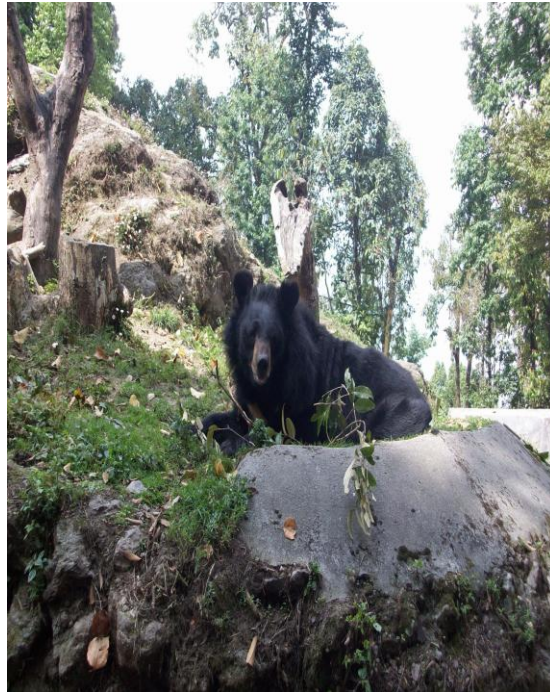


Behavioural study for the conservation breeding of Asiatic black bear (*Ursus thibetanus*) in Padmaja Naidu Himalayan Zoological Park, Darjeeling



**Padmaja Naidu Himalayan Zoological Park,
Darjeeling West Bengal-734101, India**

THE PROJECT IN BRIEF

1. **Name of the Project:** “Behavioural study for the conservation breeding of Asiatic black bear (*Ursus thibetanus*) in Padmaja Naidu Himalayan zoological Park, Darjeeling”
2. **Name of the Zoo/Organization:** Padmaja Naidu Himalayan Zoological Park, Darjeeling
3. **Project Leader:** Shri A.K. Jha, IFS, Director, PNHZP
4. **Duration of the Project:** From 21/05/2007- 20/05/2009
5. **Location of the Project:** Padmaja Naidu Himalayan Zoological Park, Darjeeling
6. **Region/ State:** West Bengal
7. **Closest main city:** Darjeeling
8. **Principal Investigator:** Mr. A.K. Jha
9. **Research Associate:** Miss Upasana Rai
10. **Period to be spent on the project:** 48 hrs/week for two years
(day/month/year)
11. **Total cost of the Project:** Rs 8 Lakhs for two years

12. SIGNATURE

Director
PNHZP,
Darjeeling

Project Leader

Research Scholar

Signature
Date
Seal

Signature
Date

Signature
Date

Acknowledgements

The present project on “Behavioural study for the conservation breeding of Himalayan” was started as a short term project under the funding from Central Zoo Authority, India. The research was conducted by **Miss Upasana Rai**, on behalf of PNHZ Park, Darjeeling from 21/05/2007 to 9/06/2009.

Thanks are to the Member Secretary, CZA and Research staff of CZA for helping the research student PNHZ Park for proper guidance as well as drafting technical inputs. Deep gratitude also goes to the Director Veterinary staff and other staffs of various zoos in India to whom contact was established for collection of data and other inputs in course the research project.

The faculty members of the Wildlife Institute also helped the research project. All the staff of PNHZ Park, particularly the zoo keepers helped the research students in preparing the final report in active association with office of the Director, PNHZ Park, Darjeeling.

The aim of the study is to provide basic information on upkeep and healthcare of the Asiatic black bear which is necessary for upkeep & healthcare and planned conservation breeding of black bear in captivity. Most of the information of this report is extracted from the sources mentioned in the reference list and acknowledge them in the best spirit.

Director
PNHZ Park,
Darjeeling, W.B.

Disclaimer:

This report is prepared by the Padmaja Naidu Zoological Park Darjeeling and views expressed in the final report may not necessary reflect those of the Central Zoo Authority. The Padmaja Naidu Zoological Park may be contacted for more information or clarification on the content described in the report.

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1. INTRODUCTION:

The ursidae family consists of eight species of bear (AZAABAG), 1997), most of which are closely related, the evolutionary exceptions being the spectacled bear and giant panda. They are generally omnivorous, have a slow reproductive rate, good climbers and to do with an exceptional sense of smell. They have long maternal dependency, and cubs are born in poorly developed state. (Indian Zoo Year Book, Volume – IV (2006). Asiatic black bears (*Ursus thibetanus*) are distributed in a wide range of temperate habitats in Asia from Southern China to Russian Manchuria, and Iran to Japan (Reid et.al 1991). The average weight of an adult male bear ranges from 90-160kg and that of an adult female from 70-130 kg whereas some well-fed individuals may weigh as much as 200 kg (males) and 170 kg (females) (Walker 1975, Macdonald 1984). It is general biological exception that male bears are larger at all ages than female bears (Mc.Roberts et.al 1998).

The coat colour is generally jet black, with a distinct white crescent shaped mark on the chest (Shrestha et al. 1997). The life expectancy is said to be approximately 24 years in the wild (MacDonald 1984). Ecologically, Asiatic black bears are equivalent to American black bear (*Ursus americanus*) in terms of the body form, size and food habits (Schaller et al. 1989, Reid et.al. 1991). The Himalayan region and the hills of north east India probably support one of the largest populations of Asia. Asiatic black bears live in forested mountain habitats (1,200-3,300m) in the states of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Arunachal Pradesh, Sikkim, West Bengal, Mizoram, Meghalaya and Tripura. Asiatic black bears were reported to occur in 53 protected areas (PAs) and in 62 other localities but their population status is not known. The potential range of Asiatic black bear habitat in India is estimated to be about 14,500 km of which 5% is in PA's Asiatic black bears are decreasing in many areas due to

- Large scale habitat degradation.
- Poaching for gall bladder and skins.
- Control to reduce crop degradation (Journal of Bombay Natural History Society. Manuscript No.J2812; Distribution and Status of Asiatic Black bear (*Ursus thibetanus*) in India, 2005 S.Sathya Kumar, A. Choudhury). Currently CITES (Convention on International Trade of Endangered Species of Wild Fauna and Flora) lists the Asiatic Black bear as Appendix I species and categorized as Vulnerable by IUCN (2002). The IUCN/SSC Bear Specialist group has also stated that the Asian bears are the group in most urgent need of detailed priority actions (Herrero and Servheen).

This medium-sized black-coloured bear has a lightish muzzle and ears which appear large in proportion to the rest of its head, especially when compared with other species of bears. There is a distinct white patch on the chest, which in the shape of the 'V' and white on the chin. A brown colour phase also occurs. There is often a mane of longer hairs at the neck and shoulders. The ears are rounded and very prominent. The claws are short and very strong and quiet useful when climbing trees. This bear is a good tree climber.

Like all bears, the black bears is plantigrade, which means that it can walk with its entire foot like a human rather than on its toes like dogs and cats, which are digitigrade. They can also stand up in their hind legs for extended periods of time, which makes them look rather human. Bears also tend to sit down on their rear end with their upper body off the ground, like a person, too. They have a very short, stubby tail, just like all other bears.

1.1 Taxonomy of the species: Systematic Position

- **Common Name:** Asiatic Black Bear, Moon Bear & Tibetan Black bear
- **Scientific Name:** *Ursus thibetanus*

Kingdom: Animalia

Phylum: Chordata

Sub Phylum- Vertebrata

Class- Mammalia

Order- Eutheri, dog

Family – Ursidae

Sub Family – Ursinus

Species- *Ursus thibetanus*

- **Evolutionary Relationship**

The origin of the bears can be traced back to the raccoon – sized, dog like Cephalogale from the middle Oligocene and early Miocene (approximately 20-30 million years ago) of Europe. Cephalogale gave rise to a lineage of early bears, the genus Ursavus. This genus radiated in Asia and ultimately gave rise to the first true bears (genus *Ursus*) in Europe, 5 million years ago. Judging from appearances, one would scarcely suspect that there is a mode, and show that dogs and bears are descendants of a common ancestral stock. Different modes of life adapted by their forbearers led to the development of those differences in structure now so apparent in the two families. The progenitors of the dogs became hunters and learned to take their prey by swift and enduring chase. They developed slender sinewy limbs and compact short – clawed feet fashioned for swift movement over the ground. . The progenitors of bear chose different way of life. They probably lived as bears live now, on grasses, roots, herbs, fruits, and insects, eating meat only when opportunity offered. The getting of such food did not require swift and agile movement, but rather legs built for climbing and digging. Hence the bear’s massive limbs, which carry its heavy body, up the rocks and cliffs and trunk, and its great claws which help it to climb and dig. As a family, bears are easily recognized. A big head set with small eyes and rounded ears, a heavy body built on the thickest limbs, and a tail so small that it is scarcely seen under the coat – that is a word picture which describes all bears. The paws are short and broad, five – toed and furnished with long curving non-retractile claws. (S.H. Prater, The Book of Indian Animals 1980).

Bears are the members of the order carnivore, suborder Caniformia, and family Ursidae. Others members of the Caniformia include wolves and other – dog like mammals (family *Canidae*), weasels, badgers, and allies (family *Mustelidae*), raccoons (family *Procyonidae*), walruses (family *Odobenidae*), seals (family *Phocidae*) and sea lions (family *Otariidae*), although bears are often described as having evolved from a dog- like ancestor, their closest living relatives are the pinnipeds (walruses, seals, and sea lions). Up to seven sub- species are recognized (Ellerman and Morrison – Scott 1951).incredibly, the species was described by Cuvier in 1823 based on the letter sent to him by M. Duvaucel, in which was described three species of bear (Cuvier, 1823). Cuvier decided that one of these was a new species based on the process of elimination, so he simply reprinted the letter in brackets that he was naming the new bear *Ursus thibetanus* even though he had not seen a single specimen.

Other sub- species:

japonicus: the Japanese race was described by Schlegel in 1857. Pocock (1933) describes this as a good guess, but points out that Japanese bears are smaller than those on the mainland.

formsanus: Swinhoe (1864)described the Taiwanese race on the basis of a skin that lacked head and paws. It is said to be intermediate in size between the Japanese and Tibetan sub-species.

gedrosianus: Blanford (1877) described this sub- species of Asiatic black bear from Baluchistan on the basis of a single brown skin and he suspected that it was really a race of brown bear, *Ursus arctos*. In 1888 he retracted the name, because he believed that it was based on a discoloured skin, but this sub-species continues to be recognized.

ussuricus: in 1901 Heude described the sub species of northers china, Korea and Manchuria from a single skull of an immature animal (Pocock, 1933).

Table 1: Taxonomic designations for the bears.

Common name	Eisenberg [72]	Ewer [73]; Corbet & Hill [74]	Zhang & Ryder [75]	Thenius [76]; Wozencraft [77]	Hall [28]; Nowak [29]; Yu [4], this study
giant panda	<i>Ailuropoda melanoleuca</i>	<i>A. melanoleuca</i>	<i>A. melanoleuca</i>	<i>A. melanoleuca</i>	<i>A. melanoleuca</i>
spectacled bear	<i>Tremarctos ornatus</i>	<i>T. ornatus</i>	<i>T. ornatus</i>	<i>T. ornatus</i>	<i>T. ornatus</i>
Asian black bear	<i>Selenarctos thibethanus</i>	<i>S. thibethanus</i>	<i>S. thibethanus</i>	<i>Ursus thibethanus</i>	<i>U. thibethanus</i>
sloth bear	<i>Melursus ursinus</i>	<i>M. ursinus</i>	<i>M. ursinus</i>	<i>M. ursinus</i>	<i>Ursus ursinus</i>
sun bear	<i>Helarctos malayanus</i>	<i>H. malayanus</i>	<i>H. malayanus</i>	<i>H. malayanus</i>	<i>Ursus malayanus</i>
polar bear	<i>Thalarctos maritimus</i>	<i>T. maritimus</i>	<i>Ursus maritimus</i>	<i>U. maritimus</i>	<i>U. maritimus</i>
American black bear	<i>Ursus americanus</i>	<i>Euarctos americanus</i>	<i>E. americanus</i>	<i>U. americanus</i>	<i>U.americanus</i>
brown bear	<i>Ursus arctos</i>	<i>U. arctos</i>	<i>U. arctos</i>	<i>U. arctos</i>	<i>U. arctos</i>

1.2 Conservation Status:

- **Appendix I Species**, CITES (Convention on International Trade of Endangered Species of Wild Flora and Fauna).
- **Vulnerable by IUCN** (International Union for Conservation of Nature and Natural Resources).
- Under the **Indian Wildlife Protection Act** the Asiatic Black Bear comes under Schedule II.

2. IDENTIFICATION METHOD:

2.1 Individual Identification (e.g. banding, photographs):

Animal may be marked through leg band, ear tags or radio transponders. It is recommended that all the identified species covered under planned conservation breeding should have transponders implanted for identification. Marking of individuals must be done by authorized individuals in accordance with the conditions of the relevant authority to hold.

No records of any identification methods used in any of the Indian zoos so far visited or information gathered from other zoos.

2.2 Sexing Methods

No problem where you have prominent sexual dimorphism. But in case where sexual dimorphism is not clear it can be done using different colour ear tags.

No such methods are used for sexing in terms of Asiatic black bears in Indian zoos.

3. NATURAL HISTORY

This species is omnivorous, feeding mainly on plant material including nuts and fruit. It will also eat ants and larvae. In India and Tibet it has been known to kill domestic livestock such as sheep and goats. It frequently forages in trees and on them, removing the bark from the base and gnawing at the exposed sapwood. Foraging on succulent vegetation on avalanche slopes also occurs. These bears will build nests in trees by bending back branches until they accumulate into a rudimentary nest. Similar structures are also used as basking couches, enabling the bears to conserve valuable body heat by getting off the ground during periods of cold or wet weather. The height of these beds off the ground varies from a few centimeters to as much as 20 meters.

Adult wild weights and measurements: Appearance/ Morphology: Measurement & Weight

- **Length**

Adult: Head and body length of males is about 1.2 – 1.8m (4ft - 6 ft) a very large male reached 1.95 m (6 ft 5 inches). Females are smaller 1.5 m (5 ft) or perhaps 1.7 m (5 ft 6 inches).

Newborns: Two cubs a few days old measured 26.5 m (reputed).

- **Height**

Adults and sub adults: shoulder length 0.7 m – 1.0m (2.3 - 3.3 ft)

- **Weight**

Adult: males are generally larger than females and are particularly heavy in autumn (fall). Males may weigh 60 to 200kg (132-441 lb) with the highest weights being autumn weights; they average about 90 – 115 kg (200 – 250kg lb). Female may weigh 40 -140 Kg (88-309 lb) but 65-90 kg probably usual. Newborns: newborn cubs may weigh 300-450 gm.

- **Leg, Spines and Tracks:**

The Asiatic black bear have thick legs and short broad paws each with five toes. The claws are long, curved and non-retractile. The Asiatic black bear has hairless soles but a fringe of hairs between the pads of the digits and the plantar pad.

The forepaws are very powerful, and turned inwards when the bear is walking. The black claws are relatively short and curved, adapted for climbing.

The hind foot is 175 - 195 mm long. Bears have a caudal extension to the shoulder blade (scapula), called the post-scapular fossa, from which the subscapularis minor muscle arises; this is used in climbing, pulling the bear's body up.

- **Legs and Tracks**

The Asiatic black bear have thick legs and short broad paws each with five toes. The claws are long, curved and non-retractile.

Hind foot length 175 - 195 mm.

All four feet have five toes and black hairless soles, although with a fringe of hairs between the pads of the digits and the plantar pad.

The claws of the forefeet are black. They are shorter than those of *Ursus arctos* and more curved (adapted for tree climbing rather than digging).

The fore paws, which are very powerful, are turned inwards while walking.

Long claws on all four feet for climbing.

- **Tail**

The Asiatic black bear have a short tail; this may be hidden in the fur. The Asiatic black bear's tail is only 65 - 100 mm long. It is scarcely visible under the shaggy hair.

Distribution and habitat:

The Asiatic Black bear has been reported to be continuously distributed through southern and eastern Asia from westward through Pakistan and Afghanistan to Baluchistan Province of Iran; east to Indo- China, Korea, and Japan, and an isolated population in Taiwan (Cowan 1970; Servheen 1990, Mallon 1991, Sathyakumar 2001). Schaller (1971) reported a wide distribution for black bears from Russia and Korea to Indo- China and from the forests of the Himalayas below an altitude of 3,750 west as far as Afghanistan and Iran. The Himalayan regions and the hills of northeast India cover 591,800km² (18% of India) and probably holds one of the largest population of Asiatic Black bear in Asia. Johnsingh (2003) has presented an excellent review on the status of

the four species of Black bears in India. He reported that the Asiatic black bear is presented in at least 56 protected areas and estimated its habitat range in India to be 300,000km² and a population of a minimum of 3,000 animals.

In India, black bear inhabits forested habitats ranging from 1,200 m to 3,300 m (Prater 1980). Their range overlaps with that of the sloth bear (*Melursus ursinus*) below 1,200 m and the Himalayan brown bear (*Ursus arctos isabellinus*) above 3,000 m. In North –east India, their range overlaps with both sloth and the sun bear (*Ursus malayansis*) (Choudhury 1997). The Asiatic black bear is distributed throughout the Himalayan ranges in the northwest (Jammu & Kashmir; Himachal Pradesh), west (Himachal Pradesh and Uttaranchal), Central Sikkim and Northern West Bengal) and east (Arunachal Pradesh). The species is also present in the hills and edge of the plains of other north-eastern states of India. Black Bear distribution in the Indian subcontinent is continuous with Nepal (eastward from Uttaranchal to Sikkim) and Bhutan (eastward from Sikkim to Arunachal Pradesh). At present the black bear are continuously distributed in North India, all along the Himalayas (1,200m to 3,300m) and the Eastern Himalayan ranges and the hills of northeast India (70m to 4,300m). The results of the survey revealed that the Asiatic black bear is reported to occur in 83 PA's and over 98 Forest Divisions (FD's), Reserved Forests, (RF's) and Forested valleys (FV's). PA's include National park (NP), Wildlife Sanctuary (WS), Conservation Reserve (CR), and Community Reserve (CMR).

Asiatic black bear use a variety of habitats, including alpine habitats, ever green coniferous forest, broad – leaved forest, mixed broad leaved/coniferous forests, tropical pine forests, sub-tropical forests and tropical rain forests. In mountainous areas these bears may be found at higher elevations in summer but descends to lower areas in autumn and winter. Moist deciduous forests and brush, particularly in hilly and mountainous areas. Found upto 3,600m in the summer, but at lower elevations in winter. Not found above the tree line in summer, but they generally descend to valleys at 1,525 m (5000ft) or lower winter and in the Assam hills they are found in arid conditions. Forests (temperate, subtropical and tropical). In Russia, these bears live in mixed broad – leaved/Siberian pine forests and oak forests.

In Dachigam Sanctuary, Kashmir in the lower part of the Dachigam Valley along the Dagwan river, bears were seen on the forested floor and lower slopes of the narrow valley between the altitudes of about 1,750 - 2000m. (S.H. Prater, The Book of Indian Animals 1980).



GENERAL DISTRIBUTION OF ASIATIC BLACK BEAR (*Ursus thibetanus*)

Habits and social structure:

Habits:

Asiatic black bears are primarily nocturnal feeders and sleep in a tree hole or in a cave during the daytime, but they do sometimes forage diurnally. During the autumn, their nocturnal activity increase. They shift their ranges in early re in order to obtain broadleaved food species (mast crops) at lower elevations. They are powerful swimmers, and their short (2 inches, or 5.08 cm) claws make them adept tree climbers. They are plantigrade and typically walk on four feet, but when they fight, they stand up on their two hind feet and slap their enemy with their forepaws. Asiatic black bear usually avoid man and only attack when they are wounded or trying to protect their young but unprovoked attacks have been documented many times throughout history.

Not all Asiatic black bear hibernate though many do. They store fat during the late summer to use during the winter months of hibernation. Some may sleep the entire winter period while others may only hibernate for the worst period of winter weather.

(“Asiatic Black Bears”, 2004, Nowak, 1991; Reid et al, 1991; Ryan, Czaplewski, and Vaughn, 2000).

Social structure:

Asiatic black bears generally lead a solitary life, except for their mothers attending her cubs or males or females during mating season. They form temporary groups only when food is plentiful in a small area.

Feeding behaviour:

Asiatic black bears eat mainly vegetable matter but they are omnivorous and their diet also includes honey, fungi, invertebrates (insects such as bees, wasps and ants, small crustaceans), small vertebrates and large vertebrates (killed or eaten as carrions). Different plants are important in different geographical areas. Shoots are important and nuts left from the previous autumn also may be eaten. In summer berries are important. This is also the season when more insects are eaten. In autumn, nuts are the main food; most such as acorns or beechnuts may be very important before denning. Cultivated seed and fruit crops such as maize, sorghum, dates, pineapples etc are eaten. Depending upon the season and availability, Asiatic black bears take advantage of a variety of foods, primarily from plants. In fall, they fatten themselves on acorn, chestnuts, walnuts, and other fat-rich resources. They climb trees to get their foods, as well as picking them from the forest floor. In spring new plants growth provides a bounty for the bears which seek out bamboo, raspberry, hydrangea, and other plants. They also raid rodent's caches of acorns or collect those left on the forest floor from the previous fall. Other plants offer food in summer, including raspberries, cherries, and grasses, insect food, especially ants, augments the summer diet. Asiatic black bears eat carrion, and sometimes attack livestock. Prater (1980).

Reproduction (Including natural gestation/ age of sexual maturity, courtship, growth rates):

Natural Gestation:

The gestation length appears to be variable from 6-8 months, possibly being shorter in tropical areas than in colder areas. There is a period of delayed implantation of the blastocyst also called obligate delayed implantation and embryonic diapause, as a reproductive strategy. After a blastocyst is formed, embryonic development is arrested before implantation, and the blastocyst lies free within the uterine lumen. Data from captive bears in Taiwan indicates a gestation period of 7.5 months. Data from fecal progesterone assays suggests delayed implantation 5-6 months after mating associated with a rapid rise in progesterone concentrations, followed by about two months of active gestation. Pregnancy can be diagnosed in bears by serum fecal progesterone levels. Pseudo pregnancy has been described in several bear species. Late in gestation, approximately the last month, pregnancy can be diagnosed by transrectal or transcutaneous ultrasonography.

Age of Sexual maturity:

Sexual maturity is stated to be at three years old; females first give birth when four years old. Males appear to be sexually mature at 3-4 years, based on changing testis size. Measurement of the testes of wild *Ursus thibetanus japonicus* showed that these were small in bears of 1-3 years age than the testes size increased rapidly to 4 years and reached peak size at 5 years. Older males are more likely to have the opportunity to breed than are younger lighter males, at least in captivity under high density conditions. Northern Japan found clear seasonal changes with testes, with testes being active in May and June, degenerative in November, resting in January, early – resumptive in March and late – resumptive in April.

Courtship:

In general, the mating behaviour of bears is similar in some ways to the canids (the mount and the pelvic thrusts) and in some way to the felids (the neck bite) (Ewer 1973). During courtship the male approaches the female, sniffing the ground near her, and then sniffing or licking her head, trunk and external genitalia. The male mounts her from behind at an angle with one paw placed mid-way up on two legs. While mounting he often bites the neck behind the ears, and to one side. The neck bite is intermittently renewed throughout copulation. Occasionally the male bites the female's face.

Growth rate.

(From Zoo data):

Attempt to walk from 45-60 days

First accompany dam

First intake of solid food.- 110-120 days

First emerge from the den at about 2-2.5 months.

Remains with mother for at least a year. (reported)

Protected Species role in the ecosystem:

In most ecosystems black bear function primarily as an herbivore and secondly as a carnivore, although they are often referred to as omnivores “everything eaters” because they will eat anything to survive. Bears are also scavengers and play a role in recycling carrion. Helps transport the berry seeds. Along salmon spawning streams, bear feces and the remains of fish carried into the woods contribute to the long term nutrient cycle in the old-growth forest. Even cambium feeding by bears which sometimes kills trees creates widely scattered snags that benefit other species of wildlife.

Threats in the wild:

The reasons are stated below:

(i) Poaching threats:

Black bear populations are largely threatened due to poaching for gall bladder and skin. Although the former is believed to be of medicinal value, the latter is for trophy or ornamental purposes. Chinese medicine texts recommend Asiatic Black bear as source for medicinal bile. Although bears are protected in India, it is difficult to prosecute in poaching cases because of lack of *prima facie* evidence in the courts. Poaching and illegal trade across international borders is thought to be widespread. India has long boundaries with, Pakistan, China, Nepal, Bhutan and Myanmar much of which is remote, rugged mountainous, making it difficult to police the borders and control cross-border trade.

According to the Convention on International Trade in Endangered species of Flora and Fauna (CITES), between 1975 – 1993 about 1.3 07 bear gall bladder were reported in International markets along with 11,667 kg, 44,219 units, 750 cartons and 500 boxes of bear derivatives (Mills et al. 1995). For the same period, about 4,136 kg of gall bladder is also reported from Republic of Korea, which would mean another 68, 933 bears (at 60 gms of bile/bear) killed for trade.

Growing demand for bear products in Asia has led to serious impacts on bear populations in India. In Arunachal Pradesh and other northeastern states, indigenous or people hunt black bear for its skin and meat. For example, the “Nishi” (earlier known as Daffla) people wear bear skins on the back of their neck and use them in making “dao” (knife) holders. All huts of indigenous people have a display of wild animal skulls and skins, many including parts from Asiatic black bears.

(ii) Habitat degradation:

Based on the 2005 estimate, the potential Asiatic Black Bear distribution range in India is estimated to be about 270,000 km² which is almost similar to the estimate made by Johnsingh (2003). Of this total potential black bear habitat range in India <10% is protected under the existing network of Pas. Throughout India, there are major threats to black bear habitats. Habitat degradation is largely due to development projects and human dependence on forests for fuel wood and fodder (many of them bear food plants), as well as the extraction of other forest products such as montane bamboo (*Arundinaria falcata*), *Chimnobambusa jaunsarensis*, *Thamnocalamus falconeri*, *T. spathiflorus*). In Arunachal Pradesh and Sikkim, habitat loss is mainly due to development activities. In the northeast states, jhum (Shifting cultivation) has led to serious impacts on black bear habitat. In Meghalaya, about 95% of the land is privately owned and the state government

has difficulties in protecting wildlife or their habitats in these areas (Sathyakumar 2001). Over 70% of the PAs with black bear populations are <500 km² and suffer from anthropogenic pressures from within and outside. Identifying forested areas adjacent to PAs and forest corridors between PAs is crucial.

(iii) **Conflicts with humans:**

One of the most interesting limiting factor for black bear conservation in India is the response of people to human- black bear conflict. Reports to the Forest and Wildlife department of black bears killing livestock and attacking humans are common, largely in the north western and western Himalayan region. For example, Uttarakhand, black bears accounted for 28.5% of 540 attacks on humans by large carnivores between 1991 and 2001. Of these attacks, 9% resulted in a human fatality (Chauhan *unpublished*) in the Great Himalayan NP, 350 of 1,348 (26%) incidents of livestock predation during 1989-98 were by black or brown bears (Chauhan 2003). In Arunachal Pradesh, black bears cause damage to maize, which is a major crop for many hill tribe people. Possible causes for the increased incidences in the reporting of livestock depredation and attacks on humans by black bears are:

Shrinking habitat due to extension of agricultural lands, other human encroachment, and habitat degradation which have led to increased use of agricultural lands by bears. Increasing human and livestock population in an around PAs and forested areas, and increased dependence on forests by human leading to increased frequency of bear – human encounters; Unsupervised livestock grazing and Increased awareness among local people regarding compensation paid by the government for damage caused by wildlife, leading to an increase in the proportion of incidents reported, as a result of the above, any report of an increase in black bear population in an area in the recent past, is very unlikely with the exception of a very few undisturbed areas (Sathyakumar 2001).

CAPTIVE HUSBANDRY:

Size of the enclosure:

When designing the indoor areas it is important to consider both animals and keeper/maintenance requirements. Indoor cages must be sufficiently large to allow sliding doors to operate freely; to provide room for structures such as resting platforms or nest baskets; to allow the bears to move freely; and to allow keepers to work in comfort. For the welfare of the animal, International standards state that the minimum acceptable size of an indoor Asiatic Black bear enclosure is 3m X 3m X 3m. The minimum floor area should be $2 \times (\text{head-body length})^2$ with the smallest dimension at least $1 \times (\text{head-body length})$.

Minimum floor area= 8.0 m², smallest side minimum =2.0 m. Resting area= 2.0 x 1.0 m. The minimum height should be 3 meters. A service corridor of at least 2.5 m wide, preferably 3.5 m, is required.

The side of the cages facing the service area must be of bars (maximum space between bars of 5 cm) or weld mesh (maximum 5 cm x 10 cm) i.e. too small gaps to allow bears to put their paws through into the service area.

Sizes of the enclosure of Asiatic Black Bear (*Ursus thibetanus*) at different zoos in India

Sl. No	Name of the zoo	Size of the holding area	Size of the enclosure
1.	Bharat Ratna Pandit Gonvind Ballabh Pant High Altitude Zoo, Nainital	1.80m X 2.40m = 4.32sqm	239 sq.m
2.	Nagaland Zoological Park	2m X 2.5 m = 5.0sqm.	
3.	Aizwal Zoo, Mizoram	58.22 sq m; size of the Krall- 165 sq m	2455sq m
4.	Nandankan Zoological Park, Orrissa	2.5m X 2.5 m = 6.25sqm	24m X 25 m = 600sqm
5.	The Zoological Garden, Alipore, Kolkota	2.55m X 2.70m = 6.885sqm. ht: 2.40m	2.37mX 3.70m = 8.769sqm ht: 2.40m wet moat: 3.90m depth: 3.00m
6.	Sanjay Gandhi Biological Park, Patna	2.44mX 3.05m = 7.442sqm	18.29 m X 15.24m = 278.74sqm.
7.	Assama State Zoo, Guwahati	2.20mX 2.50m= 5.00sqm ht : 2.50m	
8.	Padmaja Naidu Himalayan Zoological Park	2.20mX 3.30m= 7.26sqm ht: 3.30m	48.30mX 10m = 483sqm

Accommodation for mammals maintained in captivity should be designed to allow the animals to be maintained in good health and to breed (if desired). Both the physical and behavioural needs should be considered in designing enclosure.

The natural history and wild behaviour of the species should also be considered:

- It is important to be aware of the natural behaviour repertoire of the animals to be held in the enclosure and the holding area including their time budget; and to build facilities which allows the animals, as far as possible to behave in a natural manner.
- The normal geographic range and the habitat of the species should be taken into consideration regarding appropriate temperature, humidity, light conditions, substrate etc.
- The animal's general habits (e.g. terrestrial, arboreal, burrowing/digging, swimming, using mud wallows) should be taken into consideration.

Enclosure standards:

- 1: Enclosure at least 3m X 3m X 3m
- 2: Enclosure at least 2.5m X 2.5 m x 2 m
- 3: Enclosure at least 2m X 2mx 1.5 m
4. Enclosure less than 2m X 2m X 2m.

- **Material for housing:**

The houses built for Asiatic black bears
Housing provides: Protection from weather and psychological security, the materials used for housing are Iron rod (mm), Cement, bricks, sky light sheets etc.

- **Shelter/screening:**

Trees, shrubs and other plants in enclosures serve a variety of functions for the inhabitants, including provision of shade and shelter, resting sites and visual barriers. In addition, a well-planted enclosure has increased aesthetic appeal.

Existence of shade trees - Valleys may provide reduced exposure to sunlight and exposed locations tend to have cooling breezes. Shade netting should be provided where natural plantings do not provide sufficient protection from the sun.

Evergreen shrubs between enclosures can screen enclosures, reducing stress where prey and predators are adjacent or potential rivals are in adjacent enclosures.

- **Water**

Water for Asiatic black bear can provide opportunities for drinking, bathing and swimming which in turn help them to-

- Help maintain good coat/skin condition;
- Stimulate defecation;
- Enable thermoregulation;
- Provide an opportunity for play;
- Allow exercise;
- Provide a retreat from irritating or biting insects;
- Be required for parturition.
- Bears should have water accessible in both indoor and outdoor enclosures at all times.
- Water bowls in indoor areas should be secured and it should be possible to service these safely from outside the cage.
- Drinking water should be provided using built-in watering devices or sturdy containers.
- Raised automatic water troughs can be used.
- Water in outdoor areas should be sufficient for bathing.

- ❖ **Drinking water:**

- Drinking water supplied with one or more troughs of a size and design appropriate for the species, filled manually.
- Water troughs need to be checked for water level/availability and cleanliness at least daily, and cleaned regularly.

- The frequency of cleaning - everyday and also depends on factors such as the species, the size of the trough, season (increased rate of algal growth in warm weather) and contamination with (urine, faeces, food, leaves, bedding etc).
- The size, number and location of water troughs should be chosen with consideration to accessibility, ease of maintenance; and drainage- water troughs kept inside the holding area(2), Krall (2) and the enclosure (1).
- Water made readily available at all times. This generally requires troughs or other drinking utensils to be present in both indoor and outdoor areas.
- In cold climate, water availability is assured even during freezing temperatures. Depending on the climate, this may require inbuilt water heaters.

❖ **Bathing/swimming water:**

- Water provided in a sufficient quantity for the animals to wallow, swim, dive or bathe in as appropriate.
- Fresh water is and must be provided.

❖ **Water for cleaning:**

- Water supply to allow cleaning (hosing down) of accommodation must be of sufficient diameter and pressure.
- There needs to be an adequate number of attachment points for hoses, sited in appropriate places to allow access to all areas where hosing is required, but without being accessible to the animals.

• **Furnishings, including suitable structure**

Furnishing and plants are an important part of the physical structure of the animal's structure. Cover is essential. This can be provided by using plants, logs, rocks etc, but plantings and furnishing must not assist the animal to escape from their enclosure hence care must be taken in the initial placement of furnishings and plantings to ensure that they do not provide a vantage from which animals can jump, leap or climb to escape from enclosures. Regular inspection and maintenance is also important.

Furnishings that can be provided to the Asiatic black bear in captivity:

A good bear enclosure provides complete ground cover, banks which the bears can dig into, trees for the bears to climb, shrubs, rocks, and water

Furnishings and plantings should provide shade; protection from rain; wind breaks; sunning areas; visual barriers and climbing opportunities.

Climbing structures should be provided.

Furnishings such as hills, trees, rocks, stumps etc. can provide shade in the summer.

Visual barriers (trees, rocks etc.) which break up lines of sight can help reduce stress and aggression in enclosures holding more than one bear.

• **Shrubs**

Provide different microclimates, shelter and shades. Provides food in some times of the year. Where practical, shrubs of species native to the bears' natural habitat can be planted. A line of taller shrubs on the side of the prevailing wind may provide a windbreak for exposed sites.

- **Trees**

Climbing opportunities.

Different microclimates e.g. shade in summer.

Provide an object for scratching, keeping the nails from becoming too long.

May provide visual barriers.

Some may construct nest platforms in the trees.

- **Dead tree or large branches as climbing frames**

- **Rocks/boulders too large to be moved by the bears:**

Climbing opportunities, resting places, shelter and shade, Provide a site for bears to dig under to make a resting place (therefore must be placed or secured such that they will not collapse on the bear).

A large rock pile can provide a slight barrier between bears and can reduce social stress also adds to decreasing stereotypic pacing.

- **Earth banks**

Provides different microclimates, dig and create dens including maternity dens in earth banks.

Digging under a large root or rock may be preferred.

- **Horizontal tree trunks or large logs:**

Provides different microclimates.

Hiding places for food.

Provide a site for bears to dig under to make a resting place (therefore must be placed or secured such that they will not collapse on the bear).

Allow scratching, keeping the nails from becoming too long.

Provide a climbing opportunity.

When rotting, provide insects for the bears to search for.

- **Elevated nest baskets/ fire hose hammock:**

Resting places.

- **Climbing frames and platforms:**

Provide an opportunity to climb (smooth poles or trunks can be made easier to climb by winding a spiral of rope (e.g. hemp rope) around the pole/trunk).

Shallow ramps should be provided to allow less agile bears to reach platforms.

Provide a means of escape from possible aggressive interactions.

- **Piles of branches:**

Provide hiding places for food and constructing nests.

- **Pipe in the ground** (vertical, 40 - 60 cm deep):

Hiding places for food.

Gravel at the bottom of the pipe improves drainage (2.5 cm/one inch of gravel is sufficient).

➤ **Rotten logs:**

Bears enjoy destroying these, may also provide some insects and rocks and logs small enough for the bears to move.

• **Humidity/Temperature/Thermoregulation**

It is preferable for the design to provide a range of temperatures so that the occupants can choose the area in which they feel most comfortable.

Higher temperatures may be required in cool climates if the relative humidity is high.

Low external temperatures may be less well tolerated if the external-internal temperature difference is high. Conversely, animals may be more willing to go outside on cold days when they are confident of the availability of a warm area in which to retreat, than if the indoor area is only heated to a barely tolerable temperature.

Thermoregulation:

Bears, like all mammals, must regulate their body heat. A bear's fur is extremely effective insulation during the winter, bear's maintaining body heat while absorbing heat from the sun. However, it does not allow adequate cooling during warm weather. As they don't have sweat glands, bears must cool themselves through several unique methods, shared by dogs.

- Balance energy expenditure and food intake.
- Rest in shady day beds and cool summer dens.
- Lie with bellies fully in touch with the cool ground.
- Dissipate heat through slobbering tongues, panting like a dog; through their paws, which is the primary means of heat loss, as the pads are well supplied with blood vessels and are flat on the cool ground- and through areas with minimal hair such as the face, ears, nose, and the insides of hind legs.
- Muscles behind shoulder contain a major supply of blood vessels and act as a radiator.
- Shake off water as they emerge from a lake or stream.
- Sprawl on snowfields or patches of snow.
- Spread legs (thighs) wide.
- Submerge in water.
- Take mud and dust baths.

• **Cleaning**

- The food, they are provided with especially the meat, if infected may cause lots of diseases including *Tularemia*, *Leptospirosis* and even rabies. *Trichinellosis* caused by *Trichinella spiralis* has been reported in black bears due to ingestion of its encysted form with meat from infected carcass. So caretakers of bears should be warned not to give meat unless it is thoroughly washed and cooked.

- The feed must be checked for toxins and deposits of salts of heavy metals if present which may head to nephrosis and other condition. One aspect of internal hygiene is its nutritional content with ample amount of roughage which ensures prevent from ulcerative gastritis.
- Feeders and waterers should be properly washed and feeding time should be chosen that encourage the animal to eat food before it is contaminated with excreta.
- Daily removal of faeces and urine from enclosure is necessary to control not only odours but also to prevent parasitic infestation and insect population.
- It has been seen that bears in captivity become caprophagous that is they start to eat faeces. Proper removal of faeces and cleaning of faeces containing parvovirus which causes highly contagious disease in wild carnivores may serve as a reservoir of infection. The virus is readily transmitted from place to place on the hair or feet of animal via contaminated cages, shoes or other objects.
- Floor surfaces should be impervious to water and cleaned prior to feeding to prevent mixing food with soil and to prevent parasitic ova contamination.
- Hard surface enclosures and food containers should be cleaned and disinfected daily. Resting platforms where animals climb and sit should also be cleaned daily.
- Malathion and Naled are effective insectide and both are used as space sprays.
- Pyrethrin is one of the oldest spray and yet effective insecticide used as a space spray. It is the safest insectide and is highly effective in immobilizing and killing insects.
- Chlorine can be used routinely to loosen tenacious faeces. Chlorine is also used for purification of water and general sanitation. It is also effective against a broad range of microorganisms, primarily, the vegetative form of bacteria, virus and fungi. It is inexpensive too.

HEALTH CARE STANDARDS:

- Environmental hygiene:

The word hygiene is derived from the Greek word “Hygeia” – the goodness of health. Hygiene may be defined as science and art of preserving and improving health. Proper hygiene in case of captive bears is required to avail conditions or practices conducive to health which necessarily involves prophylactic measures, for viral and parasitic infections. Zoo sanitation and hygiene is important for disease prevention and

aesthetically pleasing environment. Hygiene in zoo for any animal involves proper food storage, preparation and handling, insect control, vermin control and cleanliness and disinfection of animal enclosure.

Special attention should be given for the provision of better sanitation and hygienic environment. The enclosures in which bears are kept should be regularly washed with phenol. There should be a good drainage system within an outside the animal enclosures to keep the area free from water logging. Periodical operation against cockroach, cats and stray dogs should be carried out as many of these agents of many of these agents act as transmitting agent of many infection and disease. The solid and liquid waste and garbage inherited around animal enclosures should also be disposed off well. For disinfections sodium hypo chloride 5-25%, formaldehyde 10 %, caustic soda 2% can be employed.

- Known Health problems

The health of captive bears mainly depends upon the nutritional and physiological status of the animal. As the bears are kept in artificial environment created by human beings this adversely affects the health and behaviour of the animal leading to stressed condition. Stress makes an animal more prone to diseases and infections including parasitic infection. It is also found that death due to diseases in captive bears is more in comparison to free ranging wild animals.

Although bears are generally healthy and long lived in captivity, they do have two health issues that merit discussions. Tumors of the hepatobiliary system have been found repeatedly in captive bears. Dermatopathies are of frequent clinical problem of captive bears.

Extrahepatic biliary carcinomata have been found in a large number of captive bears. These tumors appear to have been originated in the gall bladder or bile duct and may metasize to the omentum, pancreas, liver and lungs. Clinical signs and clinical pathological changes associated with these neoplasms have been few and variable. Some animals have been found dead without premonitory signs, and other bears have had weakness, lethargy, vomiting and weight loss for month. Physical examinations have revealed abdominal distension, ascites, and occasionally icterus. No causes have been identified for these neoplasms. Genetic predisposition and captive diet influences have been suggested as the cause for such a large incidence of hepato biliary neoplasms in bears, but no cause have been defined.

Skin condition, in particular hair loss and rough, hair coats, have been encountered frequently in captive bears. Identified causes of alopecia are atrophy, mange, and dermatophilosis. (*Dermatophilus congolensis*).

Ascarid infection are common in Asiatic black bear and can be persistent in captive animals, *Baylisascaris transfuga* is a long worm and heavy infestations may cause intestinal obstructions. Many other nematods, cestodes and acanthocephalans have been reported in bears. Asiatic black bears can be infected with the canine heart worm, *Dirofilaria immitis*, but clinical disease have not been reported. Some questions exist as to whether bears are suitable host for *D. immitis*. Bears also have their own species of filarid worm, *Dirofilaria ursi* which lives in sub- cutaneous tissues and is considered non

– pathogenic. *Trichinella* infections in bears have received considerable attention because many bear species are hunted and consumed by local people.

Mange has been identified as a cause of alopecia and dermatitis in wild and captive bears. Mange in wild black bears can be caused by *Demodex sp*, *Sarcoptes sp* and the audycoptid mite. Audycoptid mange also has been diagnosed in captive black bears. Clinical signs include crusting and purities.

As per the survey made in different zoos during the tenure of the project, the chart below indicates the different ailments of the Asiatic black bear in different zoos in India.

Common ailments of Asiatic Black bear (*Ursus Thibetanus*) at Different zoos in India

Sl.no	Name of the zoo	Ailments of black bear
1.	Hmalayan Zoological Park, Gangtok	Injury (infighting).
2.	Sanjay Gandhi Biological Park, Patna	Malignancy and frequent G.I. disturbances.
3.	Nandankan Zoological Park	Vomiting and loose motion, senility (dysfunction of vital organs), pneumonia, jaundice
4.	Alipore Zoological Garden	Skin infection such as bacterial, fungal, mange infection, gastrointestinal problems, diarrhea, dysentery, and cardio – respiratory failure.
5.	Tata and Steel Zoological Park	Dysentery, cardio – respiratory failure, heat stroke.
6.	Itanagar Zoo	Mange, Ectoparasite, paralysis of the body, injury (infighting), viral fever.
7.	Padmajanaidu Himalayan Zoological Park	Injury, tuberculosis, adenocarcinoma.
8.	Assam State Zoo Cum Botanical Garden	Injury (infighting), chronic mange and other skin infections.



SKIN DISEASES OF ASIATIC BLACK BEARS (*Ursus thibetanus*) IN CAPTIVITY.

PREVENTIVE PROCEDURES:

"Preventative medicine is the most basic aspect of the medical care of captive wildlife." Prevention of disease is preferable to disease treatment and may be more effective, particularly since wild animals often hide signs of disease until the disease process is well advanced, and because of the problems of applying treatment. Every zoo should have a preventative medicine programme.

Preventative medicine should consider not only the animal and its interaction with specific pathogens, but take a more holistic response, in which the general environment (enclosure, climate etc.), interaction with other animals (of the same and other species), nutrition (general and specific nutrients), and stressors of all types must be taken into consideration. An integral part of preventative medicine is routine observation by the animal's caretakers, noting abnormal behaviours and/or absence of normal behaviours. Captive bears should be closely twice daily to check whether any abnormal behaviour or health problems are present.

Here are some of examples (not all existing conditions) of health problems which should immediately receive veterinary attention:

- ❖ Reddening, swelling or discharge around the nose, ears or eyes.
- ❖ Anorexia, weight loss.
- ❖ Swelling around jaw, pain evident when bear trying to eat.
- ❖ Groaning/noises of discharge from nose.
- ❖ Abnormal, loose faeces.
- ❖ Abnormal discoloration of urine e.g. red (may be blood).
- ❖ Animal is scratching abnormally.
- ❖ Skin lesions e.g. wounds, abrasion, ulcers, spots.
- ❖ Hair loss, or loss of condition of hair i.e. Dull not shiny.
- ❖ Lameness or any observable injury to paws or limbs.
- ❖ Abnormal discharge from rear end.
- ❖ Sudden abnormal aggression/other change in behaviour.
- ❖ Abnormal growth/lumps evident anywhere on body.

- Preventive programmes such as parasitological investigations, physical examination, serological and allergic testing is very important for zoo animal.

- Long and dense hair of the bears should be offered hairball laxatives at least twice weekly, since long hairs are a site of Ectoparasite (ticks, fleas, bugs etc) breeding and these Ectoparasites are vector for infectious diseases.

- Regular clipping of hair and washing them with soap and water – removes the scabs and debris. This will treat the mange infestation which is usually reported in a bear (not practicable although).

- Sarcoptic mange is highly contagious and may be passed by close contact with infected animals bedding, pens, cages and elimination of stagnant water. If possible, then a series of dips or spraying with a 2% water emulsion of Malathion may be done.
- On an opportunistic basis, bears should receive physical examination that include dental cleaning and calculus removal, claw examination and trimming
- Removal of oleander plants from the vicinity of bears cage. Oleander causes poisoning in bears with severe gastroenteritis, vomiting etc. bear is nocturnal so they may eat oleander plant unknowingly.
- Lime should be frequently spread over the carcass before they are buried to help destroy infected animal tissue by its caustic action. Lime is caustic to organic matter and hence will destroy debris, including micro – organisms.

RECOMMENDATIONS: Proper hygiene, Regular use of disinfectant, Proper enclosure maintenance, Proper feeding standards are some of the preventive measures.

➤ **Hygiene:**

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 to be met, bear's enclosure should be thoroughly cleaned twice daily. Other measures.

- Consideration should be given to ease of cleaning when designing enclosures.
- Thorough cleaning, before the use of any disinfectant, will in itself remove most of the infectious disease agents present, e.g. on feeding bowls, in incubators, inside buildings.
- Cleaning of a building or area should include dry cleaning to physically remove 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.
- . Water sources, including storage facilities and distribution channels, need to be checked periodically.
- Water troughs need to be checked and cleaned regularly.
- Water bodies, including moats, need to be checked and cleaned regularly, and if necessary emptied and refilled.
- Food storage containers and feeding troughs need to be checked regularly and cleaned as necessary.
- Food stuffs should be stored appropriately and should always be checked before feeding to ensure they are fresh (meat is particularly likely to decompose rapidly in hot climates) and do not contain obvious health hazards.
- As well as enclosure cleanliness, provision and routine use of hand-washing and foot-dipping facilities are important to reduce the transmission of infectious agents from one area or enclosure to another.

- Staff should be given training so that they understand the importance of basic hygiene measures in preventing disease transmission.
- Equipment (e.g. brooms, wheelbarrows) should be used in a single enclosure/block of enclosures, or cleaned and disinfected before being moved to another area.
- Hygiene is more difficult to provide in old, poorly maintained enclosures and overcrowded situations.
- Good buildings maintenance can enhance hygiene, for example by preventing cracks from developing, or filling/sealing those which occur.
- Overcrowding should be avoided. It tends to result in increased contamination with urine/faeces; increases risk of transmission of infectious organisms, and may make shifting of animals for enclosure cleaning and maintenance more difficult.

This cleaning schedule is very important to prevent build up of unhealthy organisms e.g. fungus and bacteria within the bear's environment. It is also important for welfare, as a bear is forced to sit in its own urine and faeces may receive physical urine scald and infection as a result of this situation, as a result of this situation, as well as being uncomfortable and unpleasant.



CLEANING IN PROGRESS OF NIGHT SHELTER FOR THE BEARS

DISINFECTION:

The benefits of disinfectant use need to be balanced against the loss of scent marks and general odours, and the potential adverse behavioural effects this may have on the animals. Use of disinfectants can be reduced in large enclosures, particularly outside enclosures exposed to sunlight, frost etc., with a relatively small population of animals, but are required more in small, particularly inside, enclosures and those with high population densities.

- Disinfection should be seen as an adjunct to removal of animal wastes etc., not as a replacement for general cleaning.
- The efficacy of most disinfectants is greatly reduced by the presence of organic matter; surfaces to be disinfected need to be cleaned thoroughly with hot water and detergent before the disinfectant is applied.
- Disinfectants require time in which to act.
- Disinfectants generally work better at higher temperatures.
- Disinfectants should be used at the manufacturer's recommended dilution, stronger does not necessarily mean better, and efficacy may be greatly decreased at too low concentrations.
- Disinfectants may be toxic, irritant, corrosive and in some cases potentially carcinogenic.
- Appropriate precautions (e.g. wearing impermeable gloves, other protective clothing, and face protection) should be used when handling disinfectants.
- Disinfectants should be used and disposed of with regard to potential deleterious environmental effects.
- After disinfectants have been applied and left for the required time for effect, they should be rinsed away thoroughly; this requires provision of adequate drainage so that animal's dens are not left wet or damp when the animals return to them.
- Not all disinfectants are equally effective against all agents.

Name of some of the disinfectants that are used in different zoos in India be used: Omnicide (Glutaryldehyde)- 1 lts – 5 lts (vet care), Phenyl, Common salt (NaCl), limes powder, Bleaching powder, tincture iodine, formalin, Potassium permanganate ($KMnO_4$) Copper Sulphate ($CuSO_4$), Khrosolin – (Virbac). These disinfectants can be used by other zoo in India.

PROPER ENCLOSURE/CAGE DESIGNING AND MAINTANENCE is an important part of preventative medicine. Considerations which may have a bearing on health include:

- Provision of behavioural requirements, including for courtship and nesting.
- Reduction of territorial disputes.
- Provision of escape routes for juveniles and subordinate adults, including multiple entrance/exit points between indoor and outdoor areas, fencing off acute-angled corners etc.
- Ease of cleaning.
- Adequacy of drainage
- Drain holes need to be large enough;
- Worn floors allowing urine etc. to collect need to be addressed.

- Provision of correct temperature, humidity, lighting and photoperiod (species-variable).
- Provision of adequate ventilation in indoor areas, while avoiding draughts.
- Provision of species-appropriate materials in enclosure construction and furnishings.
- Avoidance of overcrowding.
- Appropriate substrates:
 - Substrates which are too smooth are slippery, particularly when wet;
 - Substrates which are too rough are difficult to clean and may injure the soles of species which are adapted to soft ground;
- Removing poisonous plants and other potential toxins.
- . Ensure that enclosures are designed and maintained to avoid hazards such as protruding nails, sharp corners etc., and to ensure that animals cannot access fittings such as lights and heaters.
- Ensure that materials and construction are adequate to hold against the occupants, including both chronic testing and wear, and abnormal actions which may occur when an individual panics.
- Check the width of gaps between bars, slats etc. relative to the size of the inhabitants and parts of the body (e.g. head, limbs), ensuring that spaces will not allow any part of the body to become trapped.
- Regular checks for foreign objects which may have fallen/been thrown into the enclosure and may be hazardous for the animals (e.g. nails, coins, rubber balls, handkerchiefs, gloves, glass, wire).
- Avoiding placing intriguing plants or objects just outside an enclosure, such that animals may be tempted to reach their head or a limb out of the enclosure, increasing the risk of getting trapped.
- Ensure that water areas (including moats) do not become stagnant, get polluted (either with toxic chemicals or with urine/faeces leading to build-up of bacteria), or develop into breeding grounds for mosquitoes or toxic algae.
- Use of high-quality materials, for example stainless steel, hydraulically-operated doors, and non-slip flooring, reduces the risk of injury to both animals and personnel.

➤ **NUTRITIONAL AND FEEDING CONSIDERATION:**

Nutrition standards:

- ❖ Amount and quality of diet adequate, with bears observed to be of a good weight. Feeding occurs at least twice daily. Water always accessible and checked several times a day and refilled as needed.
- ❖ Amount and quality of diet adequate, with bears observed to be of a good weight. Feeding occurs once daily. Water always accessible, but checked and refilled only once daily.
- ❖ Amount and quality of diet observed as not of recommended ideal but bears observed to still be in good condition. This with water always accessible but only checked once daily.

- ❖ Either amount or quality of food inadequate with bears not in ideal condition/underweight or if water is not always accessible to the bear throughout the day.
-) Each animal must be offered a variety of wholesome and palatable food and water in quantities that are sufficient to provide for its good health and normal growth.
- 2) The diet must be prepared with consideration of the age, size, condition and previous history of the animals.
- 3) Nutritional advice from professional sources must be obtained in relation to the addition of food supplements to the ordinary balanced diet of animals.
- 4) Food must be unspoiled and free from chemical and bacterial contamination.
- 5) Food supplements must be appropriately handled and stored, and stocks appropriately rotated.
- 6) Care must be taken not to include food that is known to have deleterious effects to the animal.

Food Quality

- 1) Food must be clean, fresh, wholesome, and palatable and of a standard fit for consumption.
- 2) The food items' nutritional value must be sufficient to keep the animals healthy.
- 3) Food must be free of pests or disease.
- 4) The following must NOT be fed to animals:
 - a) Any animal that has died from any toxic material, including euthanasia chemicals (CO₂ is acceptable), insecticides and rodenticides; or
 - b) Animals showing clinical signs of being infected by disease; or
 - c) Laboratory animals that have been used in those research programs that lead to the animals containing chemicals different from control animals; or
 - d) A diet consisting solely of muscle or organ meats; or
 - e) Plant material that is toxic to the animals.

Food Preparation

- 1) The area in which food for the animals is prepared:
 - a) Must be indoors or completely screened; and
 - b) Must be constructed of materials that will withstand steam-cleaning and chemical infection. Walls must be non-porous and without cracks or crevices.
- 2) All chemical and bacterial contamination must be avoided when preparing food.
- 3) Thawing and preparation of the food must be done so that it retains its nutritive and wholesome qualities.
- 4) A toxic chemical or other harmful material must not be used or stored in the area used for preparing the food.
- 5) Toxic chemicals or other harmful materials must not be allowed to contaminate food provided to animals.
- 7) All foods must be fed to the animals within 24 hours of removal from freezers for thawing, or properly discarded. Discarded food must not be kept in fresh food storage areas.
- 8) The thawed product must be kept iced or refrigerated until just before feeding.

Cleanliness Relating to Food and Drink

- 1) High standards of cleanliness must be observed:
 - a) By staff engaged in the preparation of food and drink for the animals; and
 - b) In relation to the utensils and equipment used and adequate equipment must be provided to enable this to be done.
- 2) Utensils and equipment used in preparing and distributing the food and drink must be cleaned after use and kept clean when not in use.
- 3) Food preparation areas must be washed down daily and treated with appropriate non-toxic cleaning products.
- 4) Boots, aprons and brooms used in the food preparation area must be cleaned after use and kept clean when not in use.
- 5) Utensils and other equipment used in preparing the food and drink must not be used for any other purpose.

Food Storage

- 1) Supplies of food for the animals must be stored in enclosures in which they are adequately protected against deterioration, mould, contamination and pests.
- 2) Toxic substances, live animals, unrefrigerated dead animals and discarded foodstuffs must not be kept in a food storage area.
- 3) Stocks of food supplements must be handled, stored and rotated in a way that minimises nutritional loss.
- 4) Frozen food must be stored at a temperature that is not higher than 18 degrees below zero Celsius.
- 5) No non-food cadavers must be placed in food storage areas.

Food Presentation

- 1) Utensils and equipment used for the offering of food and drink to animals:
 - a) Must not be used for any other purpose;
 - b) Must be easy to clean and designed to avoid risk of injury to the animals;
 - c) Must, when in an enclosure, be placed in such a position that each animal in the enclosure has easy access to sufficient food and water and the risk of contamination from soiling by the animals is minimized. The exception is where food is being used to entice animals into a catching cage, nest box or night area;
 - d) Must be kept in a sanitary condition and, except in the case of a self-feeder, must be washed daily following use.
 - e) In the case of a self-feeder, must be inspected daily to ensure that it is working effectively and does not contain caked or unwholesome food.
- 2) Food items must be presented on an uncontaminated surface that is covered and not exposed to weather. Exception: Carcass feeding and enrichment feeds can be provided in areas that are not covered.
- 3) Where appropriate to encourage animal activity, at least some food must be scattered across substrate or included in wood chips, hay, paper, feeding puzzles or other suitable material or presented amongst the climbing structures.

BEHAVIOUR AND ENRICHMENT PROGRAMME may be a part of preventative procedures:

- Enrichment methods can encourage species-appropriate exercise (including use of the teeth and claws) and reduce time spent in abnormal behaviours (e.g. weaving, bar chewing). This may delay the onset of chronic disease conditions such as arthritis and excessive tooth wear.
- Logs, rocks, hanging strips of material etc. added to enclosures for environmental enrichment also act as visual barriers allowing subordinate animals to get out of sight of dominant animals. Similarly, multiple feeding stations and scatter feeds, multiple resting areas, climbing structures etc. reduce pressure on subordinate animals.
- Provision of choice lowers stress and thereby can improve general health.

Note: Where enrichment encourages specific exercise, sudden cessation of that activity may indicate a health problem. Training based on positive reinforcement may allow routine health checks and procedures on individual animals (from weighing to blood sampling, vaccination etc.) without the need for physical or chemical restraint.

Bear consideration:

A preventative medicine programme for bears includes appropriate diet, regular health checks, and preventative medication. Such a programme may allow early detection of disease problems and improve the bears' longevity and quality of life.

Providing an appropriate enclosure which meets the behavioural needs of bears is very important in preventative medicine in bears in order to avoid excessive stress and the development of stereotypic behaviours.

An enclosure which provides opportunities for bears to climb may reduce the development of spine and joint problems in later life.

Provide adequate space and the means for bears to get out of visual contact with one another, avoid overstocking, and ensure that accommodation design does not allow a bear to get trapped by another bear, all may decrease injuries from co specific as well as decreasing the likelihood of abnormal behaviours.

Food fed to bears should be appropriate for the species. Food should be stored properly and consideration given to the risks of food-borne diseases (e.g. parasitic diseases transmitted via intermediate hosts) and toxins (e.g. if the wrong plants are given as browse).

• TREATMENTS:

A healthy bear maintains normal body weight, level of activity and behaviour. A significant change in any of these is a warning sign. A preventive health care programme should thus be implemented in each facility that houses bears. Such a programme includes proper diet, preventive medication and a basic bear check – up performed on a regular basis. The check – up varies daily, monthly, annually and according to the

different life stages of the animal with a particular emphasis on gait, dentition, and parasitic detection and dermatology issues. The implementation of a preventive programme can detect early signs of diseases and prolong the quality and longevity of a bear's life.

Depending on the disease and the number of individuals involved, the treatment and/or control of disease may require management and manipulation of the population and/or its environment, or treatment and care of an individual or group of animals.

In zoos setting, usually treatment will involve a single bear; however group control of diseases may be required particularly for parasite control.

Injection and medication technique:

The appropriate route for administration of medication will vary depending on factors including the severity and site of disease, type, volume and formulation of medication, and the size, number, feeding habits and temperament of the animal to be treated.

Bear consideration:

Oral, Parenteral and topical medication can be used for bears.

1. Oral medication:

To reduce stress and risk associated with physical restraint (e.g. in a squeeze cage) for hand or pole injection, or with remote injection (darting). However, this can only be used when both (a) the bear will consume the required medication (usually hidden inside a food treat) and (b) it is possible to ensure that the correct individual will eat the medicated food.

Oral medications can be mixed into foods such as milk, honey, cod liver oil, meat or fish, or placed inside a small treat which will be eaten whole. Liquids or powders can be placed inside a gelatin capsule which is then hidden in the treat.

Bears have an excellent sense of smell and may detect medicines and refuse to eat food containing medication.

Individual bears vary greatly in what they will be willing to eat.

In general, sweet foods can be used to camouflage drugs for bears. Powders or ground up pills may be given inside thick honey sandwiches; similarly liquid medications may be mixed with honey.

It may be possible to conceal medication inside the carcass of a rabbit or chicken. When a group of bears is to be medicated orally, the bears need to be separated into individual dens to ensure that all animals can consume the medicated food, rather than dominant animals being overdosed and subordinate animals not getting any of the medication.



Fig1: Methods used at PNHZ Park for giving oral medication .

2. Parenteral medication:

Parenteral administration by remote injection (darting) is required in many circumstances, including for medicating free-living.

For intramuscular injections:

Anatomy of the bears needs to be known for intramuscular injection particularly, the large quantities of subcutaneous fat which may be present over the rump and hind legs of hibernating species in late summer and winter, therefore injecting into the shoulder or neck muscles is preferable.

When delivering drugs by remote injection (darting), the rifle must be powered correctly; if a charged dart hits with too low velocity, the cushioning effect of the bear's thick fur and fat may be such that the firing cap fails to fire due to insufficient impact.

Needle lengths of at least 7.5 cm (3 inches) are required for intramuscular injections into adult bears.

NOTE: bears can be trained to allow injections by hand or using a pole syringe, without physical restraint.

For intravenous access (in anaesthetized bears):

The sublingual vein is most accessible; fat layers make the jugular and femoral veins more difficult to access.

3. Topical medication:

Topical medication is needed for treatment of a number of skin diseases. Depending on the bear's cooperation, the precision needed in application and the volume of medication, it may be necessary to treat the bear while it is physically or chemically restrained, or it may be possible to apply topical medication to an unrestrained individual.

Besides these other forms of treatments are:

- **Supportive/ Nursing Care**

Topical medication is needed for treatment of a number of skin diseases. Depending on the bear's cooperation, the precision needed in application and the volume of medication, it may be necessary to treat the bear while it is physically or chemically restrained, or it may be possible to apply topical medication to an unrestrained individual. Minimizing stress is very important in all dealings with sick or injured wild animals. Proximity of humans and humans-associated noises are likely to be extremely stressful to the animal. Every effort should be made to minimize stress.

Provision of appropriate accommodation is an important part of supportive care.

Factors for supportive/nursing care:

- **Food and water:**

Intake of sufficient food and water is vital.

In calculating nutritional requirements, whether for voluntary food intake or force-feeding, it is important to remember the requirements for healing wounds, in the case of injured animals, and for regaining weight which may have been lost in the period prior to admission.

Monitoring of weight and body condition is essential to ensure that adequate nutrients are being ingested and absorbed. Fresh water should always be available, with due consideration for the risks involved when an animal is recovering from anesthetic or is unable to lift its head properly due to illness.

Fluid therapy should be given to dehydrated individuals and those unable to drink voluntarily. Depending on the degree of dehydration and the general state of the animal, fluids may be given by the oral, subcutaneous, intravenous or intraosseous routes.

Appropriate food should be provided.

- **Warmth:**

Provision of a warm environment will decrease the energy expenditure required for the animal to maintain its body temperature. Individuals unable to behaviourally regulate temperature due to illness or during anaesthesia and recovery from anaesthesia.

- **Wound management:**
 - All necessary equipment should be ready before starting the treatment.
 - When treating wild animals, maintain a warm, quiet environment.
 - Ensure sufficient personnel are available for appropriate restraint and treatment, or use chemical restraint. In general wound treatments require general sedation or anaesthesia. This is particularly true if extensive cleaning and debridement (surgical removal of dead and severely damaged tissue) is necessary.
- ***Initial Inspection And Cleaning***

Mangement of wounds in bears:

- If the wound is still bleeding, control bleeding by applying direct pressure to the wound or to the appropriate pressure point.
- Clip the hair around the wound.
- Flush the wound thoroughly with a weak solution of povidone iodine or chlorohexadine.
- It is particularly important to ensure that any pus (in an infected wound) or maggots (in a wound with myiasis) are flushed out of the wound.
- Do not cleanse deep wounds with hydrogen peroxide or alcohol, as this may cause tissue injury and increase the chance of infection developing.
- Debride any dead tissue.
- Apply topical antibiotics.
- Parental or oral antibiotics are recommended for five to seven days.
- If necessary, suture the wound using an absorbable suture material
- Absorbable sutures should be used for closure of the skin as well as deeper tissues, so that there is no need to remove the sutures.
- It is particularly important to use absorbable sutures in field situations when the animal will be released immediately.
- Use a tapered needle to suture internal muscle layers on a deep wound.
- Use a cutting needle to suture the skin.

- **Fluid therapy for bears:**

Bears may require fluids when obviously dehydrated or while undergoing prolonged surgical procedures.

- Intravenous catheters may be placed in the cephalic or medial saphenous veins to give fluids intravenously.
- Lactated Ringer's solution and 5% dextrose may be given as fluid support during surgery.
- Fluids may be given as supportive treatment for bears which have diarrhoea and vomiting and/or are refusing food and water.
- Cubs with bacterial gastroenteritis may need intravenous or subcutaneous fluid therapy with lactated Ringer's solution (Hartmann's Solution).

- In cases of severe dehydration with gastritis, supportive fluid therapy intravenously: isotonic saline or saline dextrose, 50-100 mL/kg body weight (7.5-10 mL per kg body weight).

- **ANATHESIA AND CHEMICAL RESTRAIN:**

Anesthesia of bears is not particularly difficult, but it is important to recognize the potential dangers and consider the safety of both personnel and the bear.

Note: the need for anesthesia of zoo bears for purposes such as movements, routine examinations and simple procedures can be reduced by use of positive reinforcement training.

Procedures for anaesthetising bears:

Risks to the bear from the anesthetic

Bears are monogastric and may vomit during induction or recovery, or regurgitate while anaesthetised. If possible, avoid anaesthetizing bears which have eaten recently. Physical injury, sometimes severe or even fatal, can occur when bears are darted.

Bears are at risk of injury if they can reach a hazard between injection of the anesthetic drugs and the time they become recumbent. This may occur in captivity as well as in the wild. Hazards to be considered include water (ponds, streams, water troughs etc.), cliffs and trees (which the bear could climb and then fall off/out of).

- **Pre-anaesthetic preparation:**

Whenever possible, the bear should be moved to a safe, quiet, well-controlled situation such as an indoor den with good lighting and ventilation, to allow a quiet induction and recovery, without the risk of the bear encountering hazards such as ponds or trees (which can be climbed then fallen out of) while semi-sedated, and where there will be no interference from other animals in the enclosure.

- **Preventing/reducing vomiting:**

Avoid anaesthetizing immediately after the bear has eaten, to reduce the risks associated with vomiting and regurgitation during induction, anesthesia or recovery.

Preferably starve for 24 hours before anesthesia.

Withhold water for eight hours and food for 24 hours before immobilization

- **Anaesthetic drug administration:**

Reliable, accurate drug delivery is important.

Low impact systems delivering drugs at a low velocity are preferable if this will not compromise the safety of the bear or personnel.

- **Sites for darting intra muscular injections:**

For intramuscular injections it is important to be aware of the anatomy of bears,

Injection into the fat may be ineffective.

A needle length of at least 7.5 cm (3.0 inches) is required to reach through the subcutaneous fat layer on adult bears. A preferred site is the triceps muscle area of the forelimb, dorsal to the elbow and caudal to the humerus and scapula. The hind limb should be avoided in captive bears since there may be a lot of fat present resulting in the drug being deposited in the adipose tissue rather than muscle. Fat deposits over the rump and thighs may be several inches thick. The neck and shoulder are preferred as there is less fat over the muscle. The distal (lower) muscle masses of the hind leg may be used; aiming towards the rear of the leg to make sure the femur is not hit. In captive bears at

short range, injection into the muscles of the forearm can be used, delivered by blowpipe; standard 5 cm 18 gauge or 19 gauge needles can be used.

Note: The time to induction varies depending on the injection site.

Intravenous injection of anesthetic drugs has been used for induction.

- **During induction:**

The bear should be left undisturbed during induction but monitored e.g. by looking through a peephole. Keep light, noise and movement around the bear to a minimum during induction.

If the initial anaesthetic dose fails to adequately immobilise the bear, a top-up dose is required. It is important not to underdose at this stage. It is suggested that if the bear is able to sit up or move substantially, a second dose should be equal to the first dose. If the bear is recumbent but reactive to stimuli a minimum 2/3 dose should be given. Generally bears can rouse extremely quickly from an apparently deep plane of anaesthesia and great care should be taken during induction and anaesthesia. Assess the bear's depth of anaesthesia BEFORE entering the enclosure. A bear may appear to be anaesthetised but may still react to noise or movement.

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

Anaesthetic monitoring and support:

- Monitor body temperature, respiratory rate, heart rate, colour of mucous membranes, capillary refill time, jaw tone (muscle relaxation) and the palpebral reflex throughout the anaesthesia. Use other devices such as capnography, ECG, pulse oximetry etc. as available.
- Eye protection
- Cover the eyes once the bear is unresponsive to tactile and auditory stimuli. A blindfold reduces visual stimulation and helps to protect the eyes.
- Eye lubrication (bland ophthalmic ointment) should be used, as well as a blindfold, to protect the eyes.
- Monitor depth of anaesthesia:
- The depth of anaesthesia should be monitored at all times. Do not approach the bear if it is showing signs of very light anaesthesia - head-lifting or limb movement.
- Arousal may be stimulated by: Loud noises, distress vocalization by cubs of the bear, moving the bear or changing its position, painful stimuli, such as tooth extraction.
- Do not approach the bear if it is lifting its head.
- Monitor respiration and oxygenation:
- Monitor the respiratory rate and character (depth, regularity)
- Monitor the colour of the mucous membrane.
- Using a pulse oximeter probe on the tongue.
- . Monitor arterial blood gases if possible.
- Give supplemental oxygen if the bear becomes hypoxaemic (haemoglobin saturation below 85%). A flow rate of 5-10 L/minute will be needed for most bears. In the field,

an ambulance-type regulator and a lightweight, portable but sturdy D-cylinder are useful. This can provide a flow rate of 10 L/minute for up to 30 minutes; an E-cylinder can provide 10 L/min for an hour. Oxygen can be delivered via a nasal catheter placed into one nostril and passed up the nasal chamber as far as the medial canthus of the eye. Monitor the efficiency of the oxygen therapy by pulse oximetry.

- Monitor the cardiovascular system:
- Monitor the pulse/heart rate.
- If possible, monitor peripheral blood pressure and ECG.
- Blood pressure can be measured via the femoral artery.
- Use a blood pressure cuff with a width about 0.4 times the circumference of the bear's limb.
- Monitor rectal temperature:
- Bears are prone to hyperthermia because of their thick fat layer; close monitoring of body temperature during anaesthesia is important.
- . Establishing an intravenous line early during the anaesthetic ensures that venous access is available in the event of an emergency and drugs and fluids can be given rapidly if required. This is particularly recommended during prolonged surgical procedures. Appropriate veins include the cephalic, femoral vein or the medial saphenous on the inside of the hind leg.
- Give fluids: During prolonged surgical procedures, fluids should be given intravenously.

- **During Recovery**

The bear should be left undisturbed, preferably in a cool, dimly lit area in which it can be kept under observation.

The bear's mouth and airways must be clear and its respiration monitored.

The bear should not have access to food, water or other animals, nor be able to climb, until it is fully recovered.

- **Anaesthetic drug for bears:**

The choice of anesthetic drug or drugs to use will depend on what the bear is being anaesthetized for (e.g. physical examination, surgical procedure) and personal choice - what the person carrying out the procedure is most comfortable with.

KETAMINE-XYLAZINE ANAESTHESIA IN BEARS:

Preparation for anaesthesia:

- Whenever possible (with captive bears), the bear should be moved to a safe, quiet, well-controlled situation away from other bears.
- Avoid anaesthetizing immediately after the bear has eaten, to reduce the risks associated with vomiting and regurgitation during induction, anaesthesia or recovery.
- Preferably starve for 24 hours before anaesthesia.
- Withhold water for eight hours and food for 24 hours before immobilization.

Administration:

- Give xylazine and ketamine by intramuscular injection, mixed together in one syringe, by hand syringe in physically restrained bears (e.g. cubs), by pole syringe, or by remote injection.
 - Injection into the shoulder/neck region rather than the rump is suggested to ensure injection into muscle rather than fat.
 - Blowpipes can be used for intramuscular injection of bears restrained in foot-hold snares or in traps (barrel or culvert traps).
 - Hand-injection can be used for additional doses in recumbent individuals.
- SUGGESTED DOSE:**
- Usually 1:2 Xylazine Ketamine or a 1:1 ratio.
 - Xylazine 3-9 mg/kg + Ketamine 3-9 mg/kg OR xylazine 2-4.5 mg/kg + ketamine 5-9 mg/kg.
 - Xylazine 2 mg/kg plus Ketamine 4-10 mg/kg Xylazine 1-2 mg/kg plus Ketamine 5 mg/kg immobilizes most bear species.
 - Xylazine 2 mg/kg plus ketamine 5-8 mg/kg.
- Ursus thibetanus* : **Asiatic Black Bear**
- Xylazine 2 mg/kg estimated body mass plus ketamine 4 - 5 mg/kg estimated body mass for wild bears following capture in traps. The drugs to be administered intramuscularly using a blowpipe.
 - Xylazine 1 mg/kg plus ketamine 15 mg/kg in culvert-trapped bears, for handling and attaching radio-collars. The drugs were administered intramuscularly using a blowpipe

DRUG 1	DRUG 2	REVERSAL	NOTES
Tiletamine-Zolazepam 4.4mg/kg	-	-	Ketamine 2.2mg/kg as a supplemental drug if required.
Tiletamine Zolazepam- 2.8-4.4 mg/kg	-	-	-
Medetomidine 0.01mg/kg	Tiletamine Zolazepam- 1.0mg/kg	-	Atipamezole
Xylazine 2 mg/kg estimated body mass	Ketamine 4-5mg/kg estimated body mass	-	In captive bears, this provides stage 2/stage 3 anaesthesia for about 30-40 minute, allowing physical examination or minor surgical procedures such as wound treatment, skin biopsy and castration.
Xylazine 1 mg/kg	Ketamine 15mg/kg	-	For foot snared or barrel-trapped wild bears.
			For culvert – trapped wild bears.

Different types of combination of drugs used for anaesthesia in *Ursus thibetanus* (Asiatic Black Bears)

Anaesthetic crises:

1. Insufficient sedation following administration of appropriate agents: if the attempt to anaesthetize the animal persists, it is likely to get hyperthermia.
2. In case of hyperthermia, cold water enema and cool fluids intravenously. Get all the personnel away except for one observer and give the appropriate antagonists.
3. Respiratory problem if the animal is not intubated and which has failed to respond to intravenous diazepam hydrochloride. Terminate the immobilizing procedure, administer appropriate antagonist.
4. seizures: wrap the animal in a tarpaulin to prevent it injuring itself during seizure, keep the bear quiet and make sure that there are no sharp objects nearby: hold the head and make sure the eyes are protected.

The table below depicts the details of tranquilization conducted for the Asiatic black bear (*Ursus thibetanus*) at Padmaja Naidu Himalayan Zoological Park, Darjeeling

Date	Sex	Age	Ailment	Dose(ketamine+ xylazine)	Recovery
30.4.01	Male		Cough and cold	7.5 ml +2.5 ml	Without antidote recovered in 60 min
5.12.01	Female	3 years	Abscess in back	7.5+ 1.4 ml	Without antidote recovered in 90 min
10.12.01	Female	3 years	Wound treatment	7+ 1.4 ml	Without antidote recovered in 75 min
16.12.01	Female	3 years	Wound treatment	6.5+ 1.2 ml	After reversine i/m recovered in 30 mins
27.9.02	Female		Shifting	4+ 0.8 ml	Without antidote recovered in 20 mins
27.9.02	Female	3 years	Shifting	9+ 1.8 ml	After antagozil i/m recovered in 30 mins
12.1.02	Female	4 years	Wound treatment	9+ 1.8 ml	After antagozil i/m recovered in 60 mins
19.1.02	Female	4 years	Wound treatment	6+ 1.2 ml	After antagozil i/m recovered in 65 mins
23.1.03	Female	4 years	Blood collection, check up and trimming of nails	7 + 1.4 ml	After antagozil recovered in 85 mins
23.1.03	Female	18 years	Blood collection, check up and trimming of nails	3.5+ 0.7 ml	After antagozil i/m recovered in 50 mins
12.12.03	Female	4 years	Wound treatment	4+ 0.8 ml	After antagozil i/m recovered in 45 mins
19.2.04	Male	9 years	Skin disease	6+ 1.2 ml	Without antidote recovered in 120 mins
23.2.04	Male	9 years	Wound dressing	6+1.2 ml	Without antidote recovered in 110 mins
15.2.05	Female	6 years	Cutting/trimming of nails	4 + 0.8 ml	After reversine i/m recovered in 30 mins
21.2.05	Female	20 yrs	Tuberculosis test	3+ 0.7 ml	After reversine i/m recovered after 35 mins
12.5.06	Male	13 years	Check up and treatment	10.5 + 2.1 ml	After reversine i/m recovered after 25 mins
11.8.07	Female	8 years	Blood collection/ check up/ trimming	4.5 + 0.9 ml	After reversine i/m recovered after 80 mins
23.8.07	Female	8 years	Blood collection/ check up/ trimming	4+ 0.8 ml	After reversine i/m recovered after 75 mins

➤ **Surgery:**

The commonest surgical procedures performed on bears are repairs of traumatic injuries. Other surgeries performed are for dental diseases, Canine tooth removal, Root Canal Treatment (RTC) and pulpotomy.

No records of surgery of Asiatic black bears recorded from any zoos.

➤ **EUTHANASIA:**

"Euthanasia" is a term used to describe an animal killed in a humane manner.

- The use of euthanasia may be appropriate for example to prevent unnecessary suffering in a terminally ill animal, or in a wild animal in which treatment will not allow a return to the wild and for which there is no appropriate place in a conservation breeding or educational programme. In flock medicine (the treatment of large numbers of birds), a few ill birds may be euthanased and necropsied to provide accurate data allowing effective treatment of the remaining individuals. Humane methods of killing (i.e. euthanasia) should also be used if pest species are live-caught and cannot be appropriately relocated.

- The method used will vary depending on the size and type of animal concerned and the availability of different physical and chemical means of euthanasia. Both physical and chemical methods of euthanasia may be extremely effective and humane in the right circumstances, and ineffective or inhumane if used incorrectly. In some countries the use of chemical methods of euthanasia may be restricted to e.g. veterinarians, due to regulations on the handling and storage of the required drugs.

- Euthanasia may be required in bears suffering from terminal illness or in severe pain.
- Are in severe pain or distress.
- Have injuries which would require treatment or care involving an unacceptable level of pain and distress.
- Have injuries which would prevent return to the wild, and for which there is no appropriate long-term captive or semi-captive accommodation.
- Are dangers to other animals or humans.
- Require treatment/facilities which are not available, or which would be available only following transport which would cause unacceptable pain or suffering, or which would be available only following transport and such transport is not available/feasible.

- **Veterinary procedures:**

While bears are hardy individuals and easy to maintain in captivity, familiarity with basic principles and a development of a good preventive medicine programme will improve their longevity and quality of life. Bears are largely free of family specific, bacteria, fungal and viral diseases particularly ascarid are more problematic, and dermatitis due to mites, lice, fleas has been encountered. Dental problems, especially fracture of the canine teeth, are a common occurrence. Bite wounds, laceration and other traumatic injuries are reasons for surgical interventions. Neoplasm's often hepatobiliary in origin, occur in older animals, as does arthritis and other "age related" conditions. Balanced nutrition and proper housing contributes to the health and well-being of these unique creatures and need to be an integral part of their overall care.

➤ **HEALTH SCREENING:**

All mammals should be visually checked twice daily, for example at feeding time. 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.

Daily checks, records, and repeated checks of animals which are "not quite right" require that animals are individually identifiable. Periodic checks by individuals other than the regular caretaker may assist in detection of slowly progressive changes. Unexplained loss of weight should be investigated even if the animal appears otherwise normal. All animals which die should be subjected to a post mortem examination). This may allow early identification of potentially disastrous group or herd problems.

Animals immobilized for any reason should be given a general physical examination. If possible, a blood sample should be taken to check hematological values and serum biochemistry. Excess serum should be stored frozen; in the event of a later infectious disease outbreak, a bank of serum samples may provide important information about when the disease arrived and which animals has antibodies to the disease agent.

Checking hematology and biochemistry may detect a health problem at an early stage, and if the animal is healthy, may provide normal values for that individual, for comparison with values measured when the individual is ill.

Dental examinations should be carried out routinely on all animals during physical examination, as well as on individuals known to have dental problems.

Routine serological screening for certain diseases may be required if the disease is prevalent in a particular geographical area or in a particular zoo species.

Tuberculosis testing is required.

For Asiatic black bear (*Ursus thibetanus*)

❖ All individuals should be visually inspected at least twice daily; this is not always easy for bears in large naturalistic enclosures.

❖ Behavioural training can be used to facilitate observation, with a signal requesting the bears show themselves and a reward for this behaviour.

❖ There should be several vantage points around large enclosures, offering good views of the exhibit so that it is possible for caretakers to observe the bears and check their health.

❖ For northern bears which may become very lethargic in winter and even hibernate, there needs to be a system in place allowing the bears to be checked without being disturbed.

❖ For mothers with cubs in the den, a microphone and/or close circuit video monitoring can be used to allow the health of the cubs to be assessed without disturbing the bear.

❖ The general demeanor of the individual should be noted, also its food and water intake, and the quantity and appearance of urine and faeces produced. Abnormalities in behaviour, feeding, defecation etc. should always be noted and the veterinarian informed.

❖ Abnormal faeces vomit, and other discharges should be collected so that they can be examined if necessary.

❖ Sudden apparent changes in personality (changes in behaviour or temperament) may indicate the development of medical problems - illness or injury.

❖ Gait, dentition, skin condition and parasite detection should be considered in daily, monthly and annual health checks.

❖ Body weights should be monitored. For thick-coated animals such as bears, in which changes in body weight may not easily be visible, a weighing platform incorporated into a passageway or onto a shelf used by the bears is advantageous.

❖ Significant change in weight may indicate illness.

❖ Bears can be trained to use a weighing platform

➤ **DIET/NUTRITION:**

❖ Provision of correct nutrition is important to maintain the general health of animals as well as to prevent any specific nutrition-related diseases.

❖ Diets should be reviewed periodically by a veterinarian and nutritionist.

❖ In analyzing diets it is important to analyze what is actually eaten, recognizing that this may be different from the diet offered.

➤ **VACCINATION PROTOCOLS:**

❖ It is possible to vaccinate animals against a number of infectious diseases. This option is generally preferred when it is available for non-domestic animals maintained in zoos

and other collections, due to the problems of detecting disease and in treating sick animals.

- ❖ Vaccination protocols (i.e. what immunizations to give) may vary considerably depending on the species of mammals and the diseases which may be problematic in wild and domestic animals in the area in which they are being kept.

- ❖ Depending on the disease and the vaccines available, best results may be obtained by vaccinating individuals directly or, for juveniles, by vaccinating the parent to ensure passive protection of the young animal in their first few weeks of life.

- ❖ Both live vaccines and inactivated vaccines may be available.

- ❖ In general, live vaccines produce a better immune response but inactivated vaccines are "safer", less likely to cause disease.

- ❖ 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 (either in the same syringe, or by concurrent use - such as bacitracins given at the same time as antibiotics). N.B. Extreme caution must be used if considering using a vaccine in a species for which it is not licensed; live vaccines which may revert to virulence and inactivated vaccines may stimulate an anaphylactic reaction.

- ❖ 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 and in neonates by the presence of maternal antibodies).

- ❖ Avoid giving vaccines at the same time as subjecting animals to the considerable physiological stresses associated with transfer between collections.

- ❖ Vaccine is a live or dead preparation used to stimulate active immunity.

- ❖ Vaccination means producing immunity to a disease by using a vaccine to stimulate the formation of appropriate antibodies. It may be assumed that bears suffer from the diseases common to other carnivores and should be treated along the same principle. Only the vaccines which are tested and safe for these animals must be used. Inactivated viral and bacterial vaccines should be preferred in wild animals to avoid risk.

- ❖ Bears are apparently not susceptible to most of the infectious diseases of carnivores and it is not generally considered necessary to vaccinate them against the viruses of dogs and cats. Outbreaks of canine adenovirus (infectious hepatitis) (CAV) have been documented in American Black bears. Killed vaccines are available in the U.K. for CAV, but the clinical disease is now so rare in dogs that vaccination of bears is not probably warranted. However leptospirosis in bears has occurred more frequently and immunization against this disease is recommended in animals exposed to rodents. The existence of combined killed vaccines against CAV and leptospirosis suggests that their use in bears, which should carry no risk, should be routine. At least two doses are required, separated by a four-week interval; the development of immunity is slow and should probably be monitored by serology. Killed vaccines should be boosted again after six months and then repeated annually.

- ❖ Apparently no systematic studies on the diseases of bears have been undertaken yet. A lot of research has to be done on this. However following diseases have been recorded in bears. *Tularemia*, *Toxoplasmosis*, *Leptospirosis*, *Brucellosis*, *Trichinosis*, *Q-fever*,

rabies, Canine Distemper, Infectious canine hepatitis etc. vaccination against infectious disease must be a routine preventive programme because occurrence of these infectious diseases in bears may also infect wild animals as well as man.

❖ Among these diseases we can prevent many infectious diseases by prophylactic vaccination. But it is very unfortunate that we are using only anti-rabies vaccine in captive bears in India. However many vaccines are easily available. They are:-

1. Anti Rabies vaccines:-

(a) Inactivated tissue culture rabies virus, CVBS strain produced on BHK 21 cell line which is available as “RAKSHARB”

DOSAGE:1 mlS/C I/M

Prophylactic :-

1st Dose – 3 months & above

Booster dose- if primary vaccination is given below 3 months, booster dose should be given at 3 months of age.

Revaccination – annually.

(b) Tissue culture rabies, CVS strain produced on BHK 21 cell line and inactivated with aziridine compound available as megavac – r

Doses and administration- 1 ml/s/c or I/m

Prophylactic – 3 months and above

Booster dose – if primary vaccination given at 3 months, a booster dose should be given at 3 months of age.

Revaccination – annually.

(c) flurry egg passage (LEP) strain of rabies virus grown at BHK- 21 cell culture inactivated with aziridine compound and adsorbed on to aluminium hydroxide, which is available as RABDOMUN.

Dose: 1mlS/C or I/M

Prophylactic:-

Primary vaccination- 3 months and above

Revaccination- annually

2. Canine Distemper- killed vaccine should be used as modified live vaccine may be sufficiently attenuated. For wild animals albeit is safely used.

Vaccination should be done after weaning by I/M injection, with monthly boosters upto 4 months of age and thereafter annual vaccination suffices.

3. Anti- leptospirosis vaccine:

inactivated bivalent leptospira organism available as Nobivac-L

doses:- 1ml S/C

Primary vaccination- 9-12 weeks

Revaccination – annually

Other vaccines are Duramune, Paramune – 5, adenomune- 7, Cannigen, Vanguard-5L

4. Anti- infectious canine hepatitis vaccine- CAV-1 the schedule is the same as per canine distemper.

- Another disease against which we can use vaccine is **anthrax**. However carnivores are considered to be resistant to anthrax but according to Edetsten et.al. (1990) that any mammal in the zoo can be infected if it consumes anthrax infected meat. This disease can be controlled among the bears by treatment with antiserra and vaccination with anthrax spore vaccine @ 1ml/adult S/C and 0.5 ml/cub.

- “**Navel ill**” is a common problem in hand reared bears that do not receive colostrums from the female. A single prophylactic dose of 75000 units Benzathine, penicillin- G administered I/M and the local application of 2% mixture of iodine to the umbilical stump will normally prevent navel ill.

It is available 10-12 ml for homologous serum should be given S/C to provide a temporary level of acquired immunity.

- **Yersiniosis**: it is reported in bears that yersiniosis vaccination is performed in late summer or early autumn well before peak in outbreaks. Animal become vaccinated for the first time a booster injection is administered after 2-6 weeks. Vaccination is repeated on early basis.

PARASITIC SCREENING AND ROUTINE CONTROL MEASURES:

Another aspect of health management of captive bears is prevention and control of parasitism. Parasitic disease is responsible for considerable morbidity and mortality in captive bears. Affected animal becomes weak and susceptible to other infections. Examination of faeces for parasitic eggs or ova should be conducted at every 4- 6 months and when significant parasitism is found deworming should be taken up.

They are susceptible to variety of parasitic infection. The most threatening group of helminthes belongs to Nematode class.

Ascarids are the most common parasite found in captive bears. Species affecting bears are – *Bayliascaris transfuga* and *Toxocara leonine*. Ascariasis is a self limiting disease but Ursids do not develop immunity and may become reinfected despite hygienic measures. It clinical sign includes unthriftness, poor hair coat and vomition.

Parasite detection and control should begin before animals enter the collection, i.e. during quarantine, to prevent contamination of the enclosure and population.

Records should be kept of the results of systematic faecal examinations and of anthelmintic treatments given.

SCREENING

- Regular examination of faecal samples may be used to screen for gastro-intestinal parasites.

- Both qualitative and quantitative examinations should be carried out. Quantitative examination does not necessarily have to provide results in eggs per gram, but should at least indicate whether infestation is severe, moderate or occasional.

- Individual animal samples are preferable, but herd or group samples are also useful.

- The required frequency of testing will depend on the species and the past history of parasite types and levels of infection.
- All individuals or groups should be tested at least yearly; species with high susceptibility should be tested more frequently
- Examination should be carried out during quarantine; after treatment (to determine the effectiveness of treatment); and regularly thereafter, e.g. once or twice yearly, or more often if there is a known problem.
- Note: shedding of parasite eggs may vary depending on the season and time of day as well as on the time since the last anthelmintic (de-wormer) treatment given and the type of treatment given.
- False negative results may occur if samples are checked during the prepatent period (before the parasites have matured and started to shed eggs); note that some parasites shed eggs only intermittently even when mature.
- Regular faecal worm egg counts also are useful to detect any development of resistance to anthelmintic.
- Faecal samples should be taken and checked following treatment, to evaluate whether the treatment has been effective.

Control:

- Enclosure design, management, and stocking density should minimise build-up or spread of parasites.
- For parasites whose life cycle involves an intermediate host, control of the intermediate host may be an important part of preventing infection.
- Indoor surfaces which are impervious and easy to clean and disinfect assist in breaking the infection cycle of parasites with a direct life cycle. For outdoor areas, good drainage is advantageous in parasite control.
- Providing food in racks or troughs (and picking up spilled or dropped feed/hay), and water in waterers, reduces the ingestion of faecally contaminated food or water.
- Disinfectants and steam jet cleaners may be used on indoor impervious surfaces and on outdoor paved areas.
- Flamethrowers may be used to kill worm eggs on the ground, but do not penetrate far into the soil.
- Care should be taken not to move parasite eggs (e.g. *Baylisascaris* spp.) from one enclosure to another. This could occur when furnishings or equipment is moved between enclosures.
- Consider the risks of exposure to parasites when moving animals between enclosures.

Recommendations:

Internal Parasite:

- Ascarid infections may be detected by standard faecal flotation to detect ova.
- Full faecal examination includes a direct smear, flotation, sedimentation and Baermann.
- Bears with persistent ascarid infections should be treated routinely.
- Anthelmintic (de-wormers) should be given before a bear is transported to a new location.

External Parasites:

- Bears should be checked for mite infections while in quarantine and any infection eliminated.
- Individuals being translocated or reintroduced should be checked for the presence of external parasites such as mites.

SUGGESTIVE DRUGS:

SL. NO	TYPES OF PARASITES	DRUGS	DOSE
1	NEMATODES <i>Bayliasascaris transfuga</i> , <i>Ancylostomata malayanum</i> , <i>Dirofilaria ursi</i> , <i>Trichella spiralis</i> , and unidentified nematodes from the bronchii), <i>Toxocara sp</i>	Fenbendazole	10mg/kg x 2 days
		Mebendazole	15mg/kg on 2 successive days
		Piperazine salts (citrate/adipate)	50mg/kg. Animals suffering from hepatic and renal disorder should not be treated with piperazine.
		Levamisole	7.5mg/kg (broad spectrum anathelmentic & immunomodulator)
		Albendazole	25-50mg/kg x3 days
		Ivermectin	0.2g/kg orally or I/Mly
2	CESTODES (<i>Taenia sp</i>)	Bunamidine	25 mg/kg orally (single dose)
		Niclosaminde	50-75 mg/kg orally (single dose)
		Dichlorophene	200-300 mg/kg
		Praziquantel	7.5 mg/kg for 2 days
3.	TREMATODES (<i>Dicrocoelium lancaetum</i>)	Oxyclozanide	15mg/kg
		Rafoxanide	7.5-10mg/kg
4	TICKS (<i>Ixodes persulcatus</i> , <i>Haemaphylis formosensis</i> , <i>H. hystricis</i> , <i>H.japonicus</i> , <i>Dermacentor silvarum</i> and <i>D.auratus</i>), louse (<i>Trichodectes p.pinguis</i>)	Amitraz	3-4 ml/lts of water(mange) 2ml/lts of water (ticks and fleas).
		Cypermethrin	5ml/lts of water.
		Deltamethrin	For external application tick infestation 2-3 ml/lts of water. 4-6ml/lts of water (mites) 1-1.5ml/lts of water (lice)

PARASITOLOGICAL STUDY CONDUCTED AT ASIATIC BLACK BEARS AT PNHZ PARK, DARJEELING.

The scientific study of parasites and of parasitism is known as parasitology. Parasitism is a subdivision of symbiosis and is defined as an intimate association in between an organism (parasite) and another, larger species of organism (host) upon which the parasite benefits from the association. Parasitology is an active field of study.

Importance of parasitological study:

1. To know about the parasites and the parasite-induced diseases of humans, animals and plants.
2. Its phenotypic manifestation of parasites, their classification, life cycles and life manifestations.
3. Dealing with studies on epidemiology, epizootology and epiphytology of parasitoses and parasite borne diseases.
4. Studying therapeutic and prophylactic manipulation of life manifestation and life cycles of parasites in relation to the health protection and in reducing their negative impact on the hosts and environment.
5. Developing objectives of new, complex systems of humans, animal and plant protection against a damaging impact of parasites.

Why parasitological work is taken up in the park

This form of work was initiated in the park since ascarid worms are common in bears and can be persistent in captive animals. The study or the work done helps –

- (1) To learn its causes.
- (2) Quickly terminate it.
- (3) Trace back the primary cause to its source.
- (4) Trace forward possible contact animal to other exposed animals or premises for their protection or the protection of other populations

Thirdly, in terms of Veterinary aspect, parasitological work is conducted to see that the animal is free from any parasitic infection.

Losses due to parasitism:

- i) Higher mortality rate.
- ii) Higher susceptibility to other infections.
- iii) Condemnations of organs.
- iv) Lower breeding potential.
- v) Poor body growth.
- vi) Suppresses immunity.
- vii) Decrease the zoonotic cases.

Thirteen parasites have been reported from Asiatic black bear in southeast Asia or Japan these includes a trematode (*Dicrocoelium lanceatum*), a cestode (*Taenia sp*), five nematode (*Baylisascaris transfuga*, *Ancylostoma malayanum*, *Dirofilaria ursi*, *Trichinella spiralis*, and unidentified nematodes from the bronchii), six ticks (*Ixodes persulcatus*, *Haemaphysalis formosensis*, *H. hystricis*, *H. japonicus douglasi*,

Dermacentor silvarum and *D. ayraus*), and unidentified lice. In addition, a louse (*Trichodectes p. pinguis*) was reported from an Asiatic black bear in the Paris Zoo.

Techniques:

The techniques used in helminthological work that involve the separation of parasites or their eggs or larvae from the material with which they are mixed or in which they are contained, e.g. from tissues, faeces, herbage, culture medium. For this purpose use is made of differences in properties between the parasites and the materials from which they are to be separated. Properties utilized include particle size, specific gravity, the activity of the live worms and their resistance to digestive enzymes or to corrosive chemicals.

After knowing the techniques started my practical work. Consulted our S.O. Dr. Sunita Pradhan for the conduction of the practical work, advised me to use the laboratory of Darjeeling Government College for my parasitological works since it has a well equipped laboratory and experts for the identification of different parasites, its stages etc. worked in the Veterinary Hospital of PNHZ Park for my parasitological work using various methods such as-

Direct Smear Method: a small quantity of faeces is placed on a slide along with 2-3 drops of water, thoroughly emulsified with a needle, evenly placed over the slide and examined under the microscope. It is useful when infection is heavy.

Methods used for the microscopical examination of faeces-

i) **Sedimentation method:** this method is reliable for all types of parasitic eggs.

A small quantity of faeces, taken from different areas of sample, is thoroughly mixed with 10-15ml of water. The emulsion is strained through a sieve to remove all coarse particles. The filtrate is taken in a centrifuge tube at 1000 r.p.m. for 5 minutes. All the eggs get packed at the bottom in the sediment. A drop of sediment is placed on the slide, covered with a cover glass and examined under the microscope.

ii) Flotation method: light infection can be detected by this method. The common suspending media in use are

1. Saturated sol. Of common salt (sp.gr. 1.18-1.19)
2. Saturated sol. Of sugar (sp.gr. 1.25)
3. Saturated sol of CuSO_4
4. Zinc sulphate sol. (33%)

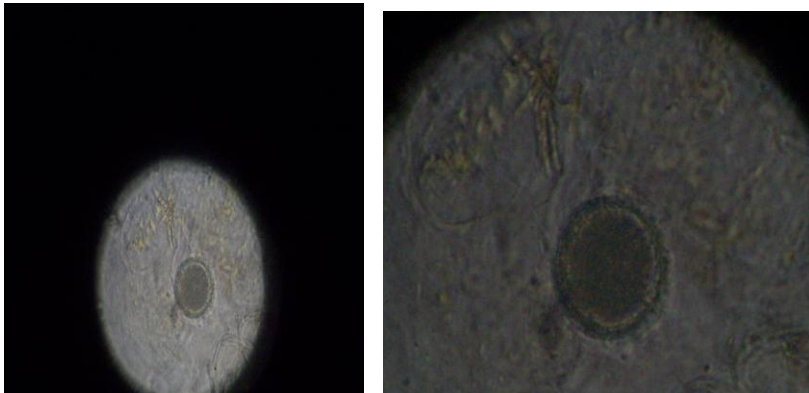
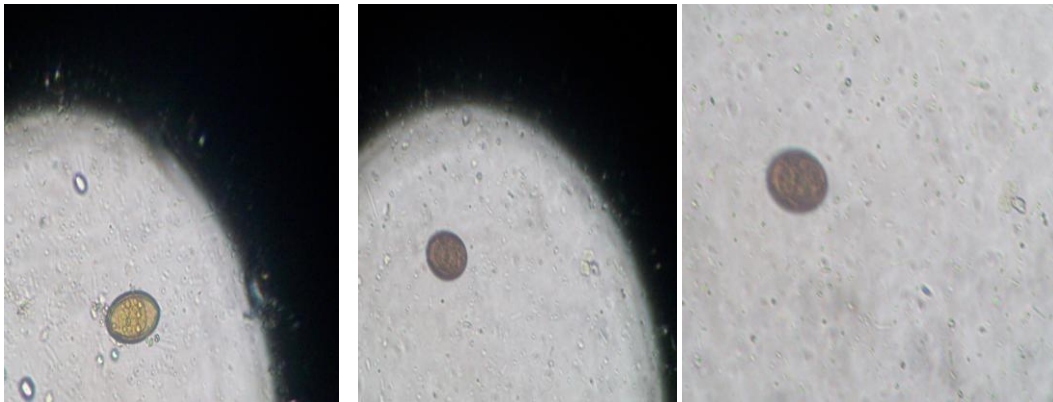
Willis technique: fill up $\frac{1}{3}^{\text{rd}}$ of a small flotation tube with thick emulsion of faeces and then fill up the tube to its capacity with saturated solution of common salt to the brim till a convex surface is formed. Allow it to stand $\frac{1}{2}$ hour by which time all the eggs would have floated up. Apply a clean slide to the surface of the fluid and removing just a drop of the fluid examine under microscope for eggs.

Lane's method: A small quantity of faeces is taken, emulsified in ten times of its volume of water, strained through a sieve and centrifuged. The supernant fluid is thrown off. The sediment is again suspended in water and centrifuged. Repeat centrifugation until supernant fluid is clear. Then the sediment is suspended in saturated Nacl solution

and again centrifuged. Examination of a few drops of the fluid from the top- most layers will reveal eggs of parasites.

Month-wise stool tests of Asiatic Black Bear (*Ursus thibetanus*) being carried out in Darjeeling Zoo Lab since November 2007.

- No significant parasitic infection has been detected so far in the bears
- Previously Asiatic Black Bear in Darjeeling Zoo have been tested positive for *Toxocara* sp.
- Later findings adult and ova of *Ascaris* sp and eggs of *Toxocara* sp.
(Parasitological results enclosed herewith)



Eggs of *Ascaris* sp. and *Toxocara* sp. found in the Asiatic black bears (*Ursus thibetanus*) at PNHZ Park.

PARASITOLOGICAL WORK CONDUCTED AT PNHZ, PARK FOR HBB FOR THE MONTH OF JANUARY 08'

NO	METHODS	DATE	ARUNA	JENNIFER
1	Direct, Sedimentation and flotation.	1.1.08	-ve for any parasite	-ve for any parasite
2	-D0-	2.1.08	-ve for any parasite	-ve for any parasite
3	-do-	3.1.08	-ve for any parasite	-ve for any parasite
4	-do-	4.1.08	-ve for any parasite	-ve for any parasite
5	-do-	5.1.08	-ve for any parasite	-ve for any parasite
6	-do-	7.1.08	-ve for any parasite	-ve for any parasite
7	-do-	8.1.08	-ve for any parasite	-ve for any parasite
8	-do-	9.1.09	-ve for any parasite	-ve for any parasite
9	-do-	10.1.08	-ve for any parasite	-ve for any parasite
10	-do-	11.1.08	-ve for any parasite	-ve for any parasite
11	-do-	13.1.08	-ve for any parasite	-ve for any parasite
12	-do-	14.1.08	-ve for any parasite	-ve for any parasite
13	-do-	15.1.08	-ve for any parasite	-ve for any parasite
14	-do-	16.1.08	-ve for any parasite	-ve for any parasite
15	-do-	17.1.08	-ve for any parasite	-ve for any parasite
16	-do-	18.1.08	-ve for any parasite	-ve for any parasite
17	-do-	19.1.08	-ve for any parasite	-ve for any parasite
18	-do-	21.1.08	-ve for any parasite	-ve for any parasite
19	-do-	22.1.08	-ve for any parasite	-ve for any parasite
20	-do-	23.1.08	-ve for any parasite	-ve for any parasite
21	-do-	24.1.08	-ve for any parasite	-ve for any parasite
22	-do-	25.1.08	-ve for any parasite	-ve for any parasite
23	-do-	26.1.08	-ve for any parasite	-ve for any parasite
24	-do-	28.1.08	-ve for any parasite	-ve for any parasite
25	-do-	29.1.08	-ve for any parasite	-ve for any parasite
25	-do-	30.1.08	-ve for any parasite	-ve for any parasite
25	-do-	31.1.08	-ve for any parasite	-ve for any parasite

PARASITOLOGICAL WORK CONDUCTED AT PNHZ, PARK FOR HBB FOR THE MONTH OF FEBRUARY 08'

NO	METHODS	DATE	ARUNA	JENNIFER
1	Direct, Sedimentation and flotation.	1.2.08	-ve for any parasite	-ve for any parasite
2	-D0-	2.2.08	-ve for any parasite	-ve for any parasite
3	-do-	4.2.08	-ve for any parasite	-ve for any parasite
4	-do-	5.2.08	-ve for any parasite	-ve for any parasite
5	-do-	6.2.08	-ve for any parasite	-ve for any parasite
6	-do-	7.2.08	-ve for any parasite	-ve for any parasite
7	-do-	8.2.08	-ve for any parasite	-ve for any parasite
8	-do-	9.2.09	-ve for any parasite	-ve for any parasite
9	-do-	11.2.08	-ve for any parasite	-ve for any parasite
10	-do-	12.2.08	-ve for any parasite	-ve for any parasite
11	-do-	13.2.08	-ve for any parasite	-ve for any parasite
12	-do-	14.2.08	-ve for any parasite	-ve for any parasite

13	-do-	15.2.08	-ve for any parasite	-ve for any parasite
14	-do-	16.2.08	-ve for any parasite	-ve for any parasite
15	-do-	18.2.08	-ve for any parasite	-ve for any parasite
16	-do-	19.2.08	-ve for any parasite	-ve for any parasite
17	-do-	20.2.08	-ve for any parasite	-ve for any parasite
18	-do-	21.2.08	-ve for any parasite	-ve for any parasite
19	-do-	22.2.08	-ve for any parasite	-ve for any parasite
20	-do-	23.3.08	-ve for any parasite	-ve for any parasite
21	-do-	25.2.08	-ve for any parasite	-ve for any parasite
22	-do-	26.2.08	-ve for any parasite	-ve for any parasite
23	-do-	27.2.08	-ve for any parasite	-ve for any parasite
24	-do-	28.2.08	-ve for any parasite	-ve for any parasite
25	-do-	29.2.08	-ve for any parasite	-ve for any parasite

PARASITOLOGICAL WORK CONDUCTED AT PNHZ, PARK FOR HBB FOR THE MONTH OF MARCH 08'

NO	METHODS	DATE	ARUNA	JENNIFER
1	Direct, Sedimentation and flotation.	1.3.08	-ve for any parasite	-ve for any parasite
2	-D0-	3.3.08	-ve for any parasite	-ve for any parasite
3	-do-	4.3.08	-ve for any parasite	-ve for any parasite
4	-do-	5.3.08	-ve for any parasite	-ve for any parasite
5	-do-	6.3.08	-ve for any parasite	-ve for any parasite
6	-do-	7.3.08	-ve for any parasite	-ve for any parasite
7	-do-	8.3.08	-ve for any parasite	-ve for any parasite
8	-do-	10.309	-ve for any parasite	-ve for any parasite
9	-do-	11.3.08	-ve for any parasite	-ve for any parasite
10	-do-	12.3.08	-ve for any parasite	-ve for any parasite
11	-do-	13.3.08	-ve for any parasite	-ve for any parasite
12	-do-	14.3.08	-ve for any parasite	-ve for any parasite
13	-do-	15.3.08	-ve for any parasite	-ve for any parasite
14	-do-	17.308	-ve for any parasite	-ve for any parasite
15	-do-	18.3.08	-. for any parasite	-ve for any parasite
16	-do-	19.3.08	-ve for any parasite	-ve for any parasite
17	-do-	20.3.08	-ve for any parasite	-ve for any parasite
18	-do-	.21.3.08	-ve for any parasite	-ve for any parasite
19	-do-	22.3.08	-ve for any parasite	-ve for any parasite
20	-do-	24.3.08	-ve for any parasite	-ve for any parasite
21	-do-	25.08	-ve for any parasite	-ve for any parasite
22	-do-	26.3.08	-ve for any parasite	-ve for any parasite
23	-do-	27.3.08	-ve for any parasite	-ve for any parasite
24	-do-	28.3.08	-ve for any parasite	-ve for any parasite
25	-do-	29.3.08	-ve for any parasite	-ve for any parasite
26	-do-	31.3.08	-ve for any parasite	-ve for any parasite

PARASITOLOGICAL WORK CONDUCTED AT PNHZ, PARK FOR HBB FOR THE MONTH OF APRIL08'

NO	METHODS	DATE	ARUNA	JENNIFER
1	Direct, Sedimentation and flotation.	1.4.08	-ve for any parasite	-ve for any parasite
2	-D0-	2.4.08	-ve for any parasite	-ve for any parasite
3	-do-	3.4.08	-ve for any parasite	-ve for any parasite
4	-do-	4.4.08	-ve for any parasite	-ve for any parasite
5	-do-	5.4.08	-ve for any parasite	-ve for any parasite
6	-do-	7.4.08	-ve for any parasite	-ve for any parasite
7	-do-	8.4.08	-ve for any parasite	-ve for any parasite
8	-do-	9.4.09	-ve for any parasite	-ve for any parasite
9	-do-	10.4.08	-ve for any parasite	-ve for any parasite
10	-do-	11.4.08	-ve for any parasite	-ve for any parasite
11	-do-	12.4.08	-ve for any parasite	-ve for any parasite
12	-do-	14.4.08	-ve for any parasite	-ve for any parasite
13	-do-	15.4.08	-ve for any parasite	-ve for any parasite
14	-do-	16.4.08	-ve for any parasite	-ve for any parasite
15	-do-	17.4.08	-ve for any parasite	-ve for any parasite
16	-do-	18.4.08	-ve for any parasite	-ve for any parasite
17	-do-	19.4.08	-ve for any parasite	-ve for any parasite
18	-do-	21.4.08	-ve for any parasite	-ve for any parasite
19	-do-	22.4.08	-ve for any parasite	-ve for any parasite
20	-do-	23.4.08	-ve for any parasite	-ve for any parasite
21	-do-	24.4.08	-ve for any parasite	-ve for any parasite
22	-do-	25.4.08	-ve for any parasite	-ve for any parasite
23	-do-	26.4.08	-ve for any parasite	-ve for any parasite
24	-do-	28.4.08	-ve for any parasite	-ve for any parasite
25	-do-	29.4.08	-ve for any parasite	-ve for any parasite
26	-do-	30.5.08	-ve for any parasite	-ve for any parasite

PARASITOLOGICAL WORK CONDUCTED AT PNHZ, PARK FOR HBB FOR THE MONTH OF MAY 08'

NO	METHODS	DATE	ARUNA	JENNIFER
1	Direct, Sedimentation and flotation.	1.5.08	-ve for any parasite	-ve for any parasite
2	-D0-	2.5.08	-ve for any parasite	-ve for any parasite
3	-do-	3.5.08	-ve for any parasite	-ve for any parasite
4	-do-	5.5.08	-ve for any parasite	-ve for any parasite
5	-do-	6.5.08	-ve for any parasite	-ve for any parasite
6	-do-	7.5.08	-ve for any parasite	-ve for any parasite
7	-do-	8.5.08	-ve for any parasite	-ve for any parasite
8	-do-	9.5.09	-ve for any parasite	-ve for any parasite
9	-do-	10.5.08	-ve for any parasite	-ve for any parasite
10	-do-	12.5.08	-ve for any parasite	-ve for any parasite
11	-do-	13.5.08	-ve for any parasite	-ve for any parasite
12	-do-	14.5.08	-ve for any parasite	-ve for any parasite
13	-do-	15.5.08	-ve for any parasite	-ve for any parasite
14	-do-	16.5.08	-ve for any parasite	-ve for any parasite

15	-do-	175.08	-ve for any parasite	-ve for any parasite
16	-do-	19.5.08	-ve for any parasite	-ve for any parasite
17	-do-	20.5.08	-ve for any parasite	-ve for any parasite
18	-do-	21.5.08	-ve for any parasite	-ve for any parasite
19	-do-	22.5.08	-ve for any parasite	-ve for any parasite
20	-do-	23.5.08	-ve for any parasite	-ve for any parasite
21	-do-	24.5.08	-ve for any parasite	-ve for any parasite
22	-do-	26.5.08	-ve for any parasite	-ve for any parasite
23	-do-	275.08	-ve for any parasite	-ve for any parasite
24	-do-	28.5.08	-ve for any parasite	-ve for any parasite
25	-do-	29.5.08	-ve for any parasite	-ve for any parasite
26	-do-	30.5.08	-ve for any parasite	-ve for any parasite
27	-do-	31.5.08	-ve for any parasite	-ve for any parasite

PARASITOLOGICAL WORK CONDUCTED AT PNHZ, PARK FOR HBB FOR THE MONTH OF JUNE 08'

NO	METHODS	DATE	ARUNA	JENNIFER
1	Direct, Sedimentation and flotation.	2.6.08	-ve for any parasite	-ve for any parasite
2	-D0-	3.6.08	-ve for any parasite	-ve for any parasite
3	-do-	4.6.08	-ve for any parasite	-ve for any parasite
4	-do-	5.6.08	-ve for any parasite	-ve for any parasite
5	-do-	6.6.08	-ve for any parasite	-ve for any parasite
6	-do-	7.6.08	-ve for any parasite	-ve for any parasite
7	-do-	9.6.08	-ve for any parasite	-ve for any parasite
8	-do-	10.6.09	-ve for any parasite	-ve for any parasite
9	-do-	11.6.08	-ve for any parasite	-ve for any parasite
10	-do-	12.6.08	-ve for any parasite	-ve for any parasite
11	-do-	13.6.08	-ve for any parasite	-ve for any parasite
12	-do-	14.6.08	-ve for any parasite	-ve for any parasite
13	-do-	16.6.08	-ve for any parasite	-ve for any parasite
14	-do-	17.6.08	-ve for any parasite	-ve for any parasite
15	-do-	18.6.08	-ve for any parasite	-ve for any parasite
16	-do-	19.6.08	-ve for any parasite	-ve for any parasite
17	Direct, Sedimentation and flotation.	20.6.08	-ve for any parasite	-ve for any parasite
18	-D0-	21.6.08	-ve for any parasite	-ve for any parasite
19	-do-	23.6.08	-ve for any parasite	-ve for any parasite
20	-do-	24.6.08	-ve for any parasite	-ve for any parasite
21	-do-	25.6.08	-ve for any parasite	-ve for any parasite
22	-do-	26.6.08	-ve for any parasite	-ve for any parasite
23	-do-	27.6.08	-ve for any parasite	-ve for any parasite
24	-do-	28.6.08	-ve for any parasite	-ve for any parasite
25	-do-	30.6.08	-ve for any parasite	-ve for any parasite

PARASITOLOGICAL WORK CONDUCTED AT PNHZ, PARK FOR HBB FOR THE MONTH OF JULY 08'

NO	METHODS	DATE	ARUNA	JENNIFER
1	Direct, Sedimentation and flotation.	1.7.08	-ve for any parasite	-ve for any parasite
2	-D0-	2.7.08	-ve for any parasite	-ve for any parasite
3	-do-	3.7.08	-ve for any parasite	-ve for any parasite
4	-do-	4.7.08	-ve for any parasite	-ve for any parasite
5	-do-	5.7.08	-ve for any parasite	-ve for any parasite
6	-do-	7.7.08	-ve for any parasite	-ve for any parasite
7	-do-	8.7.08	-ve for any parasite	-ve for any parasite
8	-do-	9.7.09	-ve for any parasite	-ve for any parasite
9	-do-	10.7.08	-ve for any parasite	-ve for any parasite
10	-do-	11.7.08	-ve for any parasite	-ve for any parasite
11	-do-	12.7.08	-ve for any parasite	-ve for any parasite
12	-do-	14.7.08	-ve for any parasite	-ve for any parasite
13	-do-	15.7.08	-ve for any parasite	-ve for any parasite
14	-do-	16.7.08	-ve for any parasite	-ve for any parasite
15	-do-	17.7.08	-ve for any parasite	-ve for any parasite
16	-do-	18.7.08	-ve for any parasite	-ve for any parasite
17	-do-	19.7.08	-ve for any parasite	-ve for any parasite
18	-do-	21.7.08	-ve for any parasite	-ve for any parasite

PARASITOLOGICAL WORK CONDUCTED AT PNHZ, PARK FOR HBB FOR THE MONTH OF AUGUST 08'

NO	METHODS	DATE	ARUNA	JENNIFER
1	Direct, Sedimentation and flotation.	8. 8.08	-ve for any parasite	+ve for <i>Ascaris sp</i>
2	-D0-	9. 8.08	-ve for any parasite	+ ve for Parasitic eggs
3	-DO-	11.8.08	-ve for any parasite	-ve for any parasite
4	-DO-	12.8.08	-ve for any parasite	-ve for any parasite
5	-DO-	13.8.08	-ve for any parasite	-ve for any parasite
6	-DO-	14.8.08	-ve for any parasite	-ve for any parasite
7	-DO-	15.8.08	-ve for any parasite	-ve for any parasite
8	-DO-	16.8.08	-ve for any parasite	-ve for any parasite
9	-DO-	18.8.08	-ve for any parasite	-ve for any parasite
10	-DO-	19.8.08	-ve for any parasite	-ve for any parasite
11	-DO-	20.8.08	-ve for any parasite	-ve for any parasite
12	-DO-	21.8.08	-ve for any parasite	-ve for any parasite
13	-DO-	22.8.08	-ve for any parasite	-ve for any parasite
14	-DO-	23.8.08	-ve for any parasite	-ve for any parasite
15		25.8.08	-ve for any parasite	-ve for any parasite
16	-DO-	26.8.08	-ve for any parasite	-ve for any parasite
17	-DO-	27.8.08	-ve for any parasite	-ve for any parasite
18	-DO-	28.8.08	-ve for any parasite	
19	-DO-	29.8.08	-ve for any parasite	-ve for any parasite
20	-DO-	30.8.08	-ve for any parasite	-ve for any parasite

PARASITOLOGICAL WORK CONDUCTED AT PNHZ, PARK FOR HBB FOR THE MONTH OF SEPTEMBER 08'

NO	METHODS	DATE	ARUNA	JENNIFER
1	Direct, Sedimentation and flotation.	1.9.08	-ve for any parasite	-ve for any parasite
2	-D0-	2.9.08	-ve for any parasite	-ve for any parasite
3	-do-	3.9.08	-ve for any parasite	-ve for any parasite
4	-do-	4.9.08	-ve for any parasite	-ve for any parasite
5	-do-	5.9.08	-ve for any parasite	-ve for any parasite
6	-do-	6.9.08	-ve for any parasite	-ve for any parasite
7	-do-	8.9.08	-ve for any parasite	-ve for any parasite
8	-do-	9.9.09	-ve for any parasite	-ve for any parasite
9	-do-	10.9.08	-ve for any parasite	-ve for any parasite
10	-do-	11.9.08	-ve for any parasite	-ve for any parasite
11	-do-	12.9.08	-ve for any parasite	-ve for any parasite
12	-do-	13.9.08	-ve for any parasite	-ve for any parasite
13	-do-	15.9.08	-ve for any parasite	-ve for any parasite
14	-do-	16.9.08	-ve for any parasite	-ve for any parasite
15	-do-	17.9.08	-ve for any parasite	-ve for any parasite
16	-do-	18.9.08	-ve for any parasite	-ve for any parasite
17	-do-	19.9.08	-ve for any parasite	-ve for any parasite
18	-do-	20.9.08	-ve for any parasite	-ve for any parasite
19	-do-	22.9.08	-ve for any parasite	-ve for any parasite
20	-do-	23.9.08	-ve for any parasite	-ve for any parasite
21	-do-	24.9.08	-ve for any parasite	-ve for any parasite
22	-do-	25.9.08	-ve for any parasite	-ve for any parasite
23	-do-	26.9.08	-ve for any parasite	-ve for any parasite
24	-do-	27.9.08	-ve for any parasite	-ve for any parasite
25	-do-	29.9.08	-ve for any parasite	-ve for any parasite
26	-do-	30.9.08	-ve for any parasite	-ve for any parasite

PARASITOLOGICAL WORK CONDUCTED AT PNHZ, PARK FOR HBB FOR THE MONTH OF OCTOBER 08'

NO	METHODS	DATE	ARUNA	JENNIFER
1	Direct, Sedimentation and flotation.	1.10.08	-ve for any parasite	-ve for any parasite
2	-DO-	2.10.08	-ve for any parasite	-ve for any parasite
3	-do-	3.10.08	-ve for any parasite	-ve for any parasite
4	-do-	4.10.08	-ve for any parasite	-ve for any parasite
5	-do-	6.10.08	-ve for any parasite	-ve for any parasite
6	-do-	7.10.08	Adult <i>Ascaris sp</i>	-ve for any parasite
7	-do-	8.10.08	-ve for any parasite	-ve for any parasite
8	-do-	9.10.08	- ve for any parasite	-ve for any parasite
9	-do-	10.10.08	- ve for any for any parasite	-ve for any parasite
10	-do-	11.10.08	- ve for any parasite	-ve for any parasite
11	-do-	13.10.08	-ve for any parasite	-ve for any parasite
12	-do-	14.10.08	-ve for any parasite	-ve for any parasite
13	-do-	15.10.08	-ve for any parasite	-ve for any parasite
14	-do-	16.10.08	-ve for any parasite	-ve for any parasite
15	-do-	17.10.08	-ve for any parasite	-ve for any parasite
16	-do-	18.10.08	-ve for any parasite	-ve for any parasite
17	-do-	20.10.08	-ve for any parasite	-ve for any parasite

18	-do-	21.10.08	-ve for any parasite	-ve for any parasite
19	-do-	22.10.08	-ve for any parasite	-ve for any parasite
20	-do-	23.10.08	-ve for any parasite	-ve for any parasite
21	-do-	24.10.08	-ve for any parasite	-ve for any parasite
22	-do-	25.10.08	- ve for any parasite	-ve for any parasite
23	-do-	27.10.08	-ve for any parasite	-ve for any parasite
24	-do-	28.10.08	- ve for any parasite	-ve for any parasite
25	-do-	29.10.08	-ve for any parasite	-ve for any parasite
26	-do-	30.10.08	-ve for any parasite	-ve for any parasite
27	-do-	31.10.08	-ve for any parasite	-ve for any parasite

PARASITOLOGICAL WORK CONDUCTED AT PNHZ, PARK FOR HBB FOR THE MONTH OF NOVEMBER 08'

NO	METHODS	DATE	ARUNA	JENNIFER
1	Direct, Sedimentation and flotation.	1.11.08	ve for any parasite	-ve for any parasite
2	-DO-	3.11.08	ve for any parasite	-ve for any parasite
3	-do-	4.11.08	ve for any parasite	-ve for any parasite
4	-do-	5.11.08	ve for any parasite	-ve for any parasite
5	-do-	6.11.08	ve for any parasite	-ve for any parasite
6	-do-	7.11.08	Adult <i>Ascaris sp</i>	-ve for any parasite
7	-do-	8.11.08	-ve for any parasite	-ve for any parasite
8	-do-	10.11.08	- ve for any parasite	-ve for any parasite
9	-do-	11.11.08	- ve for any for any parasite	-ve for any parasite
10	-do-	12.11.08	- ve for any parasite	-ve for any parasite
11	-do-	13.11.08	-ve for any parasite	-ve for any parasite
12	-do-	14.11.08	-ve for any parasite	-ve for any parasite
13	-do-	15.11.08	-ve for any parasite	-ve for any parasite
14	-do-	17.11.08	-ve for any parasite	-ve for any parasite
15	-do-	18.11.08	-ve for any parasite	-ve for any parasite
16	-do-	19.11.08	-ve for any parasite	-ve for any parasite
17	-do-	20.11.08	-ve for any parasite	-ve for any parasite
18	-do-	21.11.08	-ve for any parasite	-ve for any parasite
19	-do-	22.11.08	-ve for any parasite	-ve for any parasite
20	-do-	24.11.08	-ve for any parasite	-ve for any parasite
21	-do-	25.11.08	-ve for any parasite	-ve for any parasite
22	-do-	26.11.08	- ve for any parasite	-ve for any parasite
23	-do-	27.11.08	-ve for any parasite	-ve for any parasite
24	-do-	28.11.08	- ve for any parasite	-ve for any parasite
25	-do-	29.11.08	-ve for any parasite	-ve for any parasite

PARASITOLOGICAL WORK CONDUCTED AT PNHZ, PARK FOR HBB FOR THE MONTH OF DECEMBER 08'

NO	METHODS	DATE	ARUNA	JENNIFER
1	Direct, Sedimentation and flotation.	1.12.08	ve for any parasite	-ve for any parasite
2	-DO-	2.12.08	ve for any parasite	-ve for any parasite
3	-do-	3.12.08	ve for any parasite	-ve for any parasite
4	-do-	4.12.08	ve for any parasite	-ve for any parasite
5	-do-	6.12.08	ve for any parasite	-ve for any parasite
6	-do-	8.12.08	Adult <i>Ascaris sp</i>	-ve for any parasite
7	-do-	9.12.08	-ve for any parasite	-ve for any parasite
8	-do-	10.12.08	- ve for any parasite	-ve for any parasite
9	-do-	11.12.08	- ve for any for any parasite	-ve for any parasite
10	-do-	12.12.08	- ve for any parasite	-ve for any parasite
11	-do-	13.12.08	-ve for any parasite	-ve for any parasite
13	-do-	22.12.08	-ve for any parasite	-ve for any parasite
14.	-do-	23.12.08	-ve for any parasite	-ve for any parasite
15.	-do-	24.12.08	- ve for any parasite	-ve for any parasite
16.	-do-	125.12.08	-ve for any parasite	-ve for any parasite
17.	-do-	26.12.08	- ve for any parasite	-ve for any parasite
18.	-do-	27.12.08	-ve for any parasite	-ve for any parasite
19.	-do-	29.12.08	-ve for any parasite	-ve for any parasite
20.	-do-	30.12.08	-ve for any parasite	-ve for any parasite
21.	-do-	31.12.08	-ve for any parasite	-ve for any parasite

PARASITOLOGICAL WORK CONDUCTED AT PNHZ, PARK FOR HBB FOR THE MONTH OF JANUARY 09'

NO	METHODS	DATE	ARUNA	JENNIFER
1	Direct, Sedimentation and flotation.	1.01.09	ve for any parasite	-ve for any parasite
2	-do-	2.01.09	ve for any parasite	-ve for any parasite
3	-do-	3.01.09	ve for any parasite	-ve for any parasite
4	-do-	5.01.09	ve for any parasite	-ve for any parasite
5	-do-	6.01.09	ve for any parasite	-ve for any parasite
6	-do-	7.01.09	Adult <i>Ascaris sp</i>	-ve for any parasite
7	-do-	8.01.09	-ve for any parasite	-ve for any parasite
8	-do-	9.01.09	- ve for any parasite	-ve for any parasite
9	-do-	10.01.09	- ve for any for any parasite	-ve for any parasite
10	-do-	12.01.09	- ve for any parasite	-ve for any parasite
11	-do-	13.01.09	-ve for any parasite	-ve for any parasite
12	-do-	14.01.09	-ve for any parasite	-ve for any parasite
13	-do-	15.01.09	-ve for any parasite	-ve for any parasite
14	-do-	16.01.09	-ve for any parasite	-ve for any parasite
15	-do-	17.01.09	-ve for any parasite	-ve for any parasite
16	-do-	19.01.09	-ve for any parasite	-ve for any parasite

17	-do-	20.01.09	-ve for any parasite	-ve for any parasite
18	-do-	21.01.09	-ve for any parasite	-ve for any parasite
19	-do-	22.01.09	-ve for any parasite	-ve for any parasite
20	-do-	23.01.09	-ve for any parasite	-ve for any parasite
21	-do-	24.01.09	-ve for any parasite	-ve for any parasite
22	-do-	26.01.09	- ve for any parasite	-ve for any parasite
23	-do-	27.01.09	-ve for any parasite	-ve for any parasite
24	-do-	28.01.09	- ve for any parasite	-ve for any parasite
25	-do-	29.01.09	-ve for any parasite	-ve for any parasite
26	-do-	30.01.09	-ve for any parasite	-ve for any parasite
27	-do-	31.01.09	-ve for any parasite	-ve for any parasite

PARASITOLOGICAL WORK CONDUCTED AT PNHZ, PARK FOR HBB FOR THE MONTH OF FEBRUARY 09'

NO	METHODS	DATE	ARUNA	JENNIFER
1	Direct, Sedimentation and flotation.	1.01.09	ve for any parasite	-ve for any parasite
2	-do-	2.01.09	ve for any parasite	-ve for any parasite
3	-do-	3.01.09	ve for any parasite	-ve for any parasite
4	-do-	5.01.09	ve for any parasite	-ve for any parasite
5	-do-	6.01.09	ve for any parasite	-ve for any parasite
6	-do-	7.01.09	Adult <i>Ascaris sp</i>	-ve for any parasite
7	-do-	8.01.09	-ve for any parasite	-ve for any parasite
8	-do-	9.01.09	- ve for any parasite	-ve for any parasite
9	-do-	10.01.09	- ve for any for any parasite	-ve for any parasite
10	-do-	12.01.09	- ve for any parasite	-ve for any parasite
11	-do-	13.01.09	-ve for any parasite	-ve for any parasite
12	-do-	14.01.09	-ve for any parasite	-ve for any parasite
13	-do-	15.01.09	-ve for any parasite	-ve for any parasite
14	-do-	16.01.09	-ve for any parasite	-ve for any parasite
15	-do-	17.01.09	-ve for any parasite	-ve for any parasite
16	-do-	19.01.09	-ve for any parasite	-ve for any parasite
17	-do-	20.01.09	-ve for any parasite	-ve for any parasite
18	-do-	21.01.09	-ve for any parasite	-ve for any parasite
19	-do-	22.01.09	-ve for any parasite	-ve for any parasite
20	-do-	23.01.09	-ve for any parasite	-ve for any parasite
21	-do-	24.01.09	-ve for any parasite	-ve for any parasite
22	-do-	26.01.09	- ve for any parasite	-ve for any parasite
23	-do-	27.01.09	-ve for any parasite	-ve for any parasite
24	-do-	28.01.09	- ve for any parasite	-ve for any parasite

PARASITOLOGICAL WORK CONDUCTED AT PNHZ, PARK FOR HBB FOR THE MONTH OF MARCH 09'

NO	METHODS	DATE	ARUNA (F)	JENNIFER (F)	GUDDU (M)	SUNDARI (F)
1	Direct, Sedimentation and flotation.	2.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
2	-DO-	3.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite.
3	-do-	9.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
4	-do-	11.3.09	-ve for any parasite	-ve for any parasite	+ ve for parasitic ova of <i>Ascaris sp</i>	-ve for any parasite.
5	-do-	12.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasites	-ve for any parasites
6	-do-	13.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
7	-do-	14.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
8	-do-	16.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
9	-do-	17.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite.
10	-do-	18.3.09	-ve for any parasites	- ve for any parasites -ve for any parasites	-ve for any parasites	-ve for any parasites
11	-do-	19.3.09	-ve for any parasites	-ve for any parasites	-ve for any parasites	-ve for any parasites
12	-do-	20.3.09	-ve for any parasites	-ve for any parasites	-ve for any parasites	-ve for any parasites
13	-do-	21.3.09	-ve for any parasites	-ve for any parasites	+ve for a parasitic ova	-v for any parasites.
14	-do-	23.3.09	-ve for any parasites	-ve for any parasites	-ve for any parasites	-ve for any parasites
15	-do-	24.3.09	-ve for any parasites	-ve for any parasites	-ve for any parasites	-ve for any parasites
16	-do-	25.3.09	-ve for any parasites	-ve for any parasites	-ve for any parasites	-ve for any parasites.
17	-do-	26.3.09	-ve for any parasites	-ve for any parasites	-ve for any parasites	-ve for any parasites.
18	-do-	27.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
19	-do-	28.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
20	-do-	30.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
21	-do-	31.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite.

PARASITOLOGICAL WORK CONDUCTED AT PNHZ, PARK FOR HBB FOR THE MONTH OF APRIL 09'

NO	METHOD	DATE	ARUNA (F)	JENNIFER (F)	GUDDU (M)	SUNDARI (F)
1	Direct, Sedimentation and flotation					
2	-do-	1.4.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
3	-do-	2.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
4	-do-	3.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
5	-do-	4.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
6	-do-	6.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
7	-do-	7.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
8	-do-	8.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
10	-do-	9.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
11	-do-	10.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
12	-do-	11.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite.
13	-do-	11.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
14	-do-	13.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
15	-do-	14.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
16	-do-	15.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
17	-do-	16.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
18	-do-	17.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve or any parasite
19	-do -	18.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
20	-do-	20.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
21	-do-	21.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
22	-do-	22.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	Adult Ascaris sp
23	-do-	23.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite.
24	-do-	24.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
25	-do-	25.3.09	-ve for any	-ve for any	-ve for any	-ve for any

			parasite	parasite	parasite	parasite
26	-do-	27.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
27	-do-	28.3.09	-ve for any parasite	-ve for any parasite	-ve for any parasite	-ve for any parasite
28	-do-	29.3.09	-ve for any parasite	-ve for any parasite	-ve for parasite	-ve for any parasite
29	-do-					
30	-do-					

ROUTINE FOOT AND CLAW MONITORING:

Part of general health monitoring should include monitoring for lameness. Causes of lameness may include injury or disease of any part of the leg (muscles, bones, nerves, joints) or the spine. Many lameness problems are caused by foot problems, including hoof, nail or claw problems. The feet should always be checked if a mammal is undergoing physical examination, including as a routine matter if the individual has been immobilized. Small problems can be noted and corrected.

Correct substrates are important for the maintenance of foot, hoof and claw health; inappropriate substrates for the species are more likely to lead to disease and chronic foot problems.

Appropriate objects should be provided for scratching for species such as for carnivores, to keep their claws worn to a proper length.

For animals with claws, also, care should be taken to ensure that these do not become too long. In extreme cases, excessively long claws can curl round and grown into the pad of the toe.

Recommendations:

Part of general health monitoring should include monitoring for lameness. Causes of lameness may include injury or disease of any part of the leg (muscles, bones, nerves, joints) or the spine. Many lameness problems are caused by foot problems, including hoof, nail or claw problems

- Claw overgrowth can occur in zoo bears if they are kept in inappropriate accommodation, hence-
- The feet should always be checked if a mammal is undergoing physical examination, including as a routine matter if the individual has been immobilized. Small problems can be noted and corrected.
- Correct substrates are important for the maintenance of foot, hoof and claw health; inappropriate substrates for the species are more likely to lead to disease and chronic foot problems.
- For animals with claws, also, care should be taken to ensure that these do not become too long. In extreme cases, excessively long claws can curl round and grown into the pad of the toe.
- Claw trimming should not be required if bears have no access to logs or trees for scratching.
- Clip/trim the nails, with the bear under sedation.
- Use strong nail clippers.

- If the nail has grown into the pad, first cut through the nail and remove the tip from the pad.
- Flush the wound in the pad.

Note:

- Provide an adequate area for normal movement.
- Provide a variety of substrates which the bears can dig in and trees/logs which they can scratch.

Routine dental monitoring and care:

Captive bears are prone to develop dental problems, routine examination of the oral cavity and cleaning of dental plaque is required frequently. (Fowler, 2003).

Bears have the general dental formula $3/3, 1/1, 4/4, 2/3 = 42$. Dental disease, including caries and broken canines, is a common problem in captive bears. Once teeth are cracked or broken, abscessation or periodontal disease commonly develops.

Tooth substance is lost due to attrition (wear of the ocular surfaces of the teeth), abrasion (wearing by mechanical means such as excessive rubbing or biting on a hard surface) erosion (wear due to chemical action of the tooth) or resorption (pathological reabsorption of dental tissue by the animal).

Dental disease is more likely to occur in animals on diets which are very different from the wild diet in terms of texture and food process.

Dental and oral pathologies including maloccluded dentition and atrophy of the jaw muscles may occur in mammals fed soft-textured diets.

- **Excessive wear:**

- ❖ Bears in captivity may excessively wear their teeth by repeated biting at cage bars, heavy wire mesh etc.
- ❖ In elderly bears, excessive wear of teeth may eventually result in exposure of the pulp and development of dento- alveolar abscesses.

- **Injuries**

- ❖ Bears may traumatically damage their canines by biting hard objects.
- ❖ Bears may damage their teeth while fighting.
- ❖ Stereotypic chewing at bars, wire or other hard object may weaken the teeth and predispose to fracture.

- **Unnatural/Inappropriate Diet:**

- ❖ Unnatural diet affects the self cleaning mechanism of the oral cavity.
- ❖ Bears fed on too much soft, prepared food may develop more soft dental plaque leading to gingivitis and periodontal disease.
- ❖ Further development of this condition involves mineralization of the plaque; the microenvironment at the margin of the gingival is conducive to pathological changes.

Clinical signs:

- ❖ Slight alterations in prehension and mastication of food, and in general well-being.
- ❖ Restlessness or distress.

- ❖ Pawing at the head, rubbing and/or shaking the head.
- ❖ Aggressive behaviour due to dental pain.
- ❖ Unusual actions while eating or drinking, such as suddenly stopping while drinking cold water, chewing on one side of the mouth only.
- ❖ Dysphagia, reduced appetite or anorexia and loss of body condition.
- ❖ Unusual preference for soft foodstuffs or unwillingness to chew on hard food.
- ❖ Swellings on the face.
- ❖ Abnormal salivation.
- ❖ Teeth may be visibly damaged/fractured.
- ❖ The dental pulp may be exposed if teeth are physically damaged.
- ❖ There may be putrid discharge from the nose, the mouth or a fractured tooth.
- ❖ Fistula formation.
- ❖ Malocclusion.

Note: Bears may not show obvious signs of dental problems, such as inappetance, even with severe dental disease.

Prevention

- ❖ Bears should be provided with an appropriate diet to reduce build up of plaque. The diet should include hard materials such as large bones to chew; this may assist in removing plaque and stimulating the gingiva.
 - ❖ Mouth checks and removal of hard plaque should be carried out frequently as a routine part of bear preventative medicine whenever bears are being handled (under anaesthesia)
 - ❖ The mouth and teeth should be checked whenever an animal is anaesthetized, particularly in species in which dental disease is common.
 - ❖ Tooth problems seen during examinations should be addressed, e.g. filling or removing worn or broken teeth, as appropriate.
 - ❖ If the pulp cavity is exposed, dental treatment needs to be carried out as soon as possible to avoid complications such as bacterial infection and fistula formation, as well as to reduce pain.
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- ❖ Diets should be designed not only to provide required nutrients but also to give appropriate stimulation to the teeth, gingiva and jaw muscles.
 - ❖ Soft diets lead to build up of dental plaque; calculus, which can totally cover the teeth, also leads to gingival inflammation.
 - ❖ Soft diets fail to provide gingival stimulation, leading to decreased circulation in the gums, impaction of food in the gingival sulcus (the crevice surrounding the tooth, between the tooth and the free gingival margin), gingival inflammation and eventually loss of supporting bone
 - ❖ Caries (tooth decay) may be prevented by ensuring appropriate nutrition and limiting the amount of processed sugars in the diet.
 - ❖ Provision of bones (preferably with meat attached) and/or rawhide chews can improve dental health of carnivores.

- ❖ Food or other items provided for chewing should be hard enough to give dental exercise and reduce plaque build up, but not so hard that dental enamel is chipped or teeth fractured.
- ❖ Dental disease is commonly seen in some species as a consequence of abnormal behaviours such as bar chewing.
- ❖ Periodic treatment may be required to remove sharp edges and points from the teeth of species with continually growing teeth, or to remove hard calculus.

PEST CONTROL

- ❖ Pests of various types are abundant in zoos due to the availability of food, warm humid environments and animal faeces.
- ❖ Pest species may eat foods intended for the animals being maintained in a collection, contaminate foods, damage buildings, enclosures or plants and harbour or transmit diseases.
- ❖ No single action is likely to be effective against pests, but an integrated pest management strategy involving a variety of control measures should, in combination, keep pest numbers to a minimum.
- ❖ Well designed external fencing should exclude larger predators and act as a deterrent to many pests. Half-inch netting covering the bottom of a fence and continuing underground, together with an electrified wire near the top of the small-gauge netting, may exclude species such as weasels.
- ❖ Enclosures and ancillary buildings, food preparation and storage areas etc. should be designed and maintained so as to minimise the availability of access points for pests such as rodents; to minimise places where pests may be harboured; and/or to improve accessibility of all areas to pest control measures.
- ❖ Cavities and awkward corners must be filled and eliminated (e.g. bricked up), or a means must be available by which they can be checked and cleaned.
- ❖ Minimizing food available to pests is essential. This includes keeping feed storage bins closed; storing feed sacks neatly to allow detection and control of pests in their vicinity; and avoiding overfeeding, which leaves uneaten food available to pest species.
- ❖ Vermin control should be implemented in all areas including areas where food is stored or prepared.
- ❖ Traps are labour-intensive to place and monitor. For maximum effect they must be placed on routes known to be used by the target species. Both lethal traps (commonly used in rodent control) and live traps (commonly used for most other species) must be checked daily. Live-trapped pests must be either euthanased by an acceptable humane method or relocated.
- ❖ Poisons are commonly used in rodent control. It is important to ensure that toxic bait stations are clearly labelled and do not allow entry to non-target species. Bait stations should be monitored to determine whether the bait is being taken and to confirm that it is not being taken by non-target species.

Recommendations:

- ❖ Pest control should be carried out for bear enclosures as for other enclosures.
- ❖ Large populations of pest pigeons, starlings etc. should be discouraged.

- ❖ It is important to ensure that the bears cannot access either poison baits or poisoned rodents.
- ❖ Food stores should be kept pest-free; food for bears should be stored, and waste food disposed of, in such a manner that it is not attractive to or accessible to pests such as rodents.
- ❖ In providing food-based environmental enrichment such as scatter feeds, consideration should be given to the risks of foodstuffs attracting pests.
- ❖ Foods such as fresh or thawed meat or fish-based products, which may quickly become attractive to flies and other insects, should be fed in a manner which minimises the time for which they are attractive to pests.

CONTROL OF TOXINS

Toxic Plants:

- ❖ It is important to ensure that toxic plants are not used within an enclosure, nor near an enclosure, where animals may be able to reach them.
- ❖ A number of plant species which are known to be toxic to animals, such as yew, rhododendron and oleander, may be used for decorative landscaping within zoos but outside animal enclosures.
- ❖ If toxic plants are used for landscaping, care should be taken to minimise the risk that visitors can offer these to the animals.
- ❖ Clippings from toxic plants should be disposed of carefully to remove the risk that they are offered to animals as browse.
- ❖ Gardeners and maintenance personnel, as well as animal keepers, should be made aware of the risks from toxic plants. This reduces the likelihood of toxic species accidentally being offered to animals as browse.
- ❖ Care must be taken to buy pelleted foods from reputable sources; it is impossible to visually check such diets to ensure that they have not been manufactured using toxic plants.
- ❖ Hays should be visually checked before being fed to animals, to ensure they do not contain known toxic plants.

Toxic Chemicals:

- ❖ Toxic chemicals may be present in paint, wood preservatives etc.
- ❖ Cleaning agents can be toxic or corrosive.
- ❖ Care must be taken to ensure that containers of cleaning agents are not left where animals can reach them, and that cleaning agents are properly rinsed away and not left on surfaces or in puddles when animals may ingest them (directly, or via grooming).
- ❖ It is important that reclaimed wood is cleaned of old paint which might contain lead, before being repainted.
- ❖ Mammals may loosen paint by scratching or chewing and can then ingest flakes of paint
- ❖ Prepared foods (pellets, extruded diets etc.) should be obtained from reputable sources.

- ❖ It is important that manufacturers understand the toxicities which may occur if feedstuffs intended for one species, and containing ingredients (including medications) suitable for that species, are inadvertently mislabelled or allowed to contaminate feedstuffs for other species

Recommendations:

- ❖ Care should be taken to ensure that enclosures do not contain toxic plants. Plants which have caused poisoning when fed to bears include oleander and yew.
- ❖ Wood used inside bear enclosures, including wood shavings provided for environmental enrichment, must not have been treated with any wood preservatives (insecticides, fungicides) as these may be poisonous.

PROCEDURE IF ANIMAL DIES:

Post mortem examination (i.e. necropsy) is an extremely valuable tool in disease investigation and management. It is important to approach each carcass with an open mind, not assuming that the cause of death is known, even if there are obvious external lesions on- going disease problem. Before starting a necropsy, consider whether the skin or skeleton is important for museum based studies, if a cosmetic post moterm is required.

Reasons for performing a post mortem examination include:

- Finding the cause of death
- Conforming a diagnosis
- Investigating unsuccessful therapy
- Increasing knowledge
- Detection of sub-clinical disease.

Post moterm is particularly important for animals which die in quarantine in preparation for introduction to a collection translocation or reintroduction programme.

Post moterm may be performed in the field or laboratory by a clinician or a pathologist dependent on the circumstances.

Where the gross post moterm is performed by an individual other than the pathologist who will perform the further examinations on samples provided communication between the two parties is essential to ensure that optimal samples are taken (tissue type, volume/weight storage, transport, temperature etc.).

Inadequate or incorrect sample taking may reduce the likelihood of reaching an accurate diagnosis.

Forensic post moterm for legal investigation should be performed by an experienced wildlife pathologist, since the credentials of the pathologist will be assessed as part of the case.

Similar protocols should be used for the post- mortem examination of domestic, free-ranging or captive wild animals.

If possible findings should be dictated during the examination or as an alternative noted down at the time of examination.

When performing a necropsy or post mortem examination it is important to:

First consider the history of the animal (where available). Not the clinical signs, treatment, diagnostic tests, possible differential diagnosis, number of animal's involved etc. communication between the pathologist and the case clinician, where available is recommended.

Consider recent and historical disease problems in the collection (captive animal), region (free ranging), in-contact domestic animal and human population.

Examine the site where carcass was found if possible (e.g. of agonal movements, convulsions disturbing the local area, piles of faeces and urine around the hindquarters suggestive of prolonged recumbency).

Have a systematic approach, whether head to tail, system to system (digestive, respiratory etc), or any other.

Recognize the normal anatomy, normal appearance of organs/tissues and anatomical variations between species.

Have knowledge of seasonal variations between individual of the same species dependent on whether they are captive or free ranging (e.g. obese body condition may be seen in captive animals than those under wild conditions): Ectoparasite and endo- parasite burdens may be expected to be greater in free-ranging wild animals than those under captive management.

Have knowledge of potential artefactual findings e.g. hypostatic congestion (pooling of blood in organs under the effects of gravity which can be mistaken for potential congestion), barbiturate crystals from euthanasia solution which can be mistaken from gout, pseudo prolapse of the anus or vagina as a result of increased pressure within the abdomen caused by gas production after death.

Accurately describe lesions/ abnormalities.

Record both positive and negative findings.

Keep accurate records, including a unique identifying number for each carcass and for samples from that carcass.

Keep detailed notes on all findings and procedures for forensic post mortem, written in non- technical language wherever possible.

Avoid the use of non- standard abbreviations in permanent records.

Take photographs (include case identification, details) for animal identification and illustration of gross pathology.

Preserve samples (tissue, parasites etc) for further research and reference.

A full spectrum of samples should be taken where possible at the initial examination if possible and stored properly.

Further investigations at first, may be directed at the samples thought most likely to be important in revealing the cause of death. However if further samples are needed subsequently the full spectrum are available in store.

Where time and financial constraints limit samples taking a short list of standard tissues should be sampled, in addition to those with apparent gross pathology.

In some circumstances it may be advised to keep the entire carcass for a period following the postmortem examination refrigerated in the short term to provide samples in the future if required.

Consult the appropriate regional authority if a notifiable disease (FMD) is suspected before progressing with the post mortem examination.

Carcass location and body size may dictate whether transport to the laboratory facility for examination is possible or whether the post mortem must be performed in the field.

Autolysis of the organs occurs with variable speed, the adrenal medullae, gastro-intestinal mucosa, pancreas, liver, kidney and CNS develop autolytic changes particularly quickly, post mortem should be performed as quickly as possible after death has occurred and has been confirmed however this may not always be possible and carcass cooling to slow the rate of autolysis should be practiced.

The carcass should be placed within a sealed plastic bag clearly labeled with excess air removed and be refrigerated if its body size allows.

Carcasses preferably should be refrigerated while awaiting examination.

With large mammals cooling of central organs will not occur sufficiently quickly to prevent autolysis. Priority should be given to performing post mortem as soon as possible, opening the abdomen may help lower the core temperature as quickly as possible.

Where post mortem examination must be delayed until 72- 96 hrs after death. The carcass should be refrigerated only, however if the examination must be delayed over 96 hrs post mortem, it is recommended to freeze the carcass immediately.

When transporting a carcass or pathological sample to a laboratory for analysis attention should be paid to temperature control in transit. Insulated containers should be chosen, ice packing of frozen samples may be used and times when post gets delayed may be. (E.g. weekends, public holidays, strikes).

In an event of a die-off (mass mortality event) it is important to examine fresh carcasses of a number of individuals, representatives of the range of species affected and the ages of individuals affected and to remember that more than one disease process may be acting at any one time and that the major causes of death may change during a prolonged die-off.

The result of the post mortem should be used in conjunction with the history of the mammal or mammals and assessment of the environment to help determine their significance and recommended future action.

In areas where rabies infection is enzootic, all mammals found dead, and particularly those with a clinical history of abnormal behaviour or neurological signs should be carefully examined and considered as potentially infected until proven otherwise.

Suspect cases of sudden death should have peripheral blood smears taken to exclude anthrax infection as a differential before the carcass is opened. Bloody discharges should direct the examiners attention to the need to exclude anthrax infection before continuing with the examination. Depending on region, specialist, and veterinary staff may be legally required to carry out the anthrax testing process.

- Samples should be taken by nicking the dependent ear or from the coronary band.
- In wild equids (Equidae – Horses (family)- horses, wild pigs (Suidae – Pigs (Family) and carnivores (Carnivora- Carnivores (order), anthrax bacilli may not be present within the blood therefore examination of a smear made from the cut surface of a lymph node (usually submandibular is recommended in addition.
- Tissue and blood smears should first be air dried and then fixed in methanol.
- Staining should be performed for two minutes with polychrome methylene blue or Giesma stain.
- Samples should be examined under oil immersion microscopy for evidence of anthrax bacilli.
- If anthrax infection is confirmed, careful attention must be paid to quick and effective carcass disposal.
- Regional authorities responsible for disease control should be notified and action taken as appropriate.
- If anthrax infection is excluded, the post mortem examination should proceed.

Equipments

Laboratory post mortem facilities should be housed in a separate room to the clinical facilities and should be cleaned with adequate water supply and draining floor in consultation with the veterinary section of the park.

Weighing Scales And Measuring Devices (tapes, clippers) should be available with a level of accuracy and range appropriate for the mammals under investigation.

Suitable Dissection Instruments should be available in the laboratory or the field: 1) a curved knife for skinning, a straight pointed knife for dissecting, a pair each of 25 cm rat-toothed forceps, 15 cm pointed forceps, 15 cm dissecting scissors, a sterile scalpel and blades, an enterotome, a bone saw, a large pair of bone forceps or bone-cutting shears, an axe, a sharpening stone and steel, a balance to weigh, some nylon rope, and a small gas or alcohol burner for sterilizing instruments.

2) “Knife, lamp, matches, sterile syringes and needles, sterile swabs with transport media”

- Dissection equipments should be clearly marked and kept solely for the purpose.
- Equipments should be cleaned and sterilized following use.
- Size of equipments should be tailored to the carcass size; ophthalmology instruments, hand lens and dissecting microscopes may be useful for small mammals where available.
- All non- disposable cutting instruments should be kept sharp.

Suitable Sample Collection Equipment and disposable should be available in the laboratory or the field.

- An equipment list for specimen collection in the field includes sterile disposable 5 ml syringes and sterile needles (20 gauge); culture tubes with sterile swabs, microscope slides in box; sterile universal bottles; sterile blood tubes; plastic bags with closure taps (Ziploc types), heavy duty plastic sealing tape; 300ml wide mouthed glass and plastic jars, a measuring tape or ruler rubber or plastic string and a waterproof marker pen or pencil.
- Microscope, clean slides and cover slips.
- Sterile swabs and transport media.
- Gas source for heating metal blade to sear surface of an organ before sampling for microbiology.

Suitable Fixation Medium should be available in the laboratory or the field including 10% neutral buffered formalin, 70% alcohol for parasites, 100% acetone for cytology (danger flammable), normal saline.

Stain kits for cytological, bacteriological and fungal examinations (Gram, Ziehl- Nielsen, Diff Quick, Hemacolor, lactophenol)

GENERAL EXTERNAL EXAMINATION

- **Record the sex and estimate age.** Classification as a neonate/infant/juvenile/adult/geriatric may be useful.
- **Record any identifying numbers** e.g. tattoo, tags, microchip number etc, retain any physical markers for future reference e.g. radio transmitters, tag.
- **Record any characteristic features** e.g. characteristic scars or colour markers, coat colour e.g. (e.g. albino, leucistic, melanistic).
- **Examine** the inside of the container/wrappings that the carcass have been presented in noting contaminants (e.g. mud, oil) and possible external parasites such as fleas, lice or mites which may have left the host. Presence of maggots within the wrappings may indicate significant carcass decomposition but should alert the examiner to search the lesions of fly strike.
- **Weigh the carcass.** Dry weight should be taken where possible to minimise error where the carcass is presented wet, this should be noted for future reference to allow recognition of potential bias.
- **Biometric measurements:** a range of biometrics should be taken using graduated calipers.. the accuracy and units of measurement should be clearly noted. For e.g. body length, chest girth, head length, head girth, neck length, neck girth, ear length, ear girth, length of fore and hind limbs etc. if specific anatomical measurements to be noted, we have to carry on specifically.
- **Body condition** – use a combination of subjective and objective measurement of body conditions where possible
 1. Subjective scores can be developed, perhaps by creating indices based on muscle bulk, amount of subcutaneous and visceral fat deposits.
 2. Objective scores can be developed, perhaps by creating indices of parametric measurement to body mass.
- **Radiography** may be indicated to detect e.g. fractures radio dense foreign bodies, air gun or shot pellets, metabolic bone disease.
- **Examine the external surface** of the carcass; note whether the carcass is fresh or decomposed; whether it has been refrigerated or frozen; also whether it is intact or scavenged; and if scavenged to what degree.
- **Estimate** time of death where unknown
- **Autolysis** will be accelerated where the temperature of the animal is increased at the time of death e.g. heat stroke, lightening strike.
- **Differentiate** gas production in the gastro- intestinal tract post mortem with premortem “bloat”
- Bile staining of tissue adjacent to the gall bladder can be seen in carcasses as post mortem change.

Head and Neck

Examine the eyes, ears, nostrils (external nares) and mouth for evidence of haemorrhage, discharge, external parasites, maggots, abnormal growths, foreign bodies, other lesions etc.

Fatalities following acute plant poisoning may still have remnants of the plant material within their mouth.

Examine the eyes carefully for evidence of opacity or long standing injury which may have compromised vision.

Examine the condition of the lips, oral mucosa, soft/hard palate and tongue for lesions such as ulcers, growths or developmental abnormalities. (e.g. cleft palate).

Cut through the oral commissures to allow adequate examination right to the back of the oral cavity.

For more thorough examination, continue the incision to allow disarticulation of the lower jaw, this will allow full inspection of the nasopharyngeal area, tonsils, and retro pharyngeal and parotid nodes, as required.

The teeth should be examined for evidence of tooth loss, abnormal or excessive wear (attrition), gingivitis, periodontal disease, tartar accumulation etc.

Full dental formula should be recorded.

Remove the skin from the skull and the temporal muscle as necessary.

Examine the subcutaneous tissues and skull table for evidence of trauma, bruising etc.

Section of the base of the auricular (ear) cartilage and examine the contents for evidence of discharge, inflammation parasite etc.

Sectioning of the skull for examination of the sinuses, turbinates or tympanic bullae may be performed if required given specialist facilities.

Skin, Fur (Integument) Body – External Examination

Note the general appearance of the carcass, pelage (fur, spines) e.g. condition: wet. Muddy, oiled, clean, bloody, moult

- If in moult, note the extent and take into account the season
- Missing patches of fur should be correlated with wound, parasites, history of pruritus (itching), entanglement etc.
- Condition of the fur may indicate whether that animal was in good condition or a state of debility prior to death.

Note any wound present and characterize them in terms of age, size, location, degree of sepsis.

Check for the presence of external parasites (Ectoparasites) – fleas, lice, ticks, maggots etc.

Particular attention should be paid to checking the predilection sites for external parasites e.g. .armpits (axillae), groin, perineum, hoof clefts, eyes, ears etc.

Systematically part the hair over multiple areas of the body to examine the skin, looking for the lesions including bite wounds, macules, pustules, comedones, furuncles etc.

Examine all body orifices, including the anus, vulva, prepuce, cloaca as appropriate for evidence of haemorrhage, discharge, parasites, maggots, abnormal growth.

The carcass must be turned over allowing a full examination to be performed over both sides of the body.

Examine the perineum and hindquarters for evidence of faecal scouring suggestive of diarrhea.

At the end of the post mortem, the skin should be removed from the entire carcass to allow complete examination of the subcutaneous layer.

MUSCULO-SKELETAL SYSTEM – EXTERNAL EXAMINATION:

Examine the limb for evidence of fracture dislocation, swelling, deformity, lacerations, wound (including snare wounds) etc.

Use the other limb as a comparison for reference to help identify pathology.

Palpate the muscle bulk over all limbs using this as another indicator of body condition.

Muscle wasting (atrophy) affecting a single limb, or muscle group within a single limb may indicate recent disuse, possibly due to a long standing injury affecting the limb.

Provided the carcass is not in rigor mortis manipulate each limb and joint through its range of movement, comparing each side with one another to the top (proximal) of the limb.

Abnormal increased or restrained range of movement at a joint should direct further internal joint examination.

Radiographic examination may be indicated if an abnormality is detected on palpitation.

Bear consideration:

Note the bear's general nutritional condition and the depth of its subcutaneous fat layer.

Tacky viscera are indicative of dehydration.

Jaundice may be noted with:

- Hepatic and bile duct neoplasia.
- Infectious Canine Hepatitis.
- Sarcocystosis in bears.

Check the subcutaneous tissues; note the presence of abscess, spargonosis and nematodal parasites.

Thorax

- Note the contents of the thoracic cavity, the position of the organs, the condition of the pleura mediastinum and lymph nodes.
- Chronic pleuritis was seen in a bears.
- Extensive granulomas were present on all pleural surfaces in a bear with blastomycosis.

Abdomen

- Note the contents of the abdominal cavity, the presence and extent of fat stores, the position of the diaphragm and the organs, the condition of the peritoneum, omentum and lymph nodes.
- Ascites is common with intra-abdominal neoplastic lesions.
- Chronic peritonitis was seen in a bear with Pasteurella infection.
- Examination of the diaphragm musculature may detect the presence of Gonglyonema pulchrum nematodes or Trichinella.

Cardio vascular system:

- First examine the heart and great vessels in situ looking at their relative layout (e.g. patent ductus arteriosus (PDA), persistent right aortic arch), size, shape and colour.
- The organs of the chest are removed by cutting the trachea and great vessels as far cranial (forward) as possible. Applying gentle traction, carefully dissect back the 'pluck' containing the thymus (large if young, remnant may be identified in adult), heart and lungs.
- Alternatively, dissect along the inside of the blades of the lower jaw, free the tongue, larynx, trachea and oesophagus and remove together with the 'pluck'.
- Examine the 'pluck' as a whole and then dissect each organ free for individual examination.
- Dissect out the heart, leaving a portion of the major blood vessels intact.

- Visually examine and palpate each organ for evidence of pathology; consider colour, consistency and shape in every case.
- Organs should be palpated methodically by carefully feeling the tissue between the thumb and forefinger.
- Examine the surface of the pericardium, incise the pericardial sac and remove from the surface of the heart.
- Note the volume, colour, turbidity and viscosity of any fluid present.
- Note the presence of adhesions between the pericardium and the surface of the heart.
- Examine the overall shape and symmetry of the heart and its epicardial (outer) surface.
- Systematically dissect the heart using scissors to follow the path of blood through the heart; first examine the right side chambers, followed by the larger and thicker walled left side chambers.
- Evaluate the heart muscle and relative thickness and size of the heart chambers; look for dilatation and hypertrophy.
- Examine the endocardium (inner lining) of the heart and the valves for evidence of irregularities, plaques, thrombus formation, calcification, etc.
- Examination of the appearance of blood within the heart chambers can be used to help estimate the time since death.
- Unclotted blood in the left ventricle is suggestive of recent death and examination pre rigor mortis.
- Disintegrating blood clots within the left ventricle suggest that the animal has been dead for in excess of 24 hours and has passed through the period of rigor mortis.
- Cut through the heart in serial sections, noting the presence of any discolorations, parasitic cysts, growths, infarcts, scars, etc.
- Weigh and record organ dimensions (maximal length and width) as required.

Bear consideration:

Note the position of the heart, the condition of the heart, pericardium and associated blood vessels.

RESPIRATORY SYSTEM:

- First examine the lungs, trachea (windpipe) and major bronchi (airways) in situ; study their relative layout, size, shape and colour.
- The organs of the chest are removed by cutting the trachea and great vessels as far cranial (forward) as possible. Applying gentle traction, carefully dissect back the 'pluck' containing the thymus (large if young, remnant may be identified in adult), heart and lungs.
- Alternatively, dissect along the inside of the blades of the lower jaw, free the tongue, larynx, trachea and esophagus and remove together with the pluck.
- Examine the pluck as a whole and then dissect each organ free for individual examination.
- Visually examine and palpate the lungs for evidence of pathology; consider colour, consistency and shape in every case.
- Organs should be palpated methodically by carefully feeling the tissue between the thumb and forefinger.
- Pooling of blood in the dependent lung under the effects of gravity (hypostatic congestion)), should be recognized as an artifact.
- Using sharp scissors, cut along whole length of trachea (cut along both sides required, as tracheal rings are springy) into the major bronchi, noting presence of fluid, blood, fungal plaques, necrotic lesions, parasites, foreign bodies, etc.
- Cut through the lungs in serial sections, noting the presence of any water, froth, blood, fungal infection, abscesses tumors, parasites, tuberculous lesions, etc.
- Squeeze the lung tissue and observe for parasites within the airways.
- Placing a cut section of lung tissue within water may help evaluate congestion consolidation, etc.
- Tracheo-bronchial lymph nodes should be examined visually, by palpation and on cut serial section for evidence of enlargement, focal lesions, abscesses, tumour metastases, tuberculous granulomata etc.
- Weigh and record organ dimensions (maximal length and width) as required.

For bears:

- Note the position of the organs and the condition of the lungs, bronchi, respiratory blood vessels and associated lymph nodes.
- Check the lungs, particularly the trachea, bronchi and bronchioles, for nematodes; both *Crenosoma* sp. and *Capillaria aerophila* lungworms

- Generally no pathology has been described associated with lungworms in bears, but viscous exudates in the air passages (trachea, bronchi, bronchioles) can be observed.
- Flukes have also been found in the lungs
- Lesions of TB have been found, very rarely, in the lungs of bears.

ENDOCRINE SYSTEM:

- Examine the thyroid and parathyroid glands, the endocrine pancreas, and the adrenal glands, first in situ, then dissect free and examine in detail.
- Visually examine and palpate the organs for evidence of pathology; consider colour, consistency and shape in every case.
- Organs should be palpated methodically by carefully feeling the tissue between the thumb and forefinger.
- Weigh and record organ dimensions (maximal length and width), as required.

For bears:

- Check the thyroid and thymus in the neck, the pancreas and adrenals in the abdomen.
- Thyroid enlargement has been seen associated with hypothyroidism and cretinism in bears.

LIVER:

- Ensure knowledge of the normal shape and number of liver lobes in the species under examination since significant variation exists between taxa.
- First examine the liver in situ; study its layout, size, shape and colour and relation to other abdominal organs.
- Dissect the liver lobes free of their attachments and remove.
- Visually examine and palpate the liver for evidence of pathology; consider colour, consistency and shape in every case.
- Organs should be palpated methodically by carefully feeling the tissue between the thumb and forefinger.
- Note any haemorrhage on the liver surface or free in the body cavity; whether the capsule surface is intact or split; the presence of pale areas or other discolouration; whether lesions are flush with the surface, protruding or shrunken; whether edges of liver lobes are sharp (normal) or rounded (enlarged).
- Weigh and record organ dimensions (maximal length and width), as required.
- Cut through the liver lobes in serial sections, noting the presence of any colour variations, size and shape of any lesions (pale areas, haemorrhages, abscesses, growths, cirrhosis, etc.).
- Note the size of the gall bladder; estimate the volume of bile present and describe its appearance.
- Note the degree of post mortem local bile staining of tissue.

- Carefully express the gall bladder to determine whether any blockages may be present.
- Dissect open the gall bladder and look for any material within the bile e.g. stones, parasites.

For bears:

- Liver pathology (swelling, mottled appearance) may be seen in bears with hepatic sarcocystosis.
- Liver lesions including necrosis have been seen with toxoplasmosis.
- In bears from bear bile farms, gall bladder fistula and associated gall bladder lesions may be found.

SPLEEN

- Ensure knowledge of the normal shape of the spleen in the species under examination since significant variation exists between taxa.
- Examination of the spleen is recommended early in the post mortem after the abdomen is cut open.
- If the spleen is enlarged, with a black and tarry bloody appearance, testing for anthrax infection should be performed before progressing further.
- First examine the spleen in situ; study its layout, size, shape and colour and relation to other abdominal organs.
- Dissect the spleen free of its attachments and remove.
- Visually examine and palpate the spleen for evidence of pathology; consider colour, consistency and shape in every case.
- Organs should be palpated methodically by carefully feeling the tissue between the thumb and forefinger.
- Note any hemorrhage on the surface of the spleen or free in the body cavity; whether the capsule surface is intact or split; the presence of pale areas or other discoloration; whether lesions are flush with the surface, protruding or shrunken; whether edges of the spleen are sharp (normal) or rounded (enlarged).
- Weigh and record organ dimensions (maximal length and width), as required.
- Splenic dimensions can be artifactually increased if the animal was euthanased with barbiturates.
- Cut through the spleen in serial sections, noting the presence of any colour variations, size and shape of any lesions (pale areas, hemorrhages, abscesses, growths, etc.).

For bears:

- The spleen may be affected by abdominal neoplasia, including hepatic neoplasia.
- Splenic laceration has been seen as a darting injection. *Gnathosoma* sp. larvae have been found in the spleen.
- With ANTHRAX in many species typically the spleen is grossly enlarged, dark and soft (pulpy). In a bear with anthrax, the spleen is not enlarged, blue-grey in colour, medium consistency, with a small quantity of dark red thickened blood. Note: If anthrax is suspected the carcass should not be opened. Take peripheral blood smears and do not continue with the necropsy if a diagnosis of anthrax is made.
- Severe congestion of the spleen may be seen associated with clostridial disease.

- The spleen may be displaced, enlarged and congested in bears with acute gastric dilation.
- Mild enlargement of the spleen was seen in a bear with leptospirosis.

Kidneys/ Uro-Genital System

- Ensure knowledge of the normal shape of the kidneys in the species under examination, since significant variation exists between taxa.
- Ensure knowledge of the normal shape of the uterine tract in the species under examination, since significant variation exists between taxa.
- First examine the urinary system and reproductive system in situ; study its layout, size, shape and colour and relation to other abdominal organs.
- Trace the flow of urine through the urinary system in situ; follow the ureters from the kidney to the bladder and the urethra as possible.
- Check for developmental abnormalities e.g. ectopic ureter.
- Dissect the kidneys free of their attachments and remove.
- Note the amount of fat deposits present over the kidneys.
- Visually examine and palpate the kidneys for evidence of pathology; consider colour, consistency (firm, soft, pulpy) and shape in every case.
- Organs should be palpated methodically by carefully feeling the tissue between the thumb and forefinger.
- Note whether the capsule is adherent or easily detaches from the kidney surface.
- Examine the cut surface of serial sections of both kidneys in two planes (longitudinal and transverse).
- Study the distinction between the cortex and medulla.
- Note the presence of any cysts, stones (uroliths), parasites, etc.
- Weigh and record organ dimensions (maximal length and width), as required.
- Dissect open the bladder; examine its mucosa and contents for abnormalities.
- Examine the external genitalia including the vulva, prepuce, penic and testis (may be best performed earlier in the post mortem examination).

Female reproductive tract:

- Ovaries: size, whether ovaries are active (follicles present and growing, corpora lutea) or inactive, appearance of oviducts. Examine serial cut sections of both ovaries.
- Dissect the tract open from the vulva through to the tips of the uterine horns.
- Note the presence and number of fetuses (estimate the stage of gestation, mummification), implantation scars; presence of retained placentae; evidence of inflammation, infection or growths.

Male reproductive tract:

- Examine the contents of the inguinal canal; check for hernia.
- Testes: size, shape, colour, growths, active or regressed. Examine serial cut sections of both testes.

For bears:

- Renal pathology may be noted with various diseases:

- Renal and retroperitoneal hemorrhage has been seen associated with a severe subacute fibrinosuppurative valvular endocarditis caused by a coagulase-positive *Staphylococcus aureus*.
- A renal tuberculous lesion.
- Congenital absence of one kidney.
- Nephritis.
- Oiling may cause renal damage.
- Neoplasia such as kidney adenoma has been seen.

GASTRO- INTESTINAL SYSTEM:

- Examine the gastro-intestinal tract in situ; note any distension, abnormal layout (twisting or volvulus), discolouration, haemorrhage or lesions on the serosal surface.
- Barbiturate crystals may be seen on the surface of the intestines if the mammal has been euthanased by intraperitoneal injection.
- Ensure knowledge of the anatomy of the gastro-intestinal system and the primary site of microbial fermentation; distinguish between simple stomached, foregut and hindgut fermenters.
- Tie off the oesophagus above or at the level of the diaphragm and the rectum as low as possible; cut above and below these ties respectively, carefully dissect the whole gastro-intestinal tract free of its mesenteric attachments.
- Carefully dissect through the soft tissues of the intestinal coils to release them and lay the tract out as one continuous strip.
- Samples for bacteriological examination should be taken before further handling of the tract to limit contamination; the surface of the area to be sampled should be seared with hot metal and a sterile swab or pipette introduced to take the sample material.
- Clips or ties can be used to isolate the contents of different sections of the gastro-intestinal tract; for example at the pylorus to isolate the gastric contents, at the ileo-caecal valve to isolate the small intestinal from the large intestinal contents.
- Collection and examination of the gut contents from each section of the gastro-intestinal tract is particularly useful for parasitological examination.
- Quantitative estimates of numbers of parasites present can be made with further techniques.
- Systematically examine the entire gastro-intestinal tract, usually from oesophagus to rectum, including the pancreas. Use scissors or an enterotome to open up the tract.
- Check for ulcers, inflammation, haemorrhage, tumours.
- Comment on the consistency, colour and volume of the gut contents.
- Note whether the mammal has eaten recently and what, if possible, it was feeding on.
- Note any foreign bodies or parasites present
- Note whether formed faecal pellets are present in the rectum.
- Examine the mesenteric lymph nodes visually, by palpation and on cut serial section for evidence of enlargement, focal lesions, abscesses, tumour metastases, granulomata etc.

For bears:

- Bears have a very heavily muscled pylorus.

- Examination of the oesophageal musculature may detect the presence of Gonglyonema pulchrum nematodes.
- Gastrointestinal lesions may also be noted.
- Gastrointestinal parasitic infections may also be noted.
- Check the gastro-intestinal contents for potentially poisonous plants.
- Check for pancreatic diseases.

LYMPH NODES

- Superficial and deep lymph nodes from both sides of the body should be examined visually, by palpation and on cut serial section for evidence of enlargement, focal lesions, abscesses tumor metastases, granulomata etc.
- Weigh and record organ dimensions (maximal length and width) as required.

For bears:

- Enlarged, congested or hemorrhagic lymph nodes may be present associated with a number of diseases including anthrax (lymph node enlargement and congestion), Brucellosis (enlarged axillary lymph node), hypersensitivity angiitis in a bear, pseudorabies (congested mesenteric lymph nodes), infectious Canine
- Hepatitis (mesenteric lymph nodes may be pale, enlarged and may be petechiated), Neoplasia (hepatic and bile duct neoplasia).

NERVOUS SYSTEM:

- Autolysis of the brain occurs particularly rapidly. Priority should be given to removal of the brain for fixation if required.
- Specialist examination of the brain is required for diagnosis of rabies infection (PRESENCE OF NEGATIVE BODIES TO BE SEE FOR POSITIVE RABIES CASES).
- First disarticulate the skull at the level of the atlanto-occipital joint and remove all overlying musculature.
- Use an appropriate saw to cut through the cranium; techniques may vary with the species under examination.
- Make a transverse cut across the width of the skull just behind the orbits (eyes).
- Make two cuts joining with the outer limits of the first cut, towards the foramen magnum.
- Alternatively cut around the skull cap.
- A medical vice used to stabilise the skull in position may be useful if available.
- Carefully lift off the top of the skull using blunt elevation.
- Examine the brain and meninges in situ for evidence of local heemorrhage bruising, swelling, redness or pale colouration, parasites, abscesses growths or inflammation, etc.
- Remove the brain from the skull through careful elevation, cutting the cranial nerves in turn.
- Weigh and record organ dimensions (maximal length and width) as required.
- Examine the cut surface of serial sections of the brain, noting the distribution of any lesions found.

- The distribution of focal lesions found on post mortem examination should be related to the clinical history where neurological signs were noted.
- Dissection for examination of the spinal cord can be time consuming.
- Dissect away the overlying musculature; carefully trim the vertebral arches to allow visualisation of the spinal cord.

FOR BEARS:

- An unusual fluke infection described in one bears included involvement of the CNS.
- Toxoplasmosis has been seen causing CNS lesions in bears.
- Gross changes with enlargement of the ventricles are seen with hydrocephalus.
- CNS lesions including extensive occlusive fibrinopurulent exudates within the cerebral ventricles were noted in a cub within the cerebral ventricle.
- Other diseases with CNS lesions include:
Brain infarct, cerebral arteriosclerosis, cretinism, neuronal degeneration, ruptured in vertebral disk.

MUSCULO-SKELETAL SYSTEM – INTERNAL

- Incise and examine the major limb joints in turn, comparing both limbs for reference in each case.
- Note the volume, colour, viscosity and turbidity of synovial fluid present.
- Examine joint surfaces and tendon sheaths for evidence of discolouration, irregularity, degeneration, joint mice, etc.
- Check the state of mineralisation of the major limb bones by seeing how difficult they are to bend or break.
- Incise and examine the leg muscles over multiple areas of the body.
- Note the muscle colour (e.g. pale areas with white muscle disease and capture myopathy dark appearance with clostridial infection), any haemorrhage present.

FOR BEARS:

- Note the condition of the muscles, tendons, joints and bones of the extremities and of the vertebral column.
- Arthritis and skeletal disease, calcium – vitamin – D Metabolism imbalance , Clostridial Myonecrosis, fractures, lacerations and punctures including bite wounds, radial agenesis, ruptured intervertebral disk.
- Various parasites may be found in muscles of bears such as Cysticercosis, Sarcocystosis, Sparganosis, Toxoplasmosis, Trichinella infection.



FIG 1: PM Conducted in Asiatic Black Bear.

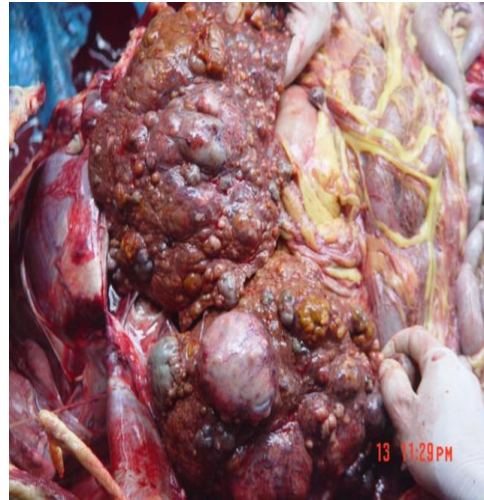


FIG 2: Adenocarcinoma in Asiatic Black Bear



FIG 3: Adenocarcinoma in Asiatic Black Bear in PNHZ Park.



FIG 4: Disposal of carcass by burning.

SL.NO.	SPECIES	HOUSE NAME & AGE	SEX	DATE OF DEATH	CAUSE OF DEATH
1.	Asiatic black bear	Suri – 22 yrs	Female	1.9. 2005	Old age
2.	Asiatic black bear	Mani – 12 yrs	Male	13.5.2006	Hepatocellular carcinoma
3.	Asiatic black bear	Sunny – 13 yrs	Male	3.7. 2007	Hepatocellular carcinoma.

THE ABOVE TABLE SHOWS THE DETAILS OF DEATH OF ASIATIC BLACK BEAR (*Ursus thibetanus*) AT PNHZ. PARK.

HUMAN HEALTH CONSIDERATION:

- Potential hazards to human health of any necropsy or post mortem examination must be considered before undertaking examinations.
- Personnel undertaking or attending necropsies or post mortem examinations must be made aware of the potential hazards to human health.
- All post mortem examinations should be considered to be harboring potentially transmissible agents of infectious disease until proven otherwise and should be handled accordingly with due caution.
- Potential hazards range from toxins on the surface of the animal (e.g. oil) to disease zoonotic which may be transmitted through cuts, absorbed through mucous membranes or inhaled in the form of dust or aerosols.
- Important zoonotic diseases to consider when dealing with mammal carcasses include, amongst others, salmonellosis Rabies, Anthrax Echinococcus spp, Cestoda- Tapeworm) Mammalian Tuberculosis, Brucellosis.
- For all necropsies, protective clothing should be worn including:
 - Disposable gloves (which should be replaced immediately if damaged).
 - Overalls (material suitable for boil clean).
 - Washable apron.
 - Rubber boots.
- A face mask, which covers the nose and mouth, is advisable, particularly when aerosol transmission infections are suspected.
- Protective eye wear may be recommended to prevent ocular splash injuries.

- **QUARANTINE PROCEDURES:**

Quarantine:

Quarantine is voluntary or compulsory isolation typically to contain the spread of something considered dangerous, often but not always disease. The word comes from the Italian (17th century Venetian) language. Italian quarantena, meaning 40 days period.

Quarantine is a basic and key part of preventative medicine; newly arrived animals should be kept separate from the main collection. Quarantine helps prevent new

pathogens/parasites from being introduced into a collection or new location, allowing screening of animals for disease, as well as permitting special monitoring of general demeanour, behaviour and feeding. Additionally, a period in quarantine can allow newly arrived animals to become used to their new housing and diet. Useful medical information can be collected while animals are being quarantined.

- A quarantine period of at least 30 days is recommended.
- A full physical examination should be carried out at the beginning of the quarantine period including weighing, taking blood for hematological and biochemical examination, parasitological tests and appropriate serological tests.
- A full physical examination should also be carried out at the end of the quarantine period.
- Appropriate sample collection and testing. Repeated sampling e.g. of faeces for bacteria and parasites which may be shed only intermittently or after a prepatent period.
- Appropriate action if an animal is found to be carrying an important pathogen or parasite. This may include treatment of the individual and/or group, or rejection of the animals for translocation.

4.3 BEHAVIOURAL NOTES

❖ **Common Captive Behavioural needs:**

Bears are intelligent and curious; they are opportunistic feeders and in the wild they spend considerable portions of their time investigating and testing their environment, foraging for a variety of foods by a variety of methods including digging, tearing open logs, debarking trees, turning over stones hence in captivity the psychological needs of the animal must be met as much as possible. Zoo environments are spatially limited and lack complexity and novelty; animal welfare can be improved by enriching the environment, giving the animals more behavioural options and providing the animal with control over elements of their environment. Thus in human care, the psychological needs of an animal should be met as much as possible.

It is accepted that the captive environment will differ from the wild environment in a number of ways, such as lack of 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 program 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. a den and/or nesting material for solitary mammals, an appropriate social group for social mammals, elevated resting places, provision of places to hide from humans and other animals;
- **Appropriate complexity** (including e.g. trees for climbing, appropriate substrate for digging or burrowing, water for swimming, depending on the species);
- **An element of novelty/unpredictability**, providing the opportunity for exploratory

behaviour;

- Opportunities to achieve goals, such as finding or gaining access to hidden foods.
- The ability to make choices.
- Opportunities for play.
- Opportunities both for work and for leisure.

❖ Behavioural enrichment activities.

Bears in captivity often show abnormal behaviours such as stereotypic and periods of excessive inactivity. In captivity animals do not need and are often unable to engage in a wide array of activities characteristic of their counterpart who live in the wild. Captive animals fill their time engaging in abnormal behaviours, including stereotypy and long periods of inactivity. (Hedgier, 1950).

Enriching captive environments to encourage species-typical activities is one solution (Carlstead, Seidensticker and Baldwin 1991; Hediger, 1950; Markowitz, 1982; Shepherdson, 1994). An enclosure conducive for activity might include cage furnishing and manipulatable objects that provide suitable opportunities for an increased range of behaviours these added elements could create more complex environments (Coe, 1985; Hancocks, 1980, Hutchins, Hancocks and Crockett, 1979). Complexity encourages interaction between the animal and its environment and reduces some of the distress produced by captivity (Synder, 1975).

The bear family (Ursidae) one animal group often engaged in stereotypic behaviour in captivity (Van Keulen-Kromhout, 1976). Only a few empirical studies however have focused on enriching the environments of captive bears and most have investigated only the use of food-related objects or activities to promote foraging and feeding behaviours.

Animals may show abnormal levels of behaviours in captivity, either reduced activity or hyperactivity. Stereotypies are a common form (The presence of stereotypies in zoo animals should be taken as a warning sign of potential suboptimal conditions and welfare problems) However, once an animal has developed stereotypic behaviour, this behaviour may continue even if the animal is provided with an appropriate enclosure, social environment and behavioural enrichment. Stopping such behaviour may be very difficult and the presence of such behaviour does not necessarily indicate that the animal's current enclosure, management and well-being are substandard.

Stress and abnormal behaviours may be reduced by providing animals with an environment which is of a biologically appropriate complexity and with control over their environment. Common stereotypic behaviours in bears include “pacing, head swinging, weaving, rubbing against or gnawing bars, circular or to-and-fro swimming and excessive grooming”

PREVENTION AND TREATMENT OF ABNORMAL BEHAVIOURS THROUGH ENVIRONMENTAL ENRICHMENT:

- The presence of substrates such as soil, leaf litter, vegetation. These increase the environment's "information content", concealing smells, food, naturally-occurring insects etc, and eliciting exploratory and forging behaviours.
- Provision of hiding places (by use of landscaping and/or barriers), vantage points,

escape routes etc. which the animals can choose to make use of.

- Varying microclimates - temperature gradients, shaded and sunny areas etc. - allowing animals to move to an area which is at a comfortable temperature at a particular time.
- Providing objects (toys) which animals can interact with.
- Adapting feeding methods to increase foraging and food handling times (scatter feeding, hiding food, use of puzzle feeders, whole food which require manipulation prior to eating, etc.).
- Puzzle feeders and other cognitive challenges, including training, which can act as cognitive enrichment.
- Providing access to different areas, e.g. access during the daytime to holding pens/night accommodation in addition to the main enclosure.

PROPER ENCLOSURE DESIGNING:

Enclosures should be designed to fulfill not only the physical needs of the inhabitants but also their psychological needs. A well designed enclosure is one in which the animals are "active, in a natural fashion, and where they will breed." The enclosure design should consider the animals' need for movement, including climbing, swimming, swinging etc. as appropriate; foraging; resting and retreating; grooming; breeding and rearing young; companionship and/or solitude. Natural substrates are generally preferable, enabling the animals to dig, graze etc. as appropriate for the species. Many species will use a dust-bathing area, if available. Semi-aquatic species and any other species which bathe should be provided with an appropriate water area for bathing or swimming, in addition to drinking water. For other species, mud wallows are more important.

ENCLOSURE DESIGNING AND FURNISHING:

General Design and Topography:

Enclosure topography is important: An enclosure which rises up or is built on a hill side provides much more viewing opportunities for the bears.

The topography of the enclosure should be planned to enable bears (which are predominantly solitary in the wild) to keep out of sight of one another.

Providing trees, and good planting, breaks up lines of sight, reducing stress and aggression. The general design of the enclosure, and/or furnishings, should provide the bears with "look out" points which enable the bears to have a wide view of their surroundings. Enclosure design and/or furnishings should provide visual barriers so that if there is more than one bear in an exhibit, they can get out of sight of one another, and out of sign of the public. Shelters should be provided which provide shade combined with good ventilation in hot, sunny weather. "Caves" or hollows should be provided in the enclosure for bears to hide away in. Raised resting areas should be provided.

- Addition of substrates such as sand, bark or turf to areas of the enclosure, particularly if it is all or largely concrete;
- Digging and filling a pond for bathing, or providing a raised pond with appropriate means of access.
- Adding rocks or logs behind which animals can hide from cage mates;

- Providing trees, branches or ropes.
- Adding a sleeping platform to the den/inside area;
- Providing extra boxes or dens;
- Provide trees, logs or rocks for animals to rub on and/or scratch.
- Providing bedding material.
- A sand pit.

This is used for feeding, rolling and resting, and can increase the time spent foraging, digging and building day beds.

- A bark litter pit.

This is used for feeding, rolling and resting, and can increase the time spent foraging, digging and building day beds.

- A large tree trunk.

This may be climbed; it also provides a visual barrier allowing a pair of bears to get out of each other's sight.

- Areas with a thick layer of soil/gravel.
- For digging and exploring.

In pools, add underwater boulders.

POOL

A pool should be provided, allowing bathing. Even a shallow pool is good enrichment. One with flowing water is excellent, if possible. The bottom of the pool should preferably have a natural substrate such as sand; large boulders may be placed in the pool and heavy PVC pipes may be fixed to the sides of pools, providing something for bears to put their paws into and to put objects into. Availability of fresh cold water is very important in hot sunny weather. A large pool with gently sloping sides is suggested to make access to and from the pool easy and allow its use by more than one bear at a time.

Waterfalls add interest for the bears.

SUBSTRATES:

Natural substrates such as soil and sand allow the Asiatic black bear to engage in natural digging behaviour.

Substrates such as tree barks, rotten logs, dry twigs etc allows the species in the digging behaviour.

VEGETATION:

Natural vegetation provides some natural food for the bears to forage for - both in the form of the vegetation and in the form of invertebrates.

ANIMAL HEALTH AND SAFETY CONSIDERATION:

Placement off furnishings should be checked to ensure that they do not allow the animals to escape. Furnishings must be secured so they cannot fall onto an animal (consider the risk if animals dig under the furnishings).

Construction methods should aim to prevent the animals from dismantling any structure.

Structures for climbing should be over soft ground to minimise risks of injury if an animal falls off. Structures for climbing or resting must be strong enough to take the weight of the animals. Check that substrates provide good footing.

Substrates preferably should not cause intestinal impaction if eaten.

Straw, hay etc. may harbour *Aspergillus fumigatus*.

- Addition of substrates such as sand, bark or turf to areas of the enclosure, particularly if it is all or largely concrete;
- Digging and filling a pond for bathing, or providing a raised pond with appropriate means of access.
- Adding rocks or logs behind which animals can hide from cage mates;
- Providing trees, branches or ropes.
- Adding a sleeping platform to the den/inside area;
- Providing extra boxes or dens;
- Provide trees, logs or rocks for animals to rub on and/or scratch.
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This is used for feeding, rolling and resting, and can increase the time spent foraging, digging and building day beds.

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This may be climbed; it also provides a visual barrier allowing a pair of bears to get out of each other's sight.

- Areas with a thick layer of soil/gravel.
- For digging and exploring. In pools, add underwater boulders.

PROVISION OF MANIPULABLE OBJECTS/TOYS:

Ropes, Burlap bags, dry rotten woods, wooden blocks such as large branches or logs. Objects should be changed periodically to help maintain interest.

SCENT ENRICHMENT

- Enriching the environment through providing scents may be a part of food provision, for example laying a scent trail leading to a piece of food, or hiding smelly (to the animal) food items for the animal to find.
- Scent enrichment may also involve providing non-food scents, including odours of other animals (e.g. faeces of herbivores for carnivores to respond to, and vice versa), and various herb and other plant scents).
- Woodchips can be stored with a little water in empty containers which have held seasonings, to absorb the scent, then can be placed in the enclosure.
- Aromatic browse can provide scent enrichment.

SOUND ENVIRONMENT

Sound, like scent, is an aspect of the animal's environment which may be neglected when considering the environment and enrichment. In zoos, frequently there is too much noise of types which may adversely affect animals. Soil and vegetation in enclosures, rather than just concrete and metal, provides a dampening effect, reducing reflection of sound. Care should be taken to ensure that deliberately-provided noises do not exceed 70 decibels for long periods. For enrichment, various sounds can be used, including music, bells, vocalizations etc. Recordings of conspecific may encourage natural behaviour. Sound and scent can be used together for enrichment, for example in providing a "prey" item for predators or scavengers.

FEEDING METHODS

In the wild, most species spend a large proportion of their day in acquiring food. In the wild, for most bear species most of the time, food sources are scattered and the bear has to travel to reach different foods. Additionally, food must be gathered by digging through soil, tearing open logs, turning over stones, climbing trees and gathering branches etc. Bears may spend large proportions of the day foraging and take in food in a number of relatively small meals rather than one large meal. Food in zoos may be presented in a prepared form which, while nutritionally adequate and balanced, does not take much time to eat. Different feeding methods may markedly affect the amount of time taken for animals to acquire process and consume foods, as well as the activity involved in doing so. Compared to the "standard" presentation of prepared (e.g. canned, cubed) food in a bowl, the following methods are recommended to increase foraging behaviour and the time spent in feeding:

- Scatter feeding of small items.
- Hiding food items for the animal to find (in holes, brush piles, natural ground cover, and other substrates).
- Hanging foods up so that the animal has to climb or jump to reach the food.
- Providing food inside logs, tubes etc. so that the animal has to manipulate the container or use a tool to reach the food.
- Placing appropriate foods in a pool or bowl of water so that the animal has to retrieve them from the surface (if they float) or from underwater.
- Providing appropriate live food such as mealworms or crickets inside a dispenser (mealworm tube, cricket log) so that the insects become available at unpredictable times.
- Use of mechanical devices which the animal manipulates (physically or vocally) in order for food to be delivered.

Animal Health and Safety consideration:

- Care must be taken to ensure that food provided for enrichment, and methods of feeding, do not present a health risk.
- It may be necessary to ensure that nutritionally complete foods are eaten before providing "treats" which are preferred but which do not provide a balanced diet.

- Foods which quickly decompose or deteriorate are not appropriate for scatter feeding or hiding unless (a) it is highly probable that the animal(s) will retrieve and eat the items quickly, before they deteriorate; (2) it is possible to safely retrieve the items if they are not eaten. This includes meat and fish, also e.g. nuts and pelleted food which may become mouldy.
- Favored items should be scattered widely to allow subordinate as well as dominant individuals the chance to forage for and get the items.

Options for feeding enrichment for Asiatic black bear:

- Maximum stimulation of foraging behaviours may be obtained by a combination of manipulable permanent furnishings in which small foods can be hidden and novel manipulable objects containing food.
- Food can be scattered around the enclosure; in a relatively bare enclosure it will be easy to find, but in long grass etc. the bears have to search for it more.
- Bears are very good at finding even very small pieces of food in long vegetation.
- Even in a bare enclosure, scattering food can be beneficial.
- Hiding places can include hollow logs, branch piles, leaf litter etc.
- Scatter feeding with whole, unshelled nuts may increase the time spent foraging, as the bears have to open each nut and extract the contents.
- Vegetation within the enclosure (grass substrate, shrubs, etc.) provides a natural source of food for the bears to obtain for themselves; insects will also be found in and around natural substrates and act as an additional food source for the bears to pursue or stalk.
- Foods can be scattered/hidden e.g. in wood piles which the bears must then search through and tear apart to reach the food.
- Food can be stuffed into holes in climbing structures, or into sections of bamboo, or into holes drilled in small logs.
- Small food items can be given inside cardboard boxes filled with straw; the bear has to tear the box apart and find the food.
- Honey, treacle, syrup or peanut butter can be sprinkled or smeared onto objects, sometimes in places difficult to get at, to stimulate natural foraging and exploratory behaviour. If provided high up e.g. in a tree, it can also encourage climbing.
- Provide a honey tree: a dead tree in which a bowl at the top of the tree is filled with honey from a container.
- Tasty tit-bits such as berries, whole pea plants etc. stimulate foraging and increase activity levels.
- Whole food items (rather than chopped or prepared), such as whole coconuts, encourage food handling behaviours.
- Pumpkins can be filled with a mixture of food and buried and/or covered with browse and leaf litter, so the bears have to use their sense of smell to find the food, then tear the pumpkin apart to get at the food inside.
- Pumpkins can be filled with a mixture of food and hung up for the bear. (
- Live food such as larvae or mealworms can be offered scattered on the ground and in objects such as rotting logs to stimulate foraging activity.
- Give food in ice blocks.

- Make feeder logs with holes drilled into them (wood, bamboo or PVC pipe), into which a variety of food treats such as peanut butter, honey, jam, grapes, raisins, nuts, hard-boiled eggs, pieces of fruit and vegetables, mealworms and cereals can be placed for the bears to retrieve.
- Holes can be plugged e.g. with a piece of bread which the bear must remove before a more attractive treat placed at the bottom of the hole can be reached.
- Provide browse (branches with leaves on).
- Bury clay or PVC pipes in the ground vertically, and then drop pieces of food into the pipes for the bears to hook out.
- Bears may use different methods for extracting different types of food.
If the bears become very adept at extracting food items, branches may be placed into the pipes over the food so the bears have to remove these first.
- Give foods such as meat and fruit in tyres, whether lying on the ground or suspended, so the bears have to scoop out the food and, if the tyre is suspended, deal with the swinging of the tyre.
- Hide food in logs or tree hollows, under rocks or buried.
- Provide food inside a large hollow container (e.g. a 180 L whiskey barrel) with holes drilled into it (e.g. 10 cm diameter, or smaller to make extracting the food items more difficult) so that the container must be manipulated for the bears to get the food.
- Give appropriate food in the pond, for example whole apples (which float) and carrots (which sink and must be retrieved by the bear from the bottom).

FUTHER SUGGESTIONS FOR ASIATIC BLACK BEAR

- Leafy branches.
- Small coniferous trees (these may be widely available after Christmas).
- Branches bearing berries (e.g. elder) or nuts.
- Ice blocks containing food.
- Root vegetables such as carrots hidden in soil, bark litter or straw on the ground.
- Logs with holes in them, into which mealworms, crickets or honey are placed, the hole then being closed with a wooden dowel or short twig.
- If there is a water moat, logs must be attached to the ground or to a fixed object
- Vertical pipes sunk into the ground and containing small items such as raisins.
- Pegs at various heights with food items stuck on the pegs.
- A log, suspended using a rope and counterweight, bearing pegs with food items on.
- Apples tossed to float in the pool.
- Hides.
- Grass turfs.
- Leafy branches or conifers fixed upright.
- Upright tree trunks with holes drilled into them and food placed in the holes, so the bears have to climb to reach the food.
- Food in large boxes, plastic drums or burlap bags.
- Food in papier-mâché balls (formed around a balloon).
- Novel food items such as sugar cane, ketchup, chilli peppers, barbecue sauce or salsa can be offered.

- An ice block containing frozen food can be placed into a container with a chute so that as the ice melts pieces of food fall out.
- Floating foods such as apples can be given in the water.
- A plastic barrel on the ground, chained to an immovable object, and with a large hole cut in the top. Food is placed in the barrel for the bear to retrieve; this can be made more complex by adding sticks, straw etc on top of the food in the barrel.

BEHAVIOURAL STUDY CONDUCTED AT PNHZ PARK

ENRICHMENT PROGRAMME:

Bears in captivity often show abnormal behaviours such as stereotypies and periods of excessive inactivity. Enriching captive environments to encourage species – typical activity is one solution (Carlstead, Seidensticker & Baldwin, 1991; Forthman et al 1992; Hediger, 1950, Markowitz, 1982; Shepherdson, 1994). An enclosure conducive for activity might include cage furnishings and manipulatable objects that provide suitable opportunities for an increased range of behaviours. These added elements could create more complex environments (Coe, 1985; hancocks, 1980; Hutchins, Hancocks & Crockett 1979). Complexity encourages interaction between the animal and its environment and reduces some of the distress produced by captivity.

The conceptual roots of enrichment are believed that captive animals should have their time occupied with work and play. A heavy emphasis is placed on the importance of providing enrichment that is appropriate to the specific biology (to the extent that it is known) of the focal species. The importance of enrichment to a bear's captive environment should not be underestimated. Research has shown bears to be extremely intelligent animals which grow stressed and bored very quickly in unstimulating captive conditions

This can lead to stereotypical behaviour, which sometimes leads to self – inflicted physical injury. Stress leads to a reduction in the efficiency of an animal's immune system and thus is a threat to the good health of the animal. It can stop eating and drinking and can also lead to greater aggression in animals.

Bears seem particularly prone to abnormal behaviours when kept in captivity. the present study hypothesized that the addition of environmental enrichment would increase active behaviour of captive Asiatic black bears , consequently lowering the levels of abnormal and passive behaviours. Different forms of enrichment were tested to see what parameters influenced the bear's mobility and what treatments were the most effective. This study emphasizes the importance of environmental enrichment in to captive animal management to ensure a high standard of welfare.

With this in view the programme was initiated in the park from 11.8.07 – 30.10.07 on an experimental basis.

INTRODUCTION

Stereotypes have been defined as repetitive, invariant behaviour patterns with no obvious goal or function (Mason 1991). The repetitive, rigid character of stereotypies

signals a general deterioration of behavioural flexibility and control (Wemelsfelder in press). In captivity, bears seem particularly prone to stereotypies and abnormal behaviour, possibly due to needs which can't be satisfied in a captive situation. These behaviours usually include pacing, head- swaying and repetitive self- sucking. Displacement or redirected activities tend to be the result of situations in which an animal is motivated to perform a behaviour pattern but is unable to do so, and thus becomes frustrated (Mason, 1991).

There is ample behavioural, psychological and neurological evidence that environmental enrichment improves the welfare of captive animals for example enrichment can reduce the performance of abnormal, injurious and aggressive behaviours as well as reducing fear levels and reactivity to stressors. Enrichment can also increase behavioural diversity, learning ability and space utilization (Young 2003).

METHOD:

Two captive Asiatic black bears (*Ursus thibetanus*) were observed in this study. Both were females wild caught, transferred from Itanagar Zoo when they were at the age of 2½ years (Home ID Aruna) and 1½ years (Home ID Jennifer). Each bear had been housed at the bear complex for a minimum of six years.

HOUSING:

DATA COLLECTION PROCEDURE:

Behavioural observation was recorded using a continuous focal animal sampling procedure (Altman 1974). Data were collected by using a standard behaviour check sheet. The starting time of change in each behaviour was recorded and behaviour was later grouped into four categories. The total area of the enclosure for the observation purpose has been divided into six areas. Area A, B, C, D, E and F. enrichment is provided in all the marked areas to allow the animal maximum area for foraging including utilization of the entire enclosure by the animal.

Observation Time: Morning Observation: 9:00 – 10:00 a.m.

Midday Observation: 11:00 – 12:00 noon.

Afternoon Observation: 3:00 – 4:00 p.m.

Total Time – 3 hrs

Total Number of days of Observation: 20 days per month.

Behaviours were categorized as:

I. PASSIVE:

- Maintenance: Bears grooms self with mouth and / paws, scratches, defecates, urinates, shakes, rubs its body on an object.
- Orient to Human: Bears locomote towards public or keepers/observers sniffs the air, sometimes the bear sways from side to side.
- Passive/ alert: bears lies, sits or stands with head up and eyes open.
- Bears sit or stand with head down or eyes visibly closed.

II. ACTIVE:

- Aggression: Hostile behaviour or actions directed towards another bear.
- Auto-play: Vigorous, exaggerated movements typify play, with or without an object may include browse material.
- Climb: to move upward on or mount climbing structure.
- Dig: to break up, turn over, or remove (earth or sand, for example) with claws or paws.
- Forage/Ingest: Bears manipulate and/or consumes food items; this includes live plant material provided as browse, and also includes drinking.
- Locomote: bears walk or run quadrupedally or bipedally.
- Nest building: to form a nest by combining materials such as hay or vegetation.
- Object investigation: bears peers closely at, mouths or manipulates non- feed items such as dead branches and logs, rocks leaves , exhibit walls and so on.
- Play: affiliative, neutral, or playful behaviour directed towards another bear.
- Swim/ dive: bears locomotes in the water or leaps into the water.

III. ABNORMAL:

- Masturbate: bears rubs genital areas with paws or on substrate, scratches genitals , leans over and mouths penis etc.
- Pace: bears traverses some path repetitively, usually a walk but may run.
- Paw suck: repetitive sucking of a body area often accompanied by a “humming vocalization”.
- Self bite: Aggressive biting t own body usually the rear legs.
- Self stimulation: bear clutches its own limbs, bites its own limbs, rocks back and forth repetitively; swing s head repetitively.
- Sway: locomotion (left- right alternatively); front feet occupy two or more positions; rear feet may be lifted and repositioned or only shuffled.

IV OTHER: Not visible- Bear is out of sight.

(Modified from Forthman et al., 1992).

Before beginning with the programme review of literatures was conducted with which following strategies was drawn out:

- Comparing the environment and behaviour in captivity with that in the wild.
- Behavioural enrichment activity.
- Designing and implementing and enrichment strategy which is as follows:

(1). FOOD HABIT CHANGE:

1. Old habit (as a control)

Main Feed

Fruits/vegetables

Given together

2. Feed given in morning. Fruits/vegetables given/or fed by keepers through out the day

3. Feed given in morning. Fruits/vegetables scattered and hidden in different places

(2). STEPS UNDERTAKEN TO ENRICH A BEAR’S ENVIRONMENT:

- Raised areas for bears to climb made from dead trunks/planks e.g. aerial walkways, climbing frames and platforms.
- Water pond to enjoy wading and bathing.
- Artificial caves to provide shade if outdoor.
- Skylight in roof to provide natural sunlight and warmth if indoors
- Piles of logs or rocks, for a keeper to hide food in, and for the bears to climb upon (can be removed at times).

(3) Hiding food around the enclosure increases mental and physical stimulation for the bear, as it moves around searching for food. Other methods of hiding food that was undertaken.

- Scattering randomly around enclosure – on floor and platforms.
- Hiding foods inside gunny bags.
- Provision of whole food – entire plants, hard vegetables e.g. potato, turnip, pumpkin, watermelon.
- A variety of foods used that keeps the bear interested in feeding as it can’t predict what will be its next meal.
- Ideally ground material provided allowing the bear to dig.
- Substrate provided – sand, mud, mulch, gravels etc.
- A possible weekly enrichment schedule was prepared that can also be used in the night shelter.

• Assessing and re-evaluating the strategy in the light of the result.

No untoward impact on the animal was observed hence this programme is continuing with addition of other enrichment forms for the well being of the species. The two females housed in the park have shown remarkable behavioural changes after the implication of different forms of enrichment. The below presented data shows the marked change in reduction of their stereotypical behaviour including one very significant natural behaviour was observed. One of the female came to oesturs during the month of June which lasted till the month of October.

ENRICHMENT SCHEDULE:

ENRICHMENT PROGRAMME OF HBB FOR THE MONTH OF MARCH-APRIL0 08’

DATE	DAY	CONDITIONS
7.4.08	MONDAY	Fruits and vegetables provided by the keeper in the enclosure throughout the day
8.4.08	TUESDAY	-do-
9.4.08	WEDNESDAY	-do-
10.4.08	THURSDAY	-do-
11.4.08	FRIDAY	- do-
12.4.08	SATURDAY	-do-
13.4.08	SUNDAY	-do-

14.4.08	MONDAY	Feed and fruits/vegetables given at once
15.4.08	TUESDAY	-do-
16.4.08	WEDNESDAY	-do-
17.4.08	THURSDAY	-do-
18.4.08	FRIDAY	-do-
19.4.08	SATURDAY	-do-
20.4.08	SUNDAY	-do-
21.4.08	MONDAY	Fruits and vegetables provided by the keeper in the enclosure throughout the day
22.4.08	TUESDAY	-do-
23.4.08	WEDNESDAY	-do-
24.4.08	THURSDAY	-do-
25.4.08	FRIDAY	-do-
26.4.08	SATURDAY	-do-
27.4.08	SUNDAY	-do-
28.4.08	MONDAY	Scattering/ hiding the fruits in the enclosure
29.4.08	TUESDAY	-do-
30.4.08	WEDNESDAY	-do-
1.5.08	THURSDAY	-do-
2.5.08	FRIDAY	-do-
3.5.08	SATURDAY	-do-
4.5.08	SUNDAY	-do-
6.5.08	MONDAY	Fruits and vegetables provided by the keeper in the enclosure throughout the day
7.5.08	TUESDAY	-do-
8.5.08	WEDNESDAY	-do-
9.5.08	THURSDAY	-do-
10.5.08	FRIDAY	-do-
11.5.08	SATURDAY	-do-
12.5.08	SUNDAY	-do-

TOTAL NO OF DAYS FOR OBSERVATION: 35 DAYS

TOTAL NO. OF DAYS FOR EACH CONDITION:

FRUITS AND VEGETABLES PROVIDED BY THE KEEPER IN THE ENCLOSURE: 21 DAYS

FEED. FRUITS, VEGETABLES GIVEN AT ONCE: 7 DAYS

SCATERING/HIDING THE FRUITS IN THE ENCLOSURE: 7 DAYS

ENRICHMENT SCHEDULE OF HBB FOR THE MONTH OF MAY 08'

DATE	DAY	CONDITION
9.05.08	FRIDAY	FEED + FRUITS/ VEGETABLES GIVEN TOGETHER
10.05.08	SATURDAY	-DO- Old
11.05.08	SUNDAY	-DO--
12.05.08	MONDAY	-DO-
13.05.08	TUESDAY	-DO-
14.05.08	WEDNESDAY	-DO-
15.05.08	THURSDAY	-DO-
16.05.08	FRIDAY	FRUITS AND VEGETABLES PROVIDED THROUGHOUT THE DAY (2)
17.05.08	SATURDAY	-DO-
18.05.08	SUNDAY	-DO-
19.05.08	MONDAY	-DO-

20.05.08	TUESDAY	-DO-
21.05.08	WEDNESDAY	-DO-
22.05.08	THURSDAY	-DO-
23.05.08	FRIDAY	FRUITS AND VEGETABLES SCATTERED/HIDDEN IN DIFFERENT PARTS OF THE ENCLOSURE (3)
24.05.08	SATURDAY	-DO-
25.05.08	SUNDAY	-DO-
26.05.08	MONDAY	-DO-
27.05.08	TUESDAY	-DO-
28.05.08	WEDNESDAY	-DO-
29.05.08	THURSDAY	-DO-
30.05.08	FRIDAY	FEED + FRUITS/ VEGETABLES GIVEN TOGETHER
31.05.08	SATURDAY	-DO-

TOTAL NO OF DAYS FOR OBSERVATION- 23DAYS.

NO. OD DAYS OF OBSERVATION FOR EACH CONTITION-

1. FEED + FRUITS/ VEGETABLES GIVEN TOGETHER-9 DAYS
2. FRUITS AND VEGETABLES PROVIDED THROUGHOUT THE DAY-7 DAYS
3. FRUITS AND VEGETABLES SCATTERED/HIDDEN IN DIFFERENT PARTS OF THE ENCLOSURE-7 DAYS

TOTAL TIME OF OBSERVATION IN A DAY- 4 HRS;

MORNING OBS: 8-10A.M. - 1 HR FOR EACH FEMALE

MIDDAY OBSERVATION: 11-1 P.M.; 1 HR FOR EACH OBSERVATION.

AFTERNOON OBSERVATION: 2-4 P.M.; 1 HR FOR EACH FEMALE.

ENRICHMENT SCHEDULE FOR THE MONTH OF JUNE 08'

DATE	DAY	CONDITION
9.06.08		FEED + FRUITS/ VEGETABLES GIVEN TOGETHER
10.06.08		-DO- Old
11.06.08		-DO--
12.06.08		-DO-
13.06.08		-DO-
14.06.08		FRUITS AND VEGETABLES PROVIDED THROUGHOUT THE DAY (2)
15.06.08		-DO-
16.06.08		-DO-
17.06.08		-DO-
18.06.08		-DO-
19.06.08		-DO-
20.06.08		-DO-
21.06.08		FRUITS AND VEGETABLES SCATTERED/HIDDEN IN DIFFERENT PARTS OF THE ENCLOSURE (3)
22.06.08		-DO-
23.06.08		-DO-
24.06.08		-DO-
25.06.08		-DO-
26.06.08		-DO-
27.06.08		-DO-
28.06.08		FEED + FRUITS/ VEGETABLES GIVEN TOGETHER
29.06.08		-DO-
30.06.08		-DO-
31.06.08		-DO-

TOTAL NO OF DAYS FOR OBSERVATION- 23 DAYS.

NO. OD DAYS OF OBSERVATION FOR EACH CONTITION-

2. FEED + FRUITS/ VEGETABLES GIVEN TOGETHER-9 DAYS
2. FRUITS AND VEGETABLES PROVIDED THROUGHOUT THE DAY-7 DAYS

3. FRUITS AND VEGETABLES SCATTERED/HIDDEN IN DIFFERENT PARTS OF THE ENCLOSURE-7 DAYS

TOTAL TIME OF OBSERVATION IN A DAY- 3 HRS;
 MORNING OBS: 9-10.M. - 1 HR FOR EACH FEMALE
 MIDDAY OBSERVATION: 11-12 P.M.; 1 HR FOR EACH OBSERVATION.
 AFTERNOON OBSERVATION: 2-3 P.M.; 1 HR FOR EACH FEMALE

ENRICHMENT SCHEDULE FOR THE MONTH OF JULY-AUGUST 08'

DATE	DAY	CONDITION
9.07.08		FEED + FRUITS/ VEGETABLES GIVEN TOGETHER
10.07.08		-DO- Old
11.07.08		-DO--
12.07.08		FRUITS AND VEGETABLES PROVIDED THROUGHOUT THE DAY (2)
13.07.08		-DO-
14.07.08		FRUITS AND VEGETABLES PROVIDED THROUGHOUT THE DAY (2)
15.07.08		-DO-
16.07.08		-DO-
17.07.08		-DO-
18.07.08		-DO-
19.07.08		-DO-
20.07.08		-DO-
21.07.08		FRUITS AND VEGETABLES SCATTERED/HIDDEN IN DIFFERENT PARTS OF THE ENCLOSURE (3)
22.07.08		-DO-
8.08.08		-DO-
9.08.08		-DO-
10.08.08		-DO-
11.08.08		-DO-
12.08.08		-DO-
13.08.08		FEED + FRUITS/ VEGETABLES GIVEN TOGETHER
14.08.08		-DO-
15.08.08		-DO-

TOTAL NO OF DAYS FOR OBSERVATION- 23 DAYS.

NO. OD DAYS OF OBSERVATION FOR EACH CONTITION-

1. FEED + FRUITS/ VEGETABLES GIVEN TOGETHER-9 DAYS
2. FRUITS AND VEGETABLES PROVIDED THROUGHOUT THE DAY-7 DAYS

3. FRUITS AND VEGETABLES SCATTERED/HIDDEN IN DIFFERENT PARTS OF THE ENCLOSURE-7 DAYS

TOTAL TIME OF OBSERVATION IN A DAY- 3 HRS;
 MORNING OBS: 9-10.M. - 1 HR FOR EACH FEMALE
 MIDDAY OBSERVATION: 11-12 P.M.; 1 HR FOR EACH OBSERVATION.
 AFTERNOON OBSERVATION: 2-3 P.M.; 1 HR FOR EACH FEMALE

ENRICHMENT SCHEDULE FOR THE MONTH OF SEPTEMBER-OCTOBER 08'

DATE	DAY	CONDITION
8.9.08	MONDAY	FRUITS AND VEGETABLES PROVIDED THROUGHOUT THE DAY (2)
9.9.08	TUESDAY	-DO-
10.9.08	WEDNESDAY	-DO--
11.9.08	THURSDAY	-DO-
12.9.08	FRIDAY	-DO-
13.9.08	SATURDAY	-DO-
15.9.08	MONDAY	-DO-
16.9.08	TUESDAY	SCATTERING/HIDING THE FRUITS IN THE ENCLOSURE
17.9.08	WEDNESDAY	-DO-
18.9.08	THURSDAY	-DO-
19.9.08	FRIDAY	-DO-
20.9.08	SATURDAY	-DO-
22.9.08	MONDAY	-DO-
23.9.08	TUESDAY	-DO-
24.9.08	WEDNESDAY	FRUITS AND VEGETABLES TOGETHER WITH THE MAIN FEED
25.9.08	THURSDAY	-DO-
26.9.08	FRIDAY	-DO-
27.9.08	SATURDAY	-DO-
29.9.08	MONDAY	-DO-
30.9.08	TUESDAY	-DO-
1.10.08	WEDNESDAY	-DO-
2.10.08	THURSDAY	FRUITS AND VEGETABLES GIVEN THROUGHOUT THE DAY
3.10.08	FRIDAY	-DO-
4.10.08	SATURDAY	-DO-
6.10.08	MONDAY	-DO-
7.10.08	TUESDAY	-DO-

8.10.08	WEDNESDAY	-DO-
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TOTAL NO OF DAYS FOR OBSERVATION- 27 DAYS.

NO. OF DAYS OF OBSERVATION FOR EACH CONDITION-

3. FEED + FRUITS/ VEGETABLES GIVEN TOGETHER-7 DAYS
2. FRUITS AND VEGETABLES PROVIDED THROUGHOUT THE DAY-14 DAYS
3. FRUITS AND VEGETABLES SCATTERED/HIDDEN IN DIFFERENT PARTS OF THE ENCLOSURE-7 DAYS

TOTAL TIME OF OBSERVATION IN A DAY- 3 HRS;

MORNING OBS: 9-10.M. - 1 HR FOR EACH FEMALE

MIDDAY OBSERVATION: 11-12 P.M.; 1 HR FOR EACH OBSERVATION.

AFTERNOON OBSERVATION: 2-3 P.M.; 1 HR FOR EACH FEMALE

NON-FEEDERS ENRICHMENT:

Every Thursday enrichment work conducted in the enclosure.

11.09.08:

- (1) Cleaning the pond and providing fresh water.
- (2) Changing the furniture of the enclosure.
- (3) Provision of rotten logs, fresh branches, dry wigs.
- (4) Making mud and sand mounds to hide fruits and vegetables.

18.9.08:

- (1) Changing the places of the furniture.
- (2) Cleaning of the pond.
- (3) Hanging of ropes over the platform to which dry twigs, small branches, eatables tied for the bears to play and explore.
- (4) Clearing of the thickets in the enclosure.

25.9.08:

- (1) Providing piles of branches, wooden logs, for the bears to play.
- (2) Providing them bedding and nesting materials.
- (3) Construction of elevated platforms.
- (4) Boulders placed inside the pond for the bears to play.

2.10.08.

- (1) Provision of hollow logs to hide the feed and for the bears to find.
- (2) Scented logs with 1inch/2,5 cm hole drilled into them and filled with small pieces of fruit, seed vegetables. Alternatively one can fill the holes with scented herbs like herbs like mint- “Pudina” etc. the size of the hole was important so that animals cannot get their tongue or claws stuck in them. The logs can be suspended on thick rope from trees so that the animal kept them rolling around.
- (3) Providing the animal with twigs/branches, dry leaves, bark litter.
- (4) Pond to be dried and fruits and vegetables to be kept inside the pond.

Collection of wild diet every Sunday i.e. 14.09.08, 21.09.08, 28.09.08 and 5.10.08 at Senchal Wildlife Sanctuary or at the zoo forest.

ENRICHMENT SCHEDULE FOR THE MONTH OF OCTOBER - NOVEMBER 08'

DATE	DAY	CONDITION
16.10.08	THURSDAY	FRUITS AND VEGETABLES PROVIDED THROUGHOUT THE DAY (2)
17.10.08	FRIDAY	-DO-
18.10.08	SATURDAY	-DO--
20.10.08	MONDAY	-DO-
21.10.08	TUESDAY	-DO-
22.10.08	WEDNESDAY	-DO-
23.10.08	THURSDAY	-DO-
24.10.08	FRIDAY	SCATTERING/HIDING THE FRUITS IN THE ENCLOSURE
25.10.08	SATURDAY	-DO-
27.10.08	MONDAY	-DO-
28.10.08	TUESDAY	-DO-
29.10.08	WEDNESDAY	-DO-
30.10.08	THURSDAY	-DO-
31.10.08	FRIDAY	-DO-
1.11.08	SATURDAY	FRUITS AND VEGETABLES TOGETHER WITH THE MAIN FEED
3.11.08	MONDAY	-DO-
4.11.08	TUESDAY	-DO-
5.11.08	WEDNESDAY	-DO-
6.11.08	THURSDAY	-DO-
7.11.08	FRIDA Y	-DO-
8.11.08	SATURDY	-DO-
10.11.08	MONDAY	FRUITS AND VEGETABLES GIVEN THROUGHOUT THE DAY
11.11.08	TUESDAY	-DO-
12.11.08	WEDNESDAY	-DO-
13.11.08	THURSDAY	-DO-
14.11.08	FRIDAY	-DO-
15.11.08	SATURDAY	-DO-
17.11.08	SATURDAY	-DO-

TOTAL NO OF DAYS FOR OBSERVATION- 27 DAYS.

NO. OD DAYS OF OBSERVATION FOR EACH CONTITION-

4. FEED + FRUITS/ VEGETABLES GIVEN TOGETHER-6 DAYS
2. FRUITS AND VEGETABLES PROVIDED THROUGHOUT THE DAY-12DAYS
3. FRUITS AND VEGETABLES SCATTERED/HIDDEN IN DIFFERENT PARTS OF THE ENCLOSURE-9 DAYS

TOTAL TIME OF OBSERVATION IN A DAY- 3 HRS;

MORNING OBS: 9-10.M. - 1 HR FOR EACH FEMALE

MIDDAY OBSERVATION: 11-12 P.M.; 1 HR FOR EACH OBSERVATION.

AFTERNOON OBSERVATION: 2-3 P.M.; 1 HR FOR EACH FEMALE

NON-FEEDERS ENRICHMENT:

Every Thursday enrichment work conducted in the enclosure.

16.10.08:

- (1) Cleaning the pond and providing fresh water.
- (2) Changing the furniture of the enclosure.

- (3) Provision of rotten logs, fresh branches, dry wigs.
- (4) Making mud and sand mounds to hide fruits and vegetables.

23.10.08:

- (1) Changing the places of the furniture.
- (2) Cleaning of the pond.
- (3) Hanging of ropes over the platform to which dry twigs, small branches, eatables tied for the bears to play and explore.
- (4) Clearing of the thickets in the enclosure.

30.10.08

- (1) Providing piles of branches, wooden logs, for the bears to play.
- (2) Providing them bedding and nesting materials.
- (3) Construction of elevated platforms.
- (4) Boulders placed inside the pond for the bears to play.

6.11.08

- (5) Provision of hollow logs to hide the feed and for the bears to find.
- (6) Scented logs with 1inch/2,5 cm hole drilled into them and filled with small pieces of fruit, seed vegetables. Alternatively one can fill the holes with scented herbs like herbs like mint- "Pudina" etc. the size of the hole was important so that animals cannot get their tongue or claws stuck in them. The logs can be suspended on thick rope from trees so that the animal kept them rolling around.
- (7) Providing the animal with twigs/branches, dry leaves, bark litter.
- (8) Pond to be dried and fruits and vegetables to be kept inside the pond.

Collection of wild diet available in the zoo forest everyday, to get the bears accustomed to the wild diet.

THE EXHIBIT AREA:



It is a big open air enclosure with U shaped dry moat (8feet deep and 10 feet wide). The total area of the enclosure is 483sqm. The enclosure is on the spur South as well as North facing slopes providing good escape area to the animals. Devoid of any big vegetation but provided with dry logs, water pond and other furniture. The night shelter is on the top with six number of night cells. There is two open verandah opening in the enclosure attached to the animal house.

Dietary Enrichment:

Foraging behaviours are important to the well being of carnivores.

- ❖ Novel presentation of food items can be accomplished by hiding food throughout the exhibit. .
- ❖ The method and timing of food delivery, and randomized feeding schedules, the unpredictability of delivery, and reduce the and increased number of feedings can

help encourage foraging and reduce the frequency and duration of stereotypic behaviours (Shepherdson, 1993).

- ❖ Variety such as altering chopped, whole feed items is significant in both food delivery and method to discourage boredom.

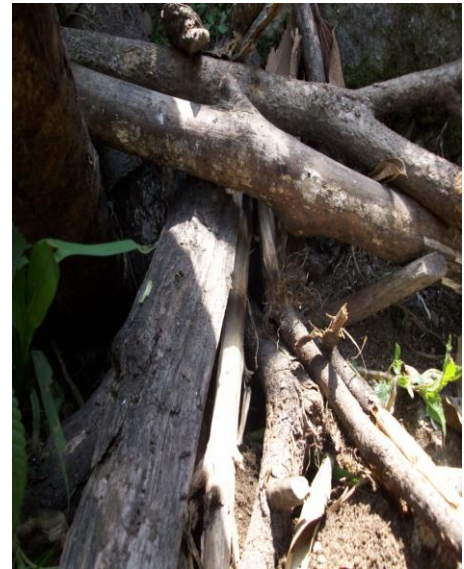
STEP I.



- (i) Hiding the fruits underneath the dry leaves and twigs. (ii) Hiding the fruits and vegetables under boulders. (iii) Underneath the dry moss.



(iv) Hiding the fruits and vegetables beneath the platform using barks and dry leaves.



(v) Hiding the fruits and vegetables underneath piles dry twigs and logs.

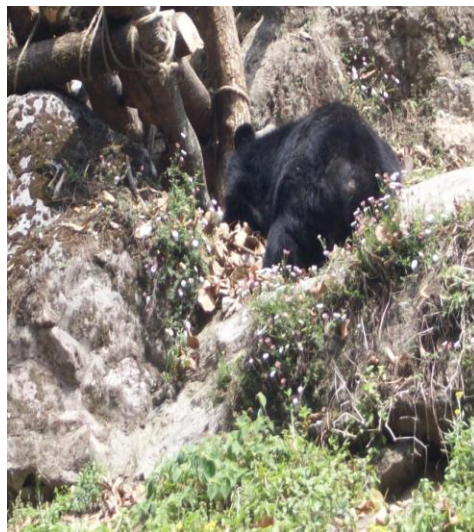


(vi) Hiding and placing the fruits and vegetables under the plants and bushes.



(vi) Ground dug to create holes to hide the fruits and vegetables.

STEP II



Foraging behaviour of Asiatic black bear at PNHZ Park.

STEP III.





The picture above indicates the removal of all the materials used for hiding of fruits and vegetables during foraging to procure the feed items.

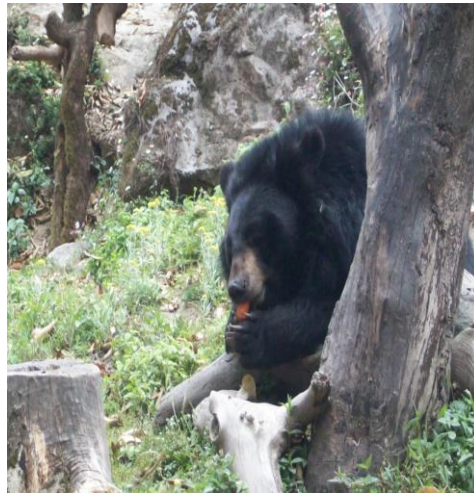


Spreading of feed items in the enclosure and the night shelter.



Feed items inside the pond.

Step IV: Engaging them in eating the procured feed item.





Other Activities



Playing/ Interacting



Honey poured inside the honey logs and spreading over other logs as well; licking honey from the honey logs.



Climbing



Sitting without activity.



Utilization of different structures inside the enclosure.



Walking.



Resting on the ground, using structures and artificially built cave.



Different types of structures used by the bears for different activities.

FINDINGS:

Activities		Rest	Playing	Exploring	Pacing	Sitting idle
	CONTROL(I)	21.7%	7.8%	10.3%	6%	7.6%
Aruna	(II)	19.5%	11.9%	6.0%	4.0%	1.3%
	(III)	14.4%	17.9%	24%	11%	2.3%
	CONTROL(I)	46.7%	13%	25.1%	6.3%	8.8%
Jennifer	(II)	37.5%	9.6%	36%	5.6%	8.1%
	(III)	35.8%	10%	38.5%	3.6%	7.8%

The enrichment programme was again initiated from March 08' which is continuing till date. The observations were not conducted in the month of July due to the tour.

Both feeding and non-feeding enrichment schedule is prepared prior to the beginning of the experiment is mentioned herewith.

Data for the month of March/ April. 08'

Activities	Control(i)	Rest	Playing	Exploring	Pacing	Sitting idle
		35%	7.9%	12.8%	4%	7.8%
Aruna	(II)	23.6%	5.3%	8.6%	12%	4.8%
	(III)	38.4%	11.6%	33.3%	8.7%	8.0%
Jennifer	Control (I)	15.6%	7.2%	7.3%	5%	3.3%
	(II)	59%	14.7%	30.7%	11%	6.2%
	(III)	45.8%	9.2%	31.6%	12.3%	7.4%

Data for the month of May 08'

Activities	Control(I)	Rest 35%	Playing 33.7%	Exploring 22.5%	Pacing 11.3%	Sitting idle 6.7%
Aruna	(II)	26.7%	40.2%	37.2%	9.8%	12%
	(III)	23%	39%	33%	11.6%	15.4%
	Control (I)	19.2%	29%	20.8%	8.7%	8.7%
Jennifer	(II)	17.4%	27%	29.7%	6.8%	10.9%
	(III)	29.3%	25.5%	23.8%	4.9%	12.3%

Data for the month of June 08'

Activities	Control(I)	Rest	Playing	Exploring	Pacing	Sitting idle
Aruna		37.5%	31.8%	17.8%	14.4%	7.8%
	(II)	43.4%	21.9%	36.8%	11.8%	4.9%
	(III)	23.7%	11.1%	51%	12.4%	13.3%
	Control (I)	29.8%	24.7%	33.3%	11.5%	11%
Jennifer	(II)	32.8%	17.7%	30%	9.2%	10%
	(III)	31.6%	11.6%	22.1%	17.1%	17.3%

(i) The most significant behavioural observation was the female coming into Oestrus from 12. 6.08 – 30.7.08

Data for the month of July-August 08'

Activities		Rest	Playing	Exploring	Pacing	Sitting idle
Aruna	Control(i)	42.7%	12.6%	17.8%	12.3%	11.1%
	(II)	45.3%	9.9%	14.3%	16.7%	12.3%
	(III)	47%	12.4%	13%	18.9%	15.6%
	Control (I)	38%	11.4%	11.2%	15.4%	18%
Jennifer	(II)	36.9%	9.8%	9.8%	8.4%	15.3%
	(III)	33.2%	6.8%	6%	7.6%	13.4%

Data for the month of September October 08'

Activities		Rest	Playing	Exploring	Pacing	Sitting idle
Aruna	Control(I)	40.5%	15.3%	12.3%	11.1%	9%
	(II)	33.6%	7.8%	15.5%	9.8%	7.6%
	(III)	46%	12.3%	14.4%	7.9%	9.5%
	CONTROL (I)	43.6%	13.8%	13.6%	5.6%	12%
Jennifer	(II)	46%	19.5%	14.4%	6.6%	16.4%
	(III)	43.8%	12.3%	13.3%	5.7%	13.5%

Data for the month of OCTOBER- NOVEMBER 08'

Activities		Rest	Playing	Exploring	Pacing	Sitting idle
Aruna	CONTROL(I)	33.3%	8.9%	14.4%	4.5%	12.4%
	(II)	26.8%	9.2%	13.2%	3.2%	14.4%
	(III)	32.3%	9.6%	16.7%	3.8%	8.9%
Jennifer	CONTROL (I)	35.4%	7.7%	16.6%	4.6%	8.6%
	(II)	36.8%	8.2%	15.9%	5.3%	12%
	(III)	33%	7.9%	19.2%	6.6%	3.5%

From January 13th .01.09 slight changes was done in the feeding enrichment programme. The control was excluded as.

The fruits and the vegetables were hidden in a more complicated manner so that the animal took more time in searching for the feed.

This form of enrichment was also followed closely by non- feeding enrichment forms once a week. Every Thursday.

Data for the month of Jan- Feb 09'

Activities	Rest	Playing	Exploring	Pacing	Sitting idle
Aruna	42.7%	7.7%	44%	1.5%	3.9%
Jennifer	49.3%	10%	36.8%	3.6%	1.6%

DISCUSSION:

One of the most important aspects of scientific investigation is sample size because a larger number of individuals will increase the validity of the result (Swaigood and Shepherdson 2005). Greater attention to experimental design, sample size, statistical analysis, better descriptions of enrichment properties and the form of stereotypy are

needed to further our understanding of the most effective enrichment techniques (Swaisgood and Shepherdson, 2005).

Bears seem particularly prone to abnormal behaviours when kept in captivity. The present study hypothesized that the addition of environmental enrichment would increase active behaviour of Asiatic black bear, consequently lowering levels of abnormal and passive behaviours. Different forms of enrichment were tested to see what parameters influenced the bear's mobility and what treatments were the most effective. This study emphasizes the importance of incorporating environmental enrichment into captive animal management to ensure a high standard of welfare.

The result of the present study suggests that environmental enrichment increases active behaviours, which consequently lead to a decrease in passive and abnormal behaviours. As hypothesized, environmental enrichment greatly increased the percentage of time the bears were active however the result did not statistically prove the hypothesis that environmental enrichment would lower the percentage of abnormal behaviours.

When bears were led out of the dens in the morning, they walked straight to the place where the enrichment items were provided the day before, regardless of whether enrichment was provided or not. There was a slight increase in abnormal behaviours between the enrichment days, as well as an increase in passive behaviours and a decrease in activity. This demonstrates the importance of providing enrichment on a regular basis.

Stereotypies had a tendency to increase prior to food arrival and took place where food arrival can be viewed, which is a finding noted.

These results add further support to a study by Forthman et al., (1992) that concluded that simple and inexpensive methods of enrichment may have a significant, positive influence on the behaviours of Asiatic black bears. A good enrichment can increase visitor's interest and enhance visitor experience and education, by allowing the animals to display more naturalistic behaviours (Davey et al. 2005). Enrichment should not be regarded as an "optional extra" for captive animals, but rather as an essential part of their keeping, along with the provision of suitable food, plentiful clean water, and appropriate health care. All animals should be given enrichment, not just those on public display.

According to Fagen and Fagen (1996) consistent behavioural differences suggest that each bear has its own distinct personality

Increasing captive animal's opportunities, to interact with its species typical behaviour at the same time decreasing behaviours that suggest diminished well-being caused by captivity.

Stereotypical behaviour is widespread amongst captive animals and since many consider it abnormal, is the cause for much concern with regard to animal welfare. Stereotypies are proving extremely challenging to study however and as a result there is still much disagreement as to their origin, proximate causes and final consequences.

The all above findings show a reduction in some abnormal captive behaviors like pacing, sitting idle etc. The enrichment also helped to some extent in bring one of the female to estrus during which infighting was observed (and also in exhibiting natural wild

behavior and one step further to helping improve the lives of captive animals and perhaps even aid conservation efforts in long term.

Mixed/intra protected species compatibilities.

Mixed Species Exhibits

Mixed species exhibits are useful to educate zoo visitors on the complexities of the interactions between species of animals and plants within ecosystems. Mixed species exhibits can be enriching for the animals, providing added mental stimulation and introducing the possibility of interspecific interaction; the level of activity of the animals may increase.

This may have a positive impact on the physical and mental health of the animals, so long as interactions and activity are not antagonistic.

Rotating individuals or groups of animals through multiple enclosures, in a controlled, regular manner, results in scent marks, visual marks etc. left by each group of animals which can act as enrichment to other species when they are moved into the enclosure.

A mixed species exhibit with a suitable species provides more stimuli in the environment and provides the possibility of interspecific interaction.

Demerits of mixed species exhibits:

Consider the quantities of food provided and ensure that food is distributed appropriately, with all individuals getting an adequate amount and none feeding excessively and becoming obese.

FEEDING STANDARDS:

Diets and supplements

Provision of the correct diet is extremely important to the care, management and breeding of any animals. Incorrect or inadequate nutrition may lead to emaciation, obesity or specific deficiency diseases, but is more frequently associated with increased susceptibility to other diseases, reduced reproduction and/or decreased longevity.

Wild mammals are adapted morphologically, physiologically and behaviourally to acquire and make use of a wide range of foods. Availability of foods may vary between seasons and in spatial distribution.

Where there are pronounced seasonal patterns in food availability, animals may be adapted to maximise their use, with reproductive stages which require the most nutritional input (lactation and early post-weaning) taking place during the time of greatest food abundance; some other species are adapted to maximise use of nutritional resources whenever they appear, in a non-seasonal manner. Some animals are also adapted to minimise energy use, and therefore nutritional requirements, in seasons when food is scarce or not available, by hibernation.

In captivity food to be provided in discrete meals, at set times of the day, and in similar quantities throughout the year. This is different from the wild situation in many respects; consideration should be given to the natural feeding habits of the species. Proper

records should be kept of foods given, including quantities provided, changes in diet, whether certain foods provided are left uneaten, and whether some food items are being consumed only by some individuals (e.g. dominant individuals eating all of favoured items). The diet and feeding programme for captive animals should: Provide all the animal's nutrient requirements; Use the teeth and digestive system properly such that these remain healthy; Provide occupation and contentment with feeding; Allow for changes such as external environmental changes and the breeding season; Avoid the development of stress. When considering the dietary requirements of bears it is important to consider not only the "average" nutrition for the species but also seasonal variations in diet, and behaviours associated with feeding.

Dietary requirements of asiatic black bear in captivity:

Diets provided to Asiatic black bears should vary appropriately, for example increasing fat content in autumn (fall) prior to cold weather, and decreasing fat in spring as warm weather approaches. Asiatic black bears in zoos are mainly fed fruit (particularly apples, plus seasonally available fruits), and vegetables (especially carrots and lettuce), generally supplemented with bread, pelleted concentrate foods and vitamin/mineral supplements. The diet for bears in captivity should be as varied as possible and reflect the range of plant and other food types eaten by wild bears. To promote oral health in bears, soft foods should be fed first and items with skin/hair or bones last. Food intake may substantially increase in summer if ample food is provided.

SPRING: Mainly green vegetables, wheat shoots, cut grasses, cloves, grass and weeds. Root vegetables, plus occasional meat (bones and skin). Normal or possibly increased vitamin/mineral supplements should be given.

SUMMER: Gradually change to increase fruit, bread and other more nutritious items. Items suggested for spring can be given sometimes for variety. Normal or possibly increased vitamin/mineral supplements should be given.

AUTUMN: Provide fruit, carrots and mast - nuts and seeds - together with occasional fatty meat. The Asiatic black bear may hibernate over winter, or semi-hibernate for weeks at a time, if provided with ample food over summer and autumn (fall), but will remain more active, not hibernate, if they have been fed less during the late summer and autumn.

Presentation of food:

In captivity, food is frequently presented in a nutritional but possibly monotonous form, and may be consumable in a short period of time. This may cause behavioural deprivation and may lead to the development of food-related stereotypic behaviours. In captivity food is usually presented in feed bowls, troughs or similar (to reduce spillage and associated wasting, spoiling and encouragement of vermin); this unnatural concentration of food may lead to excessive competition between individuals; with a risk that subordinate individuals may not get sufficient nutrition. It is important to ensure that food is available to all individuals. Increasing the number of feeding points, and spacing them at greater distances, should increase the number of individuals able to feed at one time, and minimise competition and conflict.

Separate or protected feeding stations may be needed for certain individuals, particularly when animals are newly introduced and not yet fully integrated into their new social group. The method of food presentation should also be chosen to provide environmental enrichment. Food should be presented in an appropriate location for the species. It is important to remember that when a variety of foods are made available, rather than a monotonous but balanced complete food, the animals will not necessarily choose "a balanced diet". Care must be taken to minimize the risk that food eaten by each individual will be nutritionally inadequate.

- **Seasonal/breeding changes in feeding requirements:**

Study as such has not been conducted in the park during the tenure of the project, and no records available as such in the zoos visited during the tenure of the project.

- **Feeding Schedule/interval:**

Sample chart of the feeding schedule/ interval monitored daily at pnhz park, darjeeling.

Everyday the animal is fed in between 9:00 a.m. – 10.00 a.m. for e.g. the below chart represents the feeding schedule and the feeding interval observed (latest) for a period of one month.

Month	Date	Feed items	Time interval	Total time taken
March	1.3.09	Chappati & Rice, Boiled egg, soaked chana, sattu balls, soup	M: 9: 27 a.m.- 9: 30 a.m(G)	3 mins
			F: 9:18 a.m.- 9:22 a.m. (1; ARUNA)	4 mins
			F: 9:21 a.m. – 9: 30 a.m (2; JENNI)	9 mins
			F: 9:23- 9: 26 a.m (SUNDARI)	3 mins
	2.3.09	Chappati, Milk, Boiled egg, Soaked Chana, Sattu balls	M: 8:40 a.m. – 8: 46 a.m.	6 mins
			F: 8:38 a.m. – 8: 42 a.m.	4 mins
			8:35 a.m. – 8: 37 a.m.	2 mins
			8:33 a.m.- 8: 40 a.m.	7 mins
	3.3.09	Chappati & Rice, Boiled egg, soaked chana, sattu balls, soup	M: 9:44a.m. – 9: 50 a.m.	6 mins
			F: 9:37 a.m. – 9:41 a.m.	4 mins
			9:30a.m. – 9:5 a.m.	5 mins
			9:31 a.m. – 9:33a.m	2 mins
	4.3.09	Chappati, Milk, Boiled egg, Soaked Chana, Sattu balls	M: 8:45 a.m.- 8:49 a.m.	4 mins
F: 8: 46 a.m. – 8: 50 a.m.			4 mins	
F: 9:00 a.m. – 9:03 a.m.			3 mins	

			F: 9:00 a.m.- 9: 02 a,m,	2 mins
5.3.09	Chappati & Rice, Boiled egg, soaked chana, sattu balls, soup		M: 9:40 a.m.-9:45 a.m.	5 mins
			F:9:36 a.m.- 9:42 a.m.	6 mins
			F:9:33a.m.- 9:38 a.m.	5 mins
			F: 9: 36 a.m. – 9:40 a.m.	4 mins
6.3.09	Chappati, Milk, Boiled egg, Soaked Chana, Sattu balls		M: 9:15 a.m. – 9:18 a.m.	3 mins
			F: 9:21 a.m. – 9:26 a.m.	5 mins
			F:9:18 a.m. – 9:21 a.m.	3 mins
			F: 9:17 a.m. – 9:21 a.m.	4 mins
7.3.09	Chappati & Rice, Boiled egg, soaked chana, sattu balls, soup		M: 9:0 a.m.- 9:37 a.m.	7 mins
			F: 9:24 a.m.- 9:0 a.m.	6 mins
			F: 9:28 a.m – 9: a.m.	5 mins
			F: 9:27 a.m.- 9:32 a.m.	5 mins
8.3.09	Chappati, Milk, Boiled egg, Soaked Chana, Sattu balls		M: 9:21a.m - 9:25 a.m.	4 mins
			F: 9:18 a.m.- 9:22 a.m.	4 mins
			F: 9: 14 a.m – 9:17 a.m.	3 mins
			F : 9: 12 a.m.- 9:15 a.m.	3 mins
9.3.09	Chappati & Rice, Boiled egg, soaked chana, sattu balls, soup		M: 9:28 a.m. – 9:3 a.m.	3 mins
			F: 9:15 a.m. – 9:19 a.m.	4 mins
			F: 9:25 a.m.- 9: 31 a.m.	6 mins
			F: 9:24 a.m.- 9:29 a.m	5 mins
10. 3.09	Chappati, Milk, Boiled egg, Soaked Chana, Sattu balls		M: 9:07 a.m – 9: 10 a.m.	3 mins
			F: 9:04 a.m – 9: 09 a.m.	5 mins
			F: 9:12 a.m – 9: 15 a.m.	3 mins
			F: 9:11 a.m – 9: 14 a.m.	3 mins.
11.3.09	Chappati & Rice, Boiled egg, soaked chana, sattu balls, soup		M: 9:11 a.m. – 9:16 a.m.	5 mins
			F: 9:09 a.m. – 9: 13 a.m.	4 mins
			F : 9:16 a.m – 9:21 a.m.	5 mins.
			F : 9 :15 a.m. – 9: 18 a.m.	3mins.
12.3.09	Chappati, Milk, Boiled egg, Soaked Chana, Sattu balls		M: 9:28 a.m. – 9:32 a.m.	4 mins.
			F: 9:17 a.m – 9:20a.m.	3 mins.
			F; 9:25 a.m – 9:27 a.m.	2 mins
13.3.09	Chappati & Rice, Boiled egg, soaked chana, sattu balls, soup		M: 9:57 a.m.- 10:03 a.m.	6 mins
			F: 9:40 a.m.- 9: 44 a.m.	4 mins
			F: 10: 00 – 10:05 a.m.	5 mins

			F: 10:00 a.m. – 10:04 a.m.	4 mins
	date	feed items	time interval	total time taken
14.3.09	Chappati, Milk, Boiled egg, Soaked Chana, Sattu balls		M: 9:21 a.m – 9: 28 a.m.	7 mins
			F – 9:22 a.m.- 9:25 a.m.	3 mins
			F: 9:28 a.m.- 9: a.m.	5 mins
			F: 9 :14 a.m. – 9:21 a.m.	7 mins
15.3.09	Chappati & Rice, Boiled egg, soaked chana, sattu balls, soup		M: 9: 15 a.m.- 9:18 a.m	3 mins
			F: 9:16 a.m.- 9: 19 a.m.	3 mins
			F: 9:17 a.m.- 9: 20 a.m.	4 mins
			F: 9: 17 a.m.- 9: 21 a.m.	5 mins
16.3.09	Chappati, Milk, Boiled egg, Soaked Chana, Sattu balls		M: 9:32 a.m. – 9:35 a.m.	3 mins
			F – 9:31 a.m. -9:36 a.m.-	5 mins.
			F- 9:27 a.m. – 9:34 a.m.	7 mins
			F: 9 : 28 a.m.- 9:33 a.m.	5 mins
17.3.09	Chappati & Rice, Boiled egg, soaked chana, sattu balls, soup		M:9: 28 a.m.- 9: 33a.m	5 mins
			F: - 9: 35 a.m.- 9:39 a.m.	4 mins
			F:9:14 a.m. – 9:19 a.m.	5 mins
			F: 9: 21 a.m.- 9:24 a.m.	Mins
18.3.09	Chappati, Milk, Boiled egg, Soaked Chana, Sattu balls		M:10:08 a.m.- 10: 12 a.m.	4 mins
			F: - 10:00 a.m.- 10:05 a.m.	5 mins
			F:10:01 a.m. – 10:05 a.m	4 mins
			F:10:02 – 10:03 a.m.	1 mins
19. 3.09	Chappati & Rice, Boiled egg, soaked chana, sattu balls, soup		M: 9:31 a.m.- 9:36 a.m.	5 mins
			F : 9:33 a.m.- 9:38 a.m.	5 mins
			F : 9:30 a.m.- 9:34 a.m.	4 mins
			F: 9:30 a.m. – 9: 33 a.m	mins
20.3.09	Chappati, Milk, Boiled egg, Soaked Chana, Sattu balls		M:10:10a.m.- 10:12 a.m	2 mins
			F: 10: 13 a.m.- 10: 15 a.m.	2 mins
			F: 10:11 a.m.- 10: 14 a.m.	3 mins
			F: 10:12 a.m.- 10 : 15 a.m.	3 mins
21.3.09	Chappati & Rice, Boiled egg, soaked chana, sattu balls, soup		M: 9: 28 a.m.- 9:35 a.m.	7 mins
			F: 9:00 a.m.	
			F:9: 27 a.m.- 9:36 a.m.	9 mins
			F: 9:30 – 9:3 3a.m.	3 mins
22.3.09	Chappati, Milk, Boiled egg, Soaked Chana, Sattu balls		M: 9:33 a.m – 9:36 a.m.	3 mins
			F: 8: 50 a.m. – 8:54 a.m.	4 mins
			F: 9 :27 a.m.- 9:32 a.m.	5 mins

			F: 9:29 a.m. - 9:33a.m.	4 mins
	23.3.09	Chappati & Rice, Boiled egg, soaked chana, sattu balls, soup	M:9:42 a.m. – 9:45 a.m. F: - 9:42 a.m.- 9:45 a.m F: 9:35 a.m-9:39a.m. F: 9:34 a.m- 9:38 a.m..	3 mins 3 mins 4 mins 4 mins
	24.3.09	Chappati, Milk, Boiled egg, Soaked Chana, Sattu balls	M:9:59 a.m.- 10: 05 a.m. F: - 9: 59 a.m.- 10: 08 a.m. F:9:55 a.m.- 9:58 a.m. F:9:56 – 9 :57 a.m.	6 mins 9 mins 5 mins 1 min
	25.3.09	Chappati & Rice, Boiled egg, soaked chana, sattu balls, soup	M: 10:12 a.m.- 10 : 20 a.m. F: - 10:11 a.m. – 10: 15 a.m. F:10:15 a.m.- 10 21 a.m. F: 10: 14 a.m.- 10 – 20 a.m.	8 mins 4 mins 7 mins 6 mins
	26.3.09	Chappati, Milk, Boiled egg, Soaked Chana, Sattu balls	M: 9:56 a.m – 9:59 a.m. F: - F: 9:55 a.m – 9: 58 a.m. F: 9: 55 a.m.- 9 : 57 a.m.	3 mins 3 mins 2 mins
	27.3.09	Chappati & Rice, Boiled egg, soaked chana, sattu balls, soup	M: 10:13 a.m. – 10: 16 a.m. F: - 10:00 a.m.- 10:06 a.m. F:10: 07 a.m.- 10: 16 a.m F: 10:07 a.m.- 10:13 a.m.	3 mins 6 mins 9 mins 6 mins
	28. 3.09	Chappati, Milk, Boiled egg, Soaked Chana, Sattu balls	M:10:10 a.m. – 10:06 a.m. F: - 9:00 a.m.- 9>05 a.m. F:9:07 a.m.- 9: 09 a.m. F:9:08 a.m.- 9: 10a.m	6 mins 5 mins 2 mins 2 mins
	29.3.09	Chappati, Milk, Boiled egg, Soaked Chana, Sattu balls	M: 9: 18 a.m. – 9:21 a.m.. F: 9:16 a.m.- 9: 20 a.m. F: 9:14 a.m.- 9:19 a.m. F: 9:15 a.m.- 9:17 a.m.	3 mins 4 mins 5 mins 2 mins
	30.3.09	Chappati & Rice, Boiled egg, soaked chana, sattu balls, soup	M: 9:24 a.m.- 9:27 a.m. F: - 9:24 a.m.- 9:29 a.m. F: 9:19 a.m.- 9:23 a.m. F: 9:21 a.m.- 9:26 a.m.	3 mins 6 mins 4 mins 5 mins
	31.3.09	Chappati, Milk,	M: 9:27 a.m.- 9:29 a.m.	2 mins

		Boiled egg, Soaked Chana, Sattu balls	F: 9:27 a.m.- 9:30 a.m.	4 mins
			F: 9:30 a.m.- 9:33 a.m.	3 mins
			F: 9:32 a.m.- 9:37 a.m.	5 mins

RECOMMENDATIONS:

❖ Increase the frequency in feeding:

Rather than feeding once a day, more frequent feeding with smaller amounts of food, by different means of presentation, more closely matches food availability in the wild.

In general, bears should be offered food at least three times a day, with most being offered scattered in the outdoor enclosure.

Anticipation of food appears to be an important stressor on captive bears (with stereotypic behaviours increasing prior to provision of food) and starve days appear to increase this stress.

❖ Food item preparation:

Food should be provided in forms which require manipulation and processing of the food items by the bear. Whole fruits and vegetables (e.g. apples, pears, melons, cucumbers) promote food manipulation using the paws, claws, lips and teeth.

Food in small pieces should be given as scatter feeds, so that the bear has to forage for the food, moving around the enclosure. Use of mechanical feeders should be considered only if these have been carefully designed and tested.

• Feeding locations:

The main feed is provided inside the night shelter where feeding bowls are kept for each individual animal. Other feeding sites are as follows:

- Food should be provided scattered around the enclosure, not all in one location.
- Food items can be hidden e.g. in hollow logs, holes in rotten logs, large stick piles, under leaf litter or buried in the ground; items can be placed around the enclosure and in hiding places while bears are shut in dens.
- Most food (dry items) may be offered on the ground.
- Some food should be offered off the ground, at a height such that the bear has to climb or stand on its hind legs to reach the food.
- Food may be offered in indoor areas to encourage bears to come inside to allow the outdoor enclosure to be cleaned, or for the night. This can be used to offer food in bulk. Food offered to encourage bears in should include delicacies.

➤ Hand feeding by keepers:

Keepers may hand-feed bears with tit-bits as part of a process of building up trust and mutual respect.

Hand feeding also provides a way to give oral medication.

➤ Food handling and hygiene:

Foods commonly deteriorate during storage; the rate of deterioration varies depending on the type of food, and on storage conditions such as temperature and humidity. Foodstuffs should be stored at the correct temperature and humidity conditions for the different foods. Care should be taken to minimise consumption of food by pests such as wild birds and rodents, both during storage and after food has been offered to animals. Most foodstuffs should be stored in a cool, clean, dry (low humidity) place away from vermin such as rodents and insects. Rodent droppings in feed have been associated with outbreaks of enteritis. Hays should be visually checked to ensure they do not contain known toxic plants.

It is recommended that the feeding sites should be checked everyday for any kind of left overs and thoroughly cleaned prior to keeping of any new feed items.

Waste disposal:

Leftover food should be removed promptly. Provision must be made for disposal of food wastes, rubbish (trash) and debris in a manner which minimises their attractiveness to vermin as well as production of odours and disease hazards.

- **Water:**

Water to the animal is provided for various purposes such as drinking, playing, and cleaning.

- **Diet ingredients:**

Feeding Chart for Asiatic Black Bear at PNHZ Park.

Sl No.	Feed items	Quantity
1.	Rice	250 gms
2.	Chappati	7pcs = 175 gms
3.	Sugar / Mollases	200gms
4.	Sattu balls	
5.	Seasonal vegetables like papaya, cabbage, maize, cucumber, tomato, squash etc.	1 kg
6.	Roots like sakharhand, simal tarul, radish, carrot, potato or any other roots	500gms
7.	Fruits like mausambi, anaras, banana, guava and other seasonal fruits	600gms
8.	Honey	
9.	Chicken/ Mutton Soup	1 lts
10.	Milk	500ml
11.	Boiled egg	2 pcs = 50gms

Feeding and nutrition of Asiatic black bear (*Ursus thibetanus*) at Padmaja Naidu Himalayan Zoological Park.

All living animals are the result of the interaction of two forces: hereditary and environment. The hereditary aspect is predetermined through the combination of the genetic diversity of the animals sire, with that of its dam, environmental factors are constantly acting upon the animal molding and shaping it within the constraints placed upon its genetic constitution. The most influential environmental factor at work upon individual animals is that of nutrition. Nutrition as defined by Ensminger and Olentine is: “The science of the interaction of a nutrient with some part of a living organism”. There are forty (including oxygen) nutrient chemicals that can be liberated through the action of digestion upon feedstuffs. These nutrients can then be subsequently utilized by the various organs, tissues and cells of the animal’s body.

Nutrient Function:

The utilization of the liberated nutrients varies greatly dependent upon such factors as an animals, species, age, productivity and individual variation. There are certain essential functions for which all animals use a portion of the digested nutrients. Maintenance requirements: Body metabolism, maintenance of body temperature, and the replacement and repair of body cells and tissues. Production requirement: milk production, egg production, hair coat production and work (such as exercise). Reproduction requirements: functions involved in reproduction such as development of the fetus.

Four levels of nutrient demands:

- High demand: milk and egg production.
- Low demand: hair coat production
- Variable demand: work which may be strenuous at time
- Intermediate demand: growth and fattening.

Maintenance requirements:

Maintenance requirements of an animal may be defined as:

That combination of nutrients necessary for body functioning without weight gain and loss, nor any productivity activity”

Steps undertaken by the Park for the diet and the dietary enrichment.

The diet for the Asiatic black bear on as 22 May 07’ per individual

Table -1: Diet of Asiatic Black bear (*Ursus Thibetanus*)

Sl.No	Feed items	Quantity
1	Egg	2 pcs
2	Sattu	500 gms
3	Mollases	200 gms
4	Crushed Maize	500 gms

5	Banana	4 pcs
6	Bread	1 kg
7	Honey	100 ml (females) 200ml (males)
8	Rice	500 gms
9	Apple	1 kg
10	Milk(Amul)	500 ml
11	Maize	500 gms
12	Seasonal Fruits	200 gms.

Table 2: Calorie content of the feed items in 100 gms

Feed items	Moisture	Protein	Fat	Minerals	Fibre	Carbohydrate
Rice	13.7%	6.8%	0.5%	0.6%	0.2%	78.2%
Crushed maize	14.9%	3.6%	1.5%	2.7%	0.5%	66.2%
Banana	70.1%	1.2%	0.3%	0.8%	0.4%	27.2%
Apple	84.6%	0.2%	0.5%	0.3%	1.0%	13.4%
Lemon	85.0%	1.0%	0.9%	0.3%	1.7%	11.1%
Orange	87.6%	0.7%	0.2%	0.3%	0.3%	10.9%
Papaya	90.8%	0.6%	0.1%	0.5%	0.8%	7.2%
Carrot	86.0%	0.9%	0.2%	1.1%	1.2%	10.6%
Cucumber	96.3%	0.4%	0.1%	0.3%	0.4%	22.6%
Potato	74.7 %	1.6%	0.1%	0.6%	0.4%	22.6%
Radish	94.4%	0.7%	0.1%	0.6%	0.8%	3.4%
Honey	20.0%	0.3%	0.2%	-	-	79.5%
Egg white		11.7%	0.01%	-	-	1.2 %
Egg yolk		17.1%	25.6%	-	-	0.8%

Table 3: Calorie content in 500gms for rice, maize, apple (1000 gms), other seasonal fruits: 200 gms, honey: 200 ml, egg (boiled – 50gms).

Feed items	Moisture	Protein	Fat	Minerals	Fibre	Carbohydrate
Rice	68.5%	34%	2.5%	3%	1%	391%
Maize	74.5%	18%	7.5%	13.5%	2.5%	331%
Banana	210.3%	3.6%	0.9%	2.4%	1.2%	81.6%
Apple	846%	2%	5%	3%	10%	134%
Lemon	170%	2%	1.8%	0.6%	3.4%	22.2%
Orange	175.2%	1.4%	0.4%	0.6%	0.6%	21.8%
Papaya	181.6%	3.4%	0.2%	1%	1.6%	14.4%
Carrot	172%	1.8%	8.4%	2.2%	2.4%	21.2%
Cucumber	192.6%	0.8%	0.2%	0.6%	0.8%	6.8%
Potato	194.4%	3.2%	0.2%	0.6%	0.8%	6.8%
Radish	188.8%	1.4%	0.2%	1.2%	0.8%	6.8%
Honey	60%	0.9%	0.6%	-	-	238.5%
Boiled egg	-	-	2.65%	3.655%	-	0.28%

The calorie content of the diet revealed that the items were rich in carbohydrate hence a questionnaire were sent to different zoos in India to know about the feed for the Asiatic black bears in captivity

Table 4: Feed chart of asiatic black bear (*ursus thibetanus*) at different zoos in india.

Ingredients → Name of the zoo↓	Rice	Crushed maize	Sattu	Mola sses	Soake d Chana	Bread	Milk	Egg	Seasonal fruits	Green Veg/other veg.
Nainital Zoo	300gms	-	Barley flour – 500gms Chana flour – 300gms	200g ms	-	-	500m l		-	Khera- 150 gms Brinjal – 150 gms Pumpkin – 150 gms -
Guwahati Zoo	300gms	-	-	-	-	400gms	100 ml	1 pc (alter nate days)	Jack fruit -1 kg Mango – 200gms Guava – 200gms Plum – 200gms Apple – 1 pc Bananas- 4 pcs	Carrot- 250 gms Sweet potato – 200gms.
National Zoological Park, Delhi	-	-	-	-	-	1 kg	500m l		Bananas – 3 pcs Seasonal fruits – 700gms	Carrot – 250 gms Sweet potato – 250 gms. Root potatoes – 200gms
Chattbir Zoo	Rice : Mung (1:1) 1 kg	-	-	-	-	200gms	500m l		Banana – 3 pcs Seasonal fruits – 500gms Baer – 100gms	

Table 5: Assessment of the total quantity of the feed.

SL NO.	Name of the zoo	Quantity in gms	Quantity in ml
1.	Padmaja Naidu Himalayan Zoological Park	4 kg 800 gms	800 ml
2.	Nainital Zoo	1 kg 750 gms	500 ml

3.	Guwahati Zoo	2 kg 475 gms	100 ml
4.	National Zoological Park	2 kg 550 gms	100 ml
5.	Chattbir Zoo	1 kg 950 gms	500 ml

This result clearly indicated that the diet provided to the Asiatic black bear (*Ursus thibetanus*) in the park is higher compared to other zoos. No assessment was made in terms of calorie value. Higher quantity of feed for animals in captivity can increase the weight, makes the animal lethargic, which leads to obesity and can sometimes be fatal leading to death.

Thus the diet was changed as follows with certain conditions:

- Rice and Chappati given alternately together with milk and soup.
- 1 kg of vegetables to be provided when roots are not given and 500gms when roots are given.
- Roots 500gms in co-relation with green vegetables.

Table 6: **The revised feed chart of asiatic black bear (*ursus thibetanus*)**

Sl no	Feed items	Quantity.
1.	Rice	250 gms
2.	Chappati	7pcs = 175 gms
3.	Sugar / Mollases	200gms
4.	Sattu balls	
5.	Seasonal vegetables like papaya, cabbage, maize, cucumber, tomato, squash etc.	1 kg
6.	Roots like sakharhand, simal tarul, radish, carrot, potato or any other roots	500gms
7.	Fruits like mausambi, anaras, banana, guava and other seasonal fruits	600gms
8.	Honey	
9.	Chicken/ Mutton Soup	1 lts
10.	Milk	500ml
11.	Boiled egg	2 pcs = 50gms

Table 7. : **Reduction in the quantity in the feed.**

Sl no.	Feed items	Total quantity.
1.	Rice, sattu balls, boiled eggs, seasonal vegetables, fruits,	2 kg 200gms with milk or soup – 500ml
2.	Chappati, Soup, sattu balls, boiled eggs, seasonal vegetables, fruits, soaked chana	2 kg 125 gms.with milk or soup 500ml.

Table 8: calorie chart of the revised feed in 100 gms.

Feed items	Moisture	Protein	Fat	Minerals	Fibre	Carbohydrate
Rice	13.7%	6.8%	0.5%	0.6%	0.2%	78.2%
Milk						
Banana	70.1%	1.2%	0.3%	0.8%	0.4%	27.2%
Apple	84.6%	0.2%	0.5%	0.3%	1.0%	13.4%
Lemon	85.0%	1.0%	0.9%	0.3%	1.7%	11.1%
Orange	87.6%	0.7%	0.2%	0.3%	0.3%	10.9%
Papaya	90.8%	0.6%	0.1%	0.5%	0.8%	7.2%
Carrot	86.0%	0.9%	0.2%	1.1%	1.2%	10.6%
Cucumber	96.3%	0.4%	0.1%	0.3%	0.4%	22.6%
Potato	74.7 %	1.6%	0.1%	0.6%	0.4%	22.6%
Radish	94.4%	0.7%	0.1%	0.6%	0.8%	3.4%
Honey	20.0%	0.3%	0.2%	-	-	79.5%

Table 9: Calorie chart of the revised feed in 250 gms.

Feed items	Moisture	Protein	Fat	Minerals	Fibre	Carbohydrate
Rice	34.25%	17%	1.25%	1.5%	0.5%	195.5%
Milk						
Banana	175.25%	3%	0.75%	2%	1.2%	81.6%
Apple	211.5%	0.5%	1.25%	0.75%	2.5%	33.5%
Lemon	212.5%	2.5%	2.25%	0.75%	4.25%	27.75%
Orange	219%	1.75%	0.5%	0.75%	0.75%	27.25%
Papaya	227%	1.5%	0.25%	1.25%	0.2%	18%
Carrot	215%	2.25%	0.5%	2.75%	3%	26.5%
Cucumber	240.75%	1%	0.25%	0.75%	1%	56.5%
Potato	186.25%	4%	0.25%	1.5%	1%	56.5%
Radish	236%	1.75%	0.25%	1.5%	2%	8.5%
Honey	500%	0.75%	0.5%	-	-	198.75%

The new diet was implemented from 4th August 2007'. Continuous observation and record (feeding time, time taken to complete the feed etc) was done to see the effect of the revised diet. No ill or adverse effect was observed and the animal's behaviour indicated that it was not ill fed. Further feed enrichment was added to this.

- (i) Increasing their feeding times- 3 times a day.
- (ii) Alternating their daily feed items – rice and chappati including soup and milk is given alternately every day.
- (iii) Provision of seasonal fruits and vegetables.
- (iv) Study and provision of wild diets.

The objective of the study in the sanctuary was:

- (a) Finding out all the possible number of wild items of the animal.
- (b) Inclusion of the wild diet to the captive diet.
- (c) Degree of acceptability of the wild diet by the captive two females.
- (d) Monitoring their health and behaviour.

Innumerable studies of food habits have been conducted on American black bear (*Ursus americanus*) but less data are available on the diet of its apparent ecological counterpart and close taxonomic relative (Talbot and Shields 1996), the Asiatic black bear the only previous information on the diet and foraging behaviour of Formosan black bears was obtained from feeding natural foods to a captive individual (Wang et.al. 1992, Hwang and Wang 1993). The varied forms of diet of Asiatic black bears have relied mainly on scat analysis, collected stomach contents, examination of feeding signs or even observation of bears feeding but observation of forest dwelling bears are generally rare and feces have been one of the safest media for information on diets of black bears.

Study on wild diets was conducted at Senchal Wildlife sanctuary. On 1.9.08-5.9.08. the feed items were collected and fed to the bears. For the long term implication of the wild diet the zoo forest was surveyed in which similar kinds of plants were available. Seasonally the diets are collected and given till date. Observation conducted sees its effect and its acceptability. The wild diet was accepted with no ill effect over the bear. Following is the diet of Asiatic Black bear available at Senchal Wildlife Sanctuary:

No	Scientific name	Family	local name	parts used	season
1.	<i>Arisaema nepalensis</i>	Araceae	Gurbae/ Sapko Makai	fruit	September- October
2.	<i>Polygala arileta</i>	<i>Polygalaceae</i>	Marcha	fruits	September- October
3.	<i>Berberis sp</i>	Berberidaceae	Chutro	stem	Throughout the year
4.	<i>Rubus ellipticus</i>	Rosaceae	Asielo	fruits	June- September
5.	<i>Fragaria vesca</i>	Rosaceae	Bhui asielo	fruits	June- September
6.	<i>Stephenia hernandifolia</i>	Merispermaceae	Tamarkay	Tuber	Throughout the year.
7.	<i>Quercus lamellosa</i>	fagaceae	Buk	fruit	September- October
8.	<i>Quercus lineata</i>	fagaceae	Phalant	fruit	September- October
9.	<i>Globba hookeri</i>	Zingiberaceae	sarrow	Roots, stem	April- September.
10.	<i>Rubus sp</i>	Rosaceae	Karae Asielo	fruits	June- September
11.	<i>Bergenia ciliata</i>	Saxifragaceae	Pakhanbed	roots	Throughout the year
12.	<i>Quercus fenestrata</i>	Fagaceae	Arkawla	fruits	
13.	<i>Quercus panchyphylla</i>	Fagaceae	Sungure Katus	fruit	October-December
14.	<i>Castonopsis hystrix</i>	Fagaceae	Katus jat	fruits	October-December
15.	<i>Castonopsis tribuloides</i>	Fagaceae	Musrey patley katus	fruits	October-December
16.	<i>Castonopsis sp</i>	Fagaceae	Banta Katus	fruits	October- December
17.	<i>Machilus gammieana</i>	lauraceae	Chiple Kawla	fruits	September- December
18.	<i>Machilus edulis</i>	lauraceae	Lapchae kawla	fruits	September- December
19.	<i>Machilus odoratissima</i>	lauraceae	Lali Kawla	fruits	September- December
20.	<i>Machilus sp</i>	lauraceae	Seto kawlo	fruits	September- December
21.	<i>Machilus sp</i>	lauraceae	Badara kawlo	fruits	September- December
22.	<i>Eurya japonica</i>	Theaceae	Jhingani	Leaves, fruits	September- December
23.	<i>Eurya acuminata</i>	Theaceae	Jhingani	Leaves, fruits	September- December
24.	<i>Symplocos theifolia</i>	Symplocaceae	Kharane	fruits	September- December
25.	<i>Cryptomeria japonica</i>	Taxodiaceae	Dhupi	barks	Throughout the year
26	<i>Arundinaria hookeriana</i>	Poaceae	Parang	Young shoots	Sept-Jan

Table 10: wild feed items for Asiatic black bears in captivity.

NAME OF THE ZOO	SEASON	SPRING	SUMMER	FALL	WINTER
		APPLE	APPLE	CABBAGE	UNDERGROUND MODIFIED ROOTS
		PAPAYA	BANANA	MAIZE	SUGARCANE
		TOMATOES	MOUSAMBI	APPLE	APPLE
		SQUASH	CARROT	RAW PAPAYA	BANANA
		CARROT	PUMPLIN	CUCUMBER	CABBAGE
		CUCUMBER	MOUSAMBI	BAMBOO SHOOTS	RAW PAPAYA
		GREEN LEAFY VEGETABLES	LADY FINGER	WILD FRUITS AND VEGETABLES	WILD FRUITS AND VEGETABLES
		RADDISH	RIPE PAPAYA		
		MOUSAMBI	CUCUMBER		
		FRESH BAMBOO LEAVES	WATERMELONS		
			GUAVA.		
			TOMATO		

Table 11: The frequently provided feed items at pnzh park, Darjeeling.

Behaviour related to feeding (competition, rumination, search etc) and possible means of mitigating problems, enhancing normal activities).

- ❖ Food is usually presented individually in feed bowls, troughs or similar to reduce spillage and associated wasting spoiling.
- ❖ Food is usually soft, hence palatability less.
- ❖ Frequency of pacing, head swing increases before the feeding hours.
- ❖ No infighting has been observed during feeding as the animals are fed individually but shows a tendency to fight when the two animals accidentally enters the same cubicle during feeding.
- ❖ Chewing of the feed is not observed, gulping is more common except for the bones.
- ❖ This species hardly takes 1 – 7 mins to complete its main feed.
- ❖ No carving for more feed has been observed. The animal quietly leaves the cubicle once they are let out in the enclosure.

Possible means of mitigating problems, enhancing normal activities:

During feeding the common behaviour observed is infighting, the possible reason could be the food. This tendency is often common in large group of animals (5-6) if they are provided food in the same location. Fighting could also be due to hunger.

No incidences as such have been observed in the park as the animals are fed in different cubicles in separate cells. Such problems can be easily handled by

- Providing the feed in separate feeding bowls.
- Feeding the animal in time.
- Adequate amount of feed to be provided; the animal should not be under or over fed.

Enhancing normal activities:

- Food should be provided in forms which require manipulation and processing of the food items by the bear.
- Whole fruits and vegetables (e.g. apples, pears, melons, and cucumbers) promote food manipulation using the paws, claws, lips and teeth.
- Food in small pieces should be given as scatter feeds, so that the bear has to forage for the food, moving around the enclosure
- The presentation of food items should be varied to provide behavioural enrichment; foods used for environmental enrichment should be handled and stored to the same standards as other foods.
- Food should be provided scattered around the enclosure, not all in one location.
- Food items can be hidden e.g. in hollow logs, holes in rotten logs, large stick piles, under leaf litter or buried in the ground; items can be placed around the enclosure and in hiding places while bears are shut in dens.
- Some food should be offered off the ground, at a height such that the bear has to climb or stand on its hind legs to reach the food.

- Separation into separate enclosures during feeding is suggested, to reduce fighting and to allow food consumption of individual bears to be measured accurately.
- Keepers may hand-feed bears with tit-bits as part of a process of building up trust and mutual respect.
- Hand feeding also provides a way to give oral medication.
- **Stimulation of natural feeding Behaviour:**

For the stimulation of natural feeding behaviour, dietary and non- dietary enrichment forms can be provided to the animals.

- The main course of the feed (cooked rice, boiled chana, boiled egg) should not be crushed and mixed with soup. They should be given together but not mixed thoroughly. Allow the animal to chew.
- Fruits and vegetables should be given as a whole, allow the animal to manipulate it the way they want to.
- Provide the animal with hard feed (whole coconut, watermelon, pumkin etc.).
- Scattering /hiding the fruits and vegetables in the enclosure.



Feeding Bowl of Asiatic Black Bear (*Ursus thibetanus*)



Feed and water provided for Asiatic black bear (*ursus thibetanus*)

SUMMARY:

Firstly, the enrichment programme was undertaken in the park since captive carnivores are known for exhibiting stereotypic, self destructive and abnormal behaviours, over activity, inactivity, pacing, head swinging and over grooming in order to cope with the inadequate, sterile environment or they could be expressing directed searching behaviour, mate finding, home range patrol, or hunting. Loud noises, construction, small quarters, being locked inside, expectations of food, once – a day feeding are some of the factors that contribute to stereotypy in carnivores, thus enrichment helps in involving a better quality of life, benefits with greater choices, change and cognitive challenges. The animals become well-adjusted, responsive, curious, active and healthy which are the end products of intensive enrichment efforts which the above results clearly indicate.

Secondly, dietary enrichment was conducted to provide optimal nutrition to the animals in care, while attempting to address the needs associated with the behaviour of feeding. This programme will also help in the captive management goals of reproduction, longevity and behavioural normality by attempting to meet psychological and physiological needs of the species that have evolved under diverse environmental circumstances.

Thirdly, in terms of veterinary aspect, parasitological work is conducted to see that the animal is free from any parasitic infestations both externally and internally

Losses due to parasitism:

- Higher mortality rate.
- Higher susceptibility to other infections.
- Condemnation of organs.
- Lower breeding potential.
- Poor body growth.
- Suppresses immunity.
- Decrease the zoonotic cases.

All the above works conducted and findings will help the species in exhibiting natural wild behaviour, free from any form of disease which in the long term will help in the breeding of the species in captivity and hence its conservation.

Future Works:

(i) Record keeping.

Individual records

- Transponders, ear tag, band number and sex.
- Hatch/birth date, parentage and origin.
- Weights, health problems and treatments.
- Movements of young ones, movements between closures, holding with other animals/birds.
- Breeding attempts and chicks/young reared.
- Important behavioural notes.

(ii) During the tenure of this project the park did not house a male Asiatic Black Bear. A pair of Asiatic black bears was bought from Itanagar Zoo; Arunachal Pradesh on 18. 01.09. Since the project included studying the behaviour including breeding the species in the park hence studies have to be conducted further on the newly arrived pair, introduction, social behaviour with the already existing two females in the park.

The result of this observation will lead to pairing of any of the three females with the male for breeding.

Breeding Requirements.

- General behavioural notes.
- Nesting/breeding requirements.
- Requirements of young.
- Methods of hatching/ rearing/manipulation.

Rearing Young.

- Parturition/ delivery facilities.
- Diets: method fed, frequency fed, feeding temperature.
- Records and monitoring.
- Behavioural considerations)(e.g. weaning, imprinting, socialization.

(iii) Enrichment provided to the two Asiatic black bears resulted in one of the female coming into oestrus which resulted in the infighting with the other female, a behaviour commonly observed in the wild where the female turns to be aggressive and infighting occurs thus a pair which included a male was brought from Itanagar zoo on 18.1.09, hence I would like to further study the newly brought pair, their behaviour individually, social behaviour with the already existing females in the park, impact of enrichment in their behaviour.

(iv) The result of this observation will lead to pairing of any or all of them of the three females with the male for breeding, and to study further individual behaviour of the females and the males.

(iii) To implement different forms of enrichment to instigate more of natural behaviour.

(v) Nutritional Study of the Asiatic Black Bear in captivity in determining requirements, or basic ingredients, palatability, presentation, novel food items or enrichment, food as vehicles for oral medications or medical management, intake and social group dynamics
Effect on intake.

METHODS:

Three main sources of information are used to develop zoo diets:

- The natural history of the animal.
- Study of the wild diets of the animal.
- Records of the food provided to the animals from other captive management facilities.
- Help from nutritionist, animal staff, and veterinarians to adequately assess the effectiveness of the diet.

Testing the calorie value of the food items of the wild animals in captivity by sampling the food items

(vi) In terms of veterinary aspect- use of newer diagnostic techniques, standardization of biochemical and hematological study for the Asiatic black bears for high altitude zoos. To know the general health of the animal taking their body weights at regular intervals of time.

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