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.
- ❖ Preferably starve the animal for 24 hours, withhold water for 12-24 hours and food for 24 hours.
- ❖ 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.

7.9 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 syringe through 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.

7.10 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.
- ❖ Once the animal is recumbent and an appropriate length of time has passed, prod the animal gently and then vigorously using e.g. a long broom handle, from outside the enclosure. If the animal does not respond the prodding of the body, prod the animal's ear. If it still does not respond, it should be safe to enter.

7.11 Anesthetic 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.

7.12 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.

7.13 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.]

7.14 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.

Ketamine - Xylazine Anaesthetic Drugs for Snow leopards:

The suggested doses are as follows

TABLE VI:

Anesthetic Agents	Dosage	Drugs used in the zoo as per the content per ml
Ketamine	5-10mg/kgb.wt	100mg/ml
Xylazine	1-2 mg/kg b.wt	100mg/ml

In various sedations used doses in the park has been as below---

TABLE VII

Age	Sex	Body weight	Dose of drug used
7 years	M	36 kg	Inj. Ketamine- 4 ml Inj Xylaxin- 0.8 ml
7 years 1 month	M	37 kg	Inj. Ketamine- 4 ml Inj Xylaxin- 0.8 ml
7 years 8 months	M	37 kg	Inj. Ketamine- 2.5 ml Inj Xylaxin- 0.5 ml
7 years 4 months	M	36 kg	Inj. Ketamine- 4 ml Inj Xylaxin- 0.8 ml
7 years 10 months	M	37 kg	Inj. Ketamine- 5 ml Inj Xylaxin- 1 ml
7 years 11.5 months	M	37 kg	Inj. Ketamine- 3.5 ml Inj Xylaxin- 0.7 ml
1 year 6 month	M	32 kg	Inj. Ketamine- 2 ml Inj Xylaxin- 0.4 ml
2 years	M	33 kg	Inj. Ketamine- 3 ml Inj Xylaxin- 0.6 ml
2 year 1 month	M	33 kg	Inj. Ketamine- 4.8 ml Inj Xylaxin- 1 ml
9 years 5 months	M	38 kg	Inj. Ketamine- 4.8 ml Inj Xylaxin- 1 ml
4 year 1 month	M	36 kg	Inj. Ketamine- 2.5 ml Inj Xylaxin- 0.5 ml
12 years 4 month	M	38 kg	Inj. Ketamine- 2.5 ml Inj Xylax in- 0.4 ml
7 years 7 month	M	38 kg	Inj. Ketamine- 2.5 ml Inj Xylaxin- 0.4 ml
7 years 10 month	M	38 kg	Inj. Ketamine- 3.5 ml Inj Xylaxin- 0.7 ml
17 years 3 months	M	38 kg	Inj. Ketamine- 2.8 ml Inj Xylaxin- 0.6 ml

11 years 9 months	M	38 kg	Inj. Ketamine- 2.5 ml Inj. Xylaxin- 0.5 ml
11 years 9 months 8 days	M	38 kg	Inj. Ketamine- 2.5 ml Inj. Xylaxin- 0.5 ml
M 11 years 9.5 months	M	38 kg	Inj Ketamine - 2ml Inj Xylazin- 0.4 ml
M 17 years 11 month		37 kg	Inj Ketamine - 2ml Inj Xylazin- 0.4 ml

7.15 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.



Fig 34: Tranquilizing Equipments and Drugs

CHAPTER 8: CAPTIVE DIET REQUIREMENTS

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 preservation, growth and reproduction.

8.1 FEED

- ❖ Diets should be periodically reviewed by a veterinarian.
- ❖ Meat provided to the animal should be checked every day by a veterinarian.
- ❖ 2.5 kg per individual of Beef, Chicken and Mutton to be offered to the animal.
- ❖ The feed type can be changed every day to avoid monotony to the animal.
- ❖ Animals to be fed once or twice a day.
- ❖ Live and healthy animals should be slaughtered and given to the animals along with the blood and other organs (except intestine and stomach). **NOTE:** Avoid old and aged animal for feeding.
- ❖ Muscle meat can be replaced with kidney and liver.
- ❖ Freshly killed chickens as a whole can be provide once a week.
- ❖ Soup prepared from ox tail and chicken leg to be given to the animal on a regular basis.
- ❖ Bones to be provided that reduces the chances of Metabolic Bone disease and plague formation.

8.2 PRESENTATION OF FEED:

- ❖ Food can be delivered on display or in off limit areas, it can be placed in branches or hung in low trees, it can be scattered around the display enclosure or given in the off limit dens and fed at various times.
- ❖ Feeding of several small pieces of meat can occasionally leave the cats searching for more. This may be because they are designed to eat large amounts of meat in one sitting and this type of feeding does not provide the sensation of a full stomach.
- ❖ Meat is presented at room temperature, as it is more palatable and digested easily. .

8.3 WATER

- ❖ Filtered water to be provided to the animal both in the enclosure and off-exhibit area.
- ❖ During winter's water to be boiled and made luke warm.
- ❖ Records of water consumption to be maintained in a prepared sheet (Annexure II) to know the quantity of intake in various seasons.

8.4 SUPPLEMENTS

Supplements to be provided for seven days every month and the supplements recommended for the Snow leopards are

- ❖ Cod liver oil- 1 cap daily.
- ❖ Calcium tabs- 2 tabs daily.
- ❖ Revital caps- 1 cap daily.
- ❖ Astymin- 1 cap daily.
- ❖ Evion 400-1 cap daily.
- ❖ Liv 52- 2 cap daily for seven days.

8.5 ANIMAL TO BE KEPT OFF-FED ONCE A WEEK

Many institutions fast their cats once each week. The theory behind this is that wild cats do not necessarily eat every day. Offering the cats bones on fast night is enrichment for them and helps to keep their teeth clean. Weekly fasting may help to keep the cats from becoming obese.

8.6 RECORD KEEPING OF FEED AND BENEFITS OF DATA RECORDING

- ❖ Preparation of Diet chart consisting of: *Species, Home ID, Age and sex of the animal, Date, Time, Diet Types, Total amount given, Total Amount taken, Left out, Method of feeding and place of feeding (Live/Dressed/Enclosure/Night Shelter). Diet chart below as (Annexure I)*
- ❖ Entry of the feed following details as prescribed in the format to be recorded.
- ❖ Submission of the diet chart to the animal supervisor at the end of every month duly signed by the respective keeper.
- ❖ Can calculate average and objectively evaluate the quantity consumed.
- ❖ Knowing the quantity consumed during sickness, old age, estrus period, parturition and post partum phase and help in either increasing or reducing the quantity of the items accordingly.
- ❖ Recording leftovers has been a method to evaluate the frequency and quantity of rejection thus given an idea as to whether the animal is showing a dislike for the

a particular feed item, whether it is sick or is coming into estrus or nearing parturition.

- ❖ The data which is collected provides animal managers and nutritionist information needed to offer better diets. The overall health of the collection will, hopefully benefit from improved dietary and management programs.

8.7 FEEDING ERRORS:

- ❖ Overfeeding can lead to obesity. Excessive body weight can increase the risk of liver and heart disease including respiratory problems and constipation. Furthermore, obese cats are at greater risk of developing diabetes and arthritis.

8.8 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. Gut material that is removed from large carcasses should be frozen and then disposed of in landfill.
- ❖ Leftover food should be removed properly. Provision must be made for disposal of food wastes to minimize their attractiveness to vermin as well as production of odours and disease hazards.

8.9 Suggested guidelines by Indian Veterinary Research Institute (IVRI) for feeding the Snow leopard (*Uncia uncia*)

1. For an average sized male 2.5 kg of meat for an average sized female 2 kg meat will be adequate.
2. Mutton should be better source of nutrients than beef.
3. Food should be offered in the latest hour of the afternoon as would be practicable for the management. One time feeding is sufficient except for nursing mothers whose total ration may be divided into 2-3 equal meals.
4. If excessive amount of bone is left over than precaution might be taken. In such a case, Calcium carbonate may be supplemented @ 7g/kg meat.
5. A few drops of vitamin A concentrate may be supplemented. Most important is regular monitoring of body condition. Diets should be modified accordingly with response to change in body weight.
6. Water should be made available at all times.

CHAPTER 9: CAPTIVE BEHAVIOURAL PROBLEMS

9.1 SIGNS OF STRESS: Stress can be difficult to assess with captive felids and sometimes the symptoms are very subtle. Typically once they become apparent you may be witnessing signs that are detrimental and self abusive to the individual animal. Plucking of hair from the tail and constant licking of a limb can occur as well as the usual stereotypic behaviours such as pacing and head swinging, loss of appetite, excessive aggression or cowering behaviour. These are all signs of stress, which can be displayed by captive felids and if they are occurring every endeavor available at the keeper disposal should be employed to alleviate the stress from continuing.

Captive carnivores are known for exhibiting stereotypic, self destructive or abnormal behaviours. These behaviours can include over activity, inactivity, pacing, head swinging and over-grooming, many of which are frequently observed in bears, felines, canids, weasels, civets and hyenas. These activities may be a method for animals to cope with inadequate, sterile environments, or they could be expressing redirected searching behaviour such as mate finding, home range patrol, or hunting .Loud noises, construction, small quarters, being locked inside, expectations of food, once- a day feeding, scheduled feedings, and lack of novelty may also contribute to these behaviours. Evaluation of abnormal behaviours can help staff determine what action should be taken to discourage these undesirable behaviours (Carlstead, 1998).

9.2 Common Captive Behavioural needs

It is accepted that the captive environment will differ from the wild environment in a number of ways, such as life threatening challenges by predators, diseases and hunger. Thus captivity should take this natural behaviour into consideration hence- The aim of developing an appropriate psychological environment should not be to mimic nature exactly but to create facilities that enable the animal to carry out a programme of activity similar in complexity to that which it undertakes in the wild.

Appropriate enclosure design and management, including enrichment is important to fulfill the behavioural requirements of the animal i.e to express most normal patterns of behaviour and freedom from fear and stress. Thus certain factors should be considered.

- ❖ Stability and security e.g dens, elevated resting places, provision of places to hide from humans and other animals.
- ❖ Appropriate complexity.

- ❖ An element of novelty/unpredictability providing the opportunity for exploratory behaviour.
- ❖ The ability to make choices.
- ❖ Opportunities for play.

9.3 BEHAVIOURAL ENRICHMENT ACTIVITIES

TABLE VIII:

❖ Enrichment Designing

SI No.	Enrichment Type	Goals Behaviours targeted	Set up	Remarks	
1	Exhibit enrichment	<p>Climbing structures: Trees, wooden poles, ropes, logs and rocks</p> <p>Weather considerations rain cover, shade structure, sunny spots and wind brakes</p> <p>Substrate for lying sleeping: grass, hay, straw, leaves</p> <p>Substrate for scrapping: sand, grass, mulch, rotten logs</p> <p>Visual barriers: log piles, trees, rocks, caves, dens</p> <p>Option for hanging High raised platforms</p>	<p>An increase in exploration and play</p> <p>An increase in predatory and foraging behaviour (moving about to look for "prey" stalking, killing, and consuming of "prey")</p>	<p>Maintain exhibit with a variety of substrates, dirt, leaves, mulch, woodchips, short medium and tall grass.</p> <p>Exhibit modification, placement of large logs.</p> <p>High platforms can be built by wooden logs, provide them with high vantage points</p>	<p>Can become a permanent exhibit feature and adjusted based on conclusions.</p> <p>This can be a permanent exhibit feature, as the snow leopard love to sit on high points and make a surveillance.</p> <p>The caves should not be dark and should be constructed a little higher in the ground.</p>

2	Dietary Enrichment	<p>Variable feed items</p> <p>Different forms of feed presentation and randomization of feeding times</p> <p>Live animal feeding</p> <p>Mix of whole versus processed chopped feed</p>	An increase in predatory and foraging behaviour and promote prey location instinct.	<p>Regularly meat are tied with a rope and hanged at different heights.</p> <p>Regularly meat is placed in some other places than their normal feeding cells in late evening.</p>	At least a two week interval for this activity to avoid habituation
3	Social Enrichment	Compatible individuals left in the enclosure	Social opportunities i.e. species appropriate groups.	Individual of opposite sex kept for socialization	Successful mating, enhanced behavioural activities.



Fig 35 : Artificial Caves in the enclosure



(A)



(B)



(C)



(D)



(E)



(F)



(G)



(H)



(I)



(J)



(K)



(L)

Fig 36 A: Rocky structure Fig B: Ledges Fig C& D: Natural plantation for shades Fig E: wooden platform Fig F: wooden platforms Fig G: rocky substrate Fig H: artificial caves Fig I: logs for walkways Fig J, K & L: Feeding enrichment

9.4 INTRASPECIFIC COMPATIBILITY: Aggression may occur when two males or two females are housed together after they have reached sexual maturity. It is advisable to remove any offspring before this occurs if housed with their mother.

9.5 Animal health and Safety Considerations.

- ❖ Veterinary and staff approval is important when designing enrichment ideas.
- ❖ Animals should be observed for problems when offered new enrichment.
- ❖ Furnishings should be secured so that they cannot fall onto an animal.
- ❖ Construction methods should aim to prevent the animals from dismantling any structures.
- ❖ Structures for climbing or resting must be strong enough to take the weight of the animal.
- ❖ Check that substrates provide good footing, substrates preferably should not cause intestinal impaction if eaten.
- ❖ Care must be taken to ensure that food provided for enrichment, and methods of feeding do not present a health risk.

9.6 ANIMAL INTRODUCTIONS

- ❖ Whether introducing animals or introducing animals to a new enclosure it is best to take some precautions it is recommend that the introductions occur first thing in the morning and not on a weekend.
- ❖ This will allow time to evaluate the success or failure of the introduction and provide ample staff to monitor the situation.

- ❖ The veterinary team should be notified that introductions are taking place so they have the appropriate emergency equipment on standby if necessary.
- ❖ Extra experienced carnivore staff that are familiar with the operating procedures of the area should be made available to monitor the introductions. This can also be used as an opportunity to train new staff in the process, though they should not be relied upon to assist.
- ❖ All staff involved in the introductions should have a two-way radio. Animals that are being introduced should never be forced out onto display and should be allowed to go out at their own speed. The following is a list to assist in a successful introduction.
- ❖ Prior to any initial introduction, the male and female should be housed next to each other for a few days without visual contact. They can, however, hear, and smell one another.
- ❖ The animals should be comfortable with staff and the off limit facility before introductions to the display. This includes moving from den to den and around the off limit area easily. The animals should be allowed alternated days on display before introducing them to each other. This permits each cat to be aware and investigate the presence of another cat nearby through olfactory recognition of marked spots and other deposits in the display.
- ❖ Wait until the female comes into oestrus to make the physical introduction. She may vocalise, increase the amount of foot scuff marks around the display, neck-rub on various parts of the exhibit, frequently roll on her back and display lordosis posture at this time.
- ❖ The initial introduction should take place in an area where the animals can be easily controlled. This may mean only in the off limit area away from the main display enclosure.
- ❖ Staff should be placed around the exhibit with CO2 fire extinguishers and water hoses in case the animals needed to be separated. Cats should be allowed aggressive or defensive physical contact lasting up to 30 seconds before attempting to separate the cats. It is also recommended that aggression initiated by the female be allowed as long as no serious injuries occurred. Veterinarians may advise the use of a calming treatment such as "Clomicalm" if animals are overly aggressive.
- ❖ The female should be released into the off limit yards first. When she is comfortable the male can be introduced. It is recommended that the animals have access to both off limit dens and off limit yards to create a circuit for possible escape from each other. If your facility does not have an outside off limit yard then the display and off limit dens should be used. Once it is established that the introductions are going well, it is possible to give the animals access to the larger display enclosure as well as the off limit areas.

- ❖ Animals should be monitored continuously throughout their first days together on display.
- ❖ Fire extinguishers should be kept in easily accessible locations for the first week thereafter. The animals should continue to be housed separately when off display or being fed until experienced staff members are comfortable that there will be no aggression. When animals are compatible they may not need to be separated and can remain together all evening.



Fig 37 : Snow Leopard Cub.

CHAPTER 10: Reproduction and Development

The female Snow Leopard reaches sexual maturity in captivity at around 2-3 years while males take around 4 years. The age of specific fertility rate for captive snow leopards increases with age until six years for females and eight years for males. After these peaks, fertility decreases until the end of the life span. Although 5 % of both sexes start to reproduce before they have reached their third year of age, the main reproductive life span is from three to 12 years. Males have a longer potential reproductive life than females with 11 % successful breeders at the age of 16-17 years (Blomqvist 2002).

10.1 Oestrus period

- ❖ The time of the oestrus is not always the same. This is probably the effect of captivity.

10.2 Oestrus detection

- ❖ Oestrus usually lasts for five to six days.
- ❖ A strong sign of oestrus is an increase in the time spent rolling, female in oestrus have a significant increase in rolling behaviour and captive males and females will produce more scuff marks from their hind legs.
- ❖ Head rubbing at specific spots like wooden logs, dens, tree trunk and grass field.
- ❖ The Flehmen behaviour is also often seen.
- ❖ Often the female presents herself to the male by walking in front of him with her tail raised in the air so that her anal region is clearly visible.
- ❖ Vocalizations from both male and female are prominent in oestrus.
- ❖ Monitor and record oestrus cycle in captivity as a management tool.

10.3 Copulation

- ❖ Copulation takes place over a period of three to six days.
- ❖ Mounting without copulation may occur one or two days before oestrus.
- ❖ An introduction of one hour in which copulation does not occur is usually a sign that full oestrus has not yet begun.

- ❖ During copulation the male usually grips the fur on the female's neck when he mounts. After the last thrust and with the occurrence of full immissio penis, the male gives a loud piercing yowl.
- ❖ Sometimes aggressiveness is observed.



Fig 38: Copulation in Snow leopard

10.4 Behaviours to Confirm Pregnancy in Snow leopard

- ❖ Snow leopard may show little or no behavioural changes until just prior to birth when exposure from the fur indicates an impending birth.
- ❖ Increase in the frequency of licking and cleaning of the vaginal area indicates imminent parturition.
- ❖ Less active.
- ❖ Resting at one particular place for a maximum time.
- ❖ Moderate weight gain which may not be physically visible till the third month. During this time extra food can be made available for the dam to compensate for the developing fetus.
- ❖ Change in the body shape, slight bulge in the hind quarters.
- ❖ Two days prior to birth the female will start rejecting her feed.

10.5 Gestation period

- ❖ Gestation period of snow leopard lasts from 97-127 days.

10.6 Birth and Litter Size

- ❖ Birth usually lasts two or three hours.
- ❖ New born snow leopard weighs from 300 to 380g.
- ❖ Eyes remains closed at birth. Eyes open in seventh and ninth day.
- ❖ Litter size have been reported to be one to five cubs per litter, though most litters comprise one to three cubs.
- ❖ Birth usually occurs in the late evening or early morning hours.



Fig 39: Snow leopard cubs

10.7 Managemental Interventions pre and post birth

- ❖ During the week before parturition, and for at least the first week after, foot and vehicle traffic around the den building should be monitored and severely limited.
- ❖ Breeding room to be provided with wooden platform, and wood parqueting around the walls of the room. Walls of the breeding room to be white washed.
- ❖ The breeding room and the keepers working area to be kept absolutely dry, warm and moisture free.
- ❖ The breeding room should be completed at least one month prior to birth, to allow the female prior to changes.
- ❖ Wet cleaning of the breeding room to be avoided. A clean cloth can be used to mop the floor and the surrounding area of the breeding room.
- ❖ Installation of dehumidifier to absorb the moisture coming from outside.
- ❖ Installation of UV-light to sterilize the room and make it free of any micro organisms.
- ❖ Installation of CCTV inside the breeding room to monitor and record each and every event without disturbing the animal.

- ❖ Bedding of room with dry leaves and dry wood shavings which aid in absorbing the urine and fecal matters keeping the room clean and dry.
- ❖ Installation of thermometer and hygrometer to keep the record.
- ❖ Rods of the breeding room to be shielded with ply board from inner side in order to prevent any form of casualties in the cub.

10.8 Precautions to be taken during the rearing of snow leopards

- ❖ Note down their sleeping time, feeding time and other activities like playing, auto grooming etc.
- ❖ Try to not down their day to day respiration rate.
- ❖ If the cub is resting/sleeping for a longer period than inform the higher authority and look into the matter because sleeping for a longer period is also not so good to any animals.
- ❖ While handling the animal, use mask and gloves and make sure that not more than two persons are engaged in handling the cub.
- ❖ **Assisted rearing:** It is recommended that cubs be mother-reared unless specific medical or behavioural issues would prevent this from being successful. Females that neglect the cubs should be carefully monitored, as hand rearing may be necessary in these situations.

10.9 Rearing Conditions

- ❖ Cubs should be kept relatively cool (21-23 degree celsius) to prevent excessive hair loss.
- ❖ Bedding materials should be provided for comfort and temperature regulation, and must be changed as snow leopards cub produce copious amount of urine.
- ❖ Cubs to be fed with femoral bone twice in a week as a source of calcium at the age of three months which helps in bone formation and to keep healthy teeth and gums.
- ❖ The cubs to be exposed to morning sunlight which has the maximum UV for bone development.
- ❖ A detailed nursery diary should be kept recording date, time fed, amount fed, body weight, urination/defecation, faecal condition.
- ❖ By 7th week the frequency in nursing by snow leopard slowly goes on diminishing which is clearly indicated by the drop in duration of milk intake by the cubs.

NOTE: Rectal temperature at birth range between 32.2° C-33 ° C. The cubs open their eyes between seven and ten days. The new born cubs will cry when they are hungry and sometimes stray from the warmth of their mother.

10.10 Cub Ontogeny

- ❖ Starts sniffing the mother and feed on reaching thirty to forty days.
- ❖ Enrichments like wooden balls, hanging logs, ledges and tree trunks to be provided for the cubs.
- ❖ Body weight to be taken at regular intervals. Difficulty in physically handling the cubs after seventeen weeks hence a squeeze cage is highly recommended in the breeding den where the animal can be physically restrained and record of its weight and other parameters can be recorded.
- ❖ Developmental events such as ***Eyes open, Social play, Upright walk, upper canine visible, Emerge out in the enclosure, first instance of cub sniffing the bone etc.***

10.11 Feed and Vitamin Supplements for the Lactating Mother

- ❖ Soup to be provided to the animal.
- ❖ Beef, Chicken and Mutton to be provided.
- ❖ Vitamin supplements to be provided.



Fig 40: Snow leopard's cub.

6	Teesta (Female)	113	113	88	94	98	98	113	113	179	179	103	107	79	79
7	Kim (Female)	109	109	88	90	94	94	121	127	175	175	107	111	87	89



Fig 41: Snow Leopard

CHAPTER 11: GENOTYPING OF SNOW LEOPARD SAMPLES

Seven (4:3) Snow leopard blood samples were send from Padmaja Naidu Himalayan Zoological Park, Darjeeling to LaCONES (laboratory for Conservation of Endangered Species) Hyderabad to access the genetic health of the captive Snow Leopards for future involvement in the Conservation of Breeding program of Central Zoo Authority.

11.1 Procedure for genotyping (DNA testing) of the samples: Genomic DNA was extracted from the blood samples of seven (4:3) Snow leopard using Phenol-Chloroform extraction procedures. These DNA samples subjected to PCR amplification using primers for nuclear microsatellite loci. Fluorescent- tagged amplification products were size fractionated and visualized on ABI 3730 DNA sequencer, an allele size was determined using Gene Mapper 3.1 software. The genetic status of the individual was accessed in terms of its being heterozygous /homozygous at each locus.

11.2 Results of examination: Genotypes Allelic distribution of seven (4:3) Snow leopard samples for seven microsatellite loci are given in table 25. The male Prabhat and Female Kim was found to be heterozygous at more number of loci (6 out of 07) as compared to other individuals.

TABLE IX:

Animal Identity		LOCUS													
SI No.	Animal ID	L1	L1	L2	L2	L3	L3	L4	L4	L5	L5	L6	L6	L7	L7
1	Tyson (male)	109	113	94	96	98	98	121	123	177	177	107	107	79	79
2	Prabhat (male)	109	113	88	96	98	98	121	123	177	177	107	111	79	87
3	Karan (male)	109	113	88	88	98	98	113	121	173	173	103	111	79	79
4	Budh (male)	113	113	88	94	98	98	121	121	173	173	103	107	79	87
5	Yashmin (Female)	113	113	88	96	98	98	123	123	177	177	103	107	79	79

CHAPTER 12: REINTRODUCTION PLAN OF THE SNOW LEOPARD

Earlier reintroduction projects using wild-caught animals are more successful than those using captive-born animals. Wild caught carnivores are more likely to survive than captive born carnivores and that this trend appears to remain consistent across species and families.

Taking the above review result, a new conservation breeding facility for Snow leopard have been developed in a 5 hectare area at Topkey Dara 3rd Mile, Darjeeling. The site is as close to the natural habitat of the Snow leopard on a sunny aspect and will experience snowfall at an altitude of 6800-6900 feet. The breeding centre houses two open enclosure with an area of 45x30 meter attached with six night shelters and two crawl areas. Each night shelter is provided with skylight for adequate sunlight and ventilation for proper aeration. The night shelters are also provided with wooden platforms. The slopes in the enclosures are gentle, furnishings have been provided at various points in the enclosure with rocky substrate at certain points. The facility aims towards the following goals:

- Less human interference: The facility itself is isolated and away from human habitation, one of the major factors towards preparing the species for reintroduction.
- Large enclosure and undulating slopes allowing the animal to exhibit normal activities.
- Live feeding practices to sharpen their hunting instinct and slowly getting rid of the habit of eating prepared feed in a tray.
- These form of practices to be continued until the animal is released.
- No manipulation for managemental practices with the environmental factors in the breeding centre. Animal to be made accustomed accordingly.
- In the Coordination Meeting on Snow Leopards Conservation Breeding Program held at Central Zoo Authority on 6th June 2014 it was decided that the facility of Darjeeling Zoo at Topkey dara should be used for housing wild/ rescued animals with an objective of releasing back to the wild. The release of animals if any should have linkages with the MoEFs Species Recovery Plan and Project Snow Leopard with the provision of the soft release facility.
- The committee also recommended that the facility created at the zoo should have a CCTV monitoring including organizing PHVA on snow leopard in consultation with CBSG South Asia.

CHAPTER 13: DISASTER MANAGEMENT

13.1 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.

13.2 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.

13.3 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 42: Snow Leopard

**CHAPTER 14: FUTURE PLANS AS PER THE COORDINATING MEETING ON
“SNOW LEOPARD CONSERVATION BREEDING PROGRAMME” HELD ON 6TH
JUNE 2014 AT CENTRAL ZOO AUTHORITY, NEW DELHI**

- ❖ Organizing PHVA on Snow leopard in consultation with the CBSG, South Asia to be held at New Delhi during August 2014. Before this status report from range countries to be obtained.
- ❖ Next meeting of the Snow leopard Conservation Breeding to be held at Ladakh during March 2015.
- ❖ Regional and International cooperation with Nepal, Pakistan, Bhutan and link with GSMP, CBSG, WAZA and foreign zoos (Helinski, Zurich, Leipzig, Nurnberg and others).



Fig 43: Snow Leopard

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Fig 44: Snow Leopard

KEEPERS DIARY

(ANNEXURE II)

Name of the Zoo keeper_____

Beat No_____

Day and Date_____

SI 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

3. MEDICAL RECORDS.

ANIMAL TREATMENT CARD (ANNEXURE IV)

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

Transponder No:

Date	Symptoms	Treatment	Clinical Note

ANIMAL DEWORMING CARD

(ANNEXURE V)

Species:

House name:

Date of Birth:

Beat No.

Transponder No:

Date	Findings	Medicine used	Remark

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	Remarks

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.....

(a) Skull

B Thorax.....

(b) Cervical vertebrae

(c) Lungs

C. Abdomen.....

(d) heart

(e) Ribs

D. Pelvic Girdle.....

(f) Liver

(g) Stomach

E Limbs.....

(h) Intestine

(i) Kidney

2 Any other special features

(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:

PADMAJA NAIDU HIMALAYAN ZOOLOGICAL PARK (ANNEXURE VIII)
DARJEELING

NAME:

SEX:

REFERRED BY:

DATE:

STOOL EXAMINATION REPORT

PHYSICAL EXAMINATION

Color:

Consistency:

Worms:

Mucus:

Blood:

CHEMICAL EXAMINATION

Reaction;

Occult blood:

MICROSCOPIC EXAMINATION

Pus cells:

R.B.C:

Undigested starch:

Ova of

Cyst of

Others

(Vet attendant)

Veterinary officer)

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 SNOW LEOPARD (*Uncia uncia*) (ANNEXURE X)

NAME OF THE SPECIES:

HOUSE NAME:

AGE:

SEX:

<i>Date</i>	<i>Time</i>	<i>Diet Type</i>	<i>Total amount given</i>	<i>Total Amount taken</i>	<i>Left out</i>	<i>Method of feeding and place of feeding (Live/Dressed/Enclosure/Night Shelter).</i>	<i>Remarks</i>

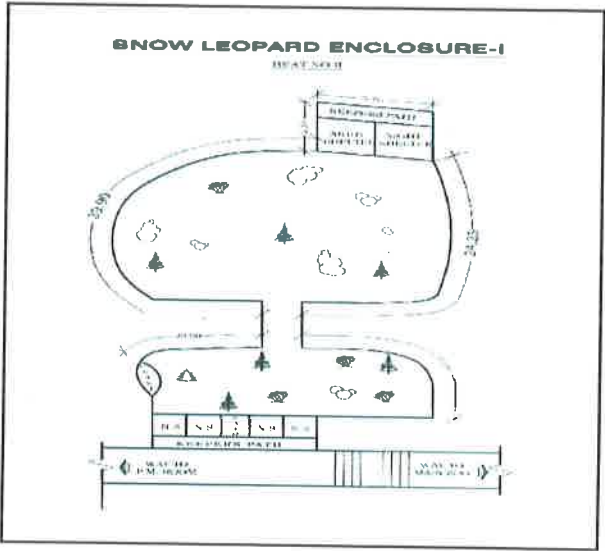
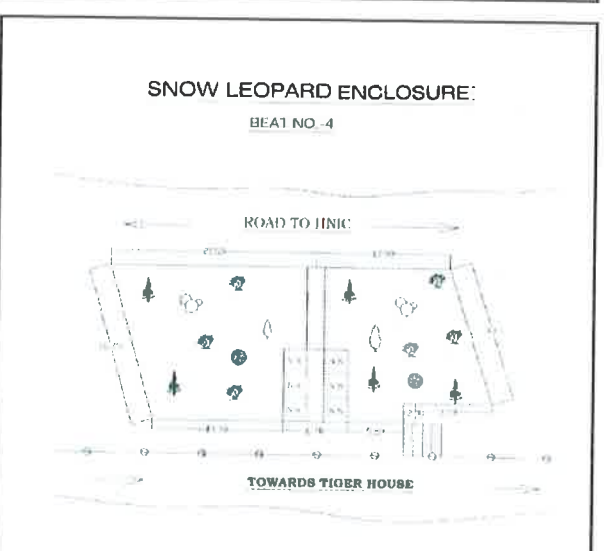
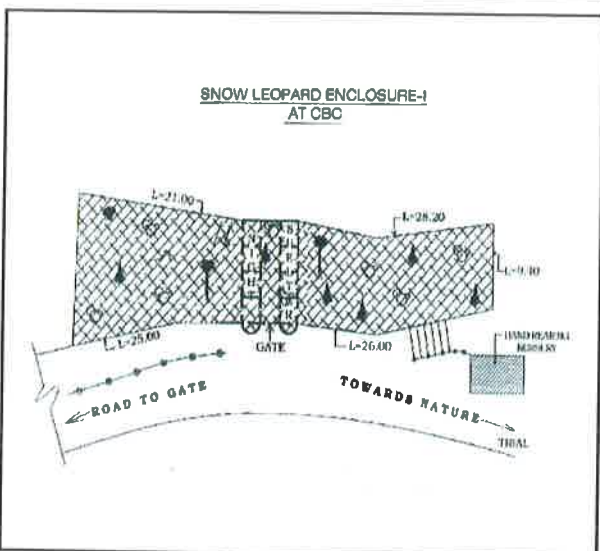
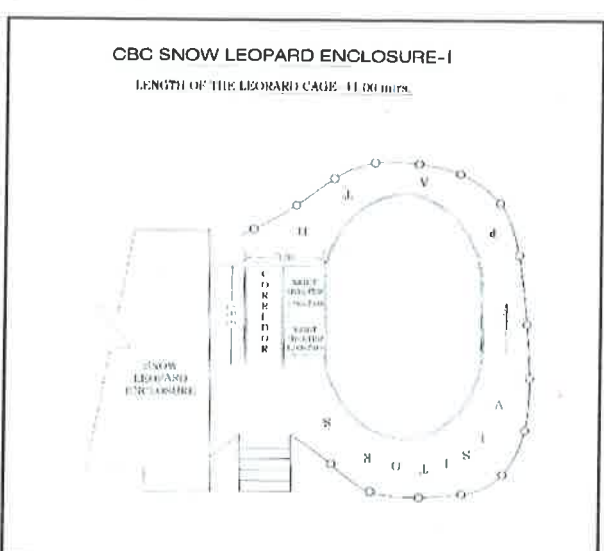
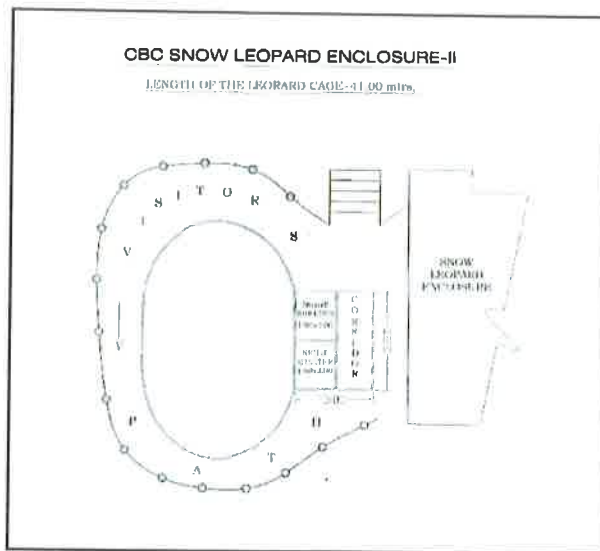
WATER COMSUMPTION BY SNOW LEOPARD (*Uncia uncia*) (ANNEXURE XI)

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

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

SL No.	Name of the Animal	Total water given (in Its)	Water consumed (in Its)

MAPS OF SNOW LEOPARD ENCLOSURES :





PADMAJA NAIDU HIMALAYAN ZOOLOGICAL PARK

Darjeeling-734 101 (West Bengal) India
Tel.: 91-354- 53709 (Off), 2270126 (Breed Centre), 2252522 (Fax)
e-mail : pnhzp@yahoo.com

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