International Journal of Zoology Studies
ISSN: 2455-7269
Impact Factor: RJIF 5.14
www.zoologyjournals.com
Volume 3; Issue 2; March 2018; Page No. 184-187

Study of red panda (*Ailurus fulgens fulgens*) in ex situ facility for conservation breeding at Padmaja Naidu Himalayan Zoological Park, Darjeeling

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Abstract
Red panda (*Ailurus fulgens fulgens*) is a solitary, nocturnal and scansorial carnivore which has adapted to the herbivore mode of life. It is a monotypic member of the family *Ailuridae* which is included in the animal collection of the zoos across America, Asia, Australia, Europe and South Africa. Each of these regions have developed their own captive husbandry protocols further strengthening it with the Global Species Management Plan which is involved with the shaping up of the husbandry and veterinary issues for the species welfare in captivity. With an aim to promote captive breeding, an effort has been made to examine how red pandas are kept and managed in captivity. This paper provides information on successful captive management of red panda during the last twenty-six years at Padmaja Naidu Himalayan Zoological Park. The other issues that paper highlights are housing, feeding, social behaviour, breeding and behavioural management of the species in captivity.

Keywords: red panda conservation breeding programme, captive management

Introduction
Ex-situ conservation deals with the planned breeding of the species, where the ultimate goal is to reintroduce the animals in the wild. Threats to the ecosystem continue to increase worldwide for which the conservation of species has become a big concern. Ex-situ conservation plays key role in conservation through education, fundraising and research as well as breeding for the reintroduction into the wild (Hutchins, 1995) [5]. Conservation breeding is not an alternative but can be considered as a complement to in-situ conservation and the protection of the wildlife habitat. Conservation breeding in some cases is the only hope for the species near extinction in the wild (Hakansson, J. 2007) [4].

Red panda is a solitary and nocturnal animal which is adapted to cool and moist environment and is found in Himalayan and Hengduan mountain ranges (Roberts and Gittleman, 1984; Glatston, 1994; Wei *et al*., 1999; Choudhury, 2001; Pradhan, 2001) [9, 3, 10, 2, 7]. The red panda (*Ailurus fulgens fulgens*) is an endangered animal and is priority species of the conservation breeding programme of Central Zoo Authority, Government of India. The animal shares its name with giant panda *Ailuropoda melanoleuca*, despite their popular name the two species are not closely related. The red panda is now placed in a monotypic family Ailuridae (Glatston, 1994) [3]. According to Choudhary, 2001 [2] red panda is found in the Himalayan belt of Nepal, India, Bhutan, Myanmar and Southern China. Populations of the species are confined to isolated mountain ranges ranging in altitude between 1,500 m and 4,800 m (Glatston, 1994; Choudhury, 2001) [3, 2]. Status of the red panda in wild has also been a matter of great discussion and speculation for over a long period (Glatston, 1994) [3]. International Union for the Conservation of Nature and Natural Resources has reassessed the global status of red panda and placed it under the endangered category. In India too, though red panda is included under the Schedule - I of Indian Wildlife (Protection) Act 1972 and very little is known about its status in the wild. It is also listed in Appendix 1 of the Convention on International Trade for Endangered Species of wild fauna and flora (CITES). Anthropogenic activities and associated global climate change are threatening the biodiversity in the Himalayas and have led to the extinction of many species of flora and fauna. Rapid growth and expanding human population which depends on the forest for livestock grazing, timber extraction, food, fodder, fertilizer, fuel-wood are the causes for the erosion of the Himalayan forest and decrease in number of red panda in the region.

Study Area
Padmaja Naidu Himalayan Zoological Park (PNHZP) in Darjeeling, established in year 1958 is dedicated to the conservation of endangered Himalayan fauna. The zoo is situated in a patch of virgin forest at an altitude of 6,874 ft above sea levels. The annual rainfall in this area varies between 100 and 115 inches and the daily temperature range from nearly freezing in the winter to about 20^0C in summer. Winter snowfall can be quite heavy at times (about once every 3-4 years) and frosts are common. The 67 acres of the Birch Hill Forest where the zoo is located are the remnants of the original woodlands of the region. This is the only specialized zoo in the country and is internationally recognized for its conservation breeding program of red panda, snow leopard, Tibetan wolf and other highly endangered animal species of Eastern Himalayan.

Ex-situ conservation breeding of Red Panda
Red panda is a local animal of Darjeeling and it was housed at

the park from the date of inception. Red panda being a charismatic species began to attract the attention of the outside world and the demand for the species started increasing. After the Indian Wildlife (Protection) Act, 1972 it became extremely difficult to acquire the red panda from the wild without proper permission. Once it was clear that no new animal can be acquired from the wild, management techniques of the park were thoroughly reviewed. A Planned Conservation Breeding Project as a part of the Global Captive Breeding Master Plan was initiated in early nineties in the Zoological Park in response to the International Conservation efforts. Conservation breeding programme of the red panda was founded on nine animals; four wild origin animals already living in the zoo in the early 1990s and five zoo-bred animals were acquired from Europe.

Continuous behaviour monitoring and studies of the animals were conducted in captivity. Information related to the species and feeding was collected from local people of the village in the vicinity of the red panda. Inputs were taken from the senior keepers of the zoo and field staffs of the national parks. Diets of the animals were modified with reference to the available literature on the species. Since the beginning, the red panda was given the following feed twice a day: Semolina 75 gms, Sugar 50 gms, eggs 1 pc, Condensed (Skimmed) milk 300 gm (to make 1.5 lts of milk), bamboo 3 kg and water. Later on quantity of sugar was reduced to avoid dental problem and was replaced by honey (Bahuguna & Chakraborty, 1997) [1]. The red panda is an arboreal animal hence the enrichment of the enclosure was done using dry logs and branches in order to provide extra climbing facilities. Safety measures were taken to prevent the escape of the animals, the tree trunks were wrapped with tin sheets and lopping of branches of the trees was done in regular interval. Red panda was allowed to use display arena both in day and night time since the animal is more active during dawn, dusk and night time. Prior to parturition red panda builds nest with twigs, branches and dry leaves. Wooden nesting boxes were provided inside the enclosure. At least 2-3 nest boxes were placed in each enclosure because red panda shifts the cubs like cats. The improvement made in housing the red panda soon brought positive results. First successful planned birth of two red panda was recorded on 20th of June 1994.

Reintroduction of captive –bred Red Panda in Singalila National Park

Padmaja Naidu Himalayan Zoological Park recorded the number of successful conservation breeding of red panda in captivity and in year 2003 Padmaja Naidu Himalayan Zoological Park had 22 red pandas in captivity. Therefore the population was considered well enough to reintroduce captive red panda in the in situ habitat of the animal. Two young female red panda Sweety and Mini were selected for the release in to the wild. Females were chosen for release as it was felt that females would be more likely to contribute to the wild population through mating with the wild male and by giving birth. After selection of the animals acclimatization process began. Captive diets were replaced largely by bamboo and wild seasonal fruits six month prior to the shifting of the animal to the soft release facility. Genetic analysis of the selected individuals were done with the help of Centre for Cellular and Molecular Biology, Hyderabad, India to confirm the taxonomic status of the red pandas and to record their genetic fingerprints. The Singalila National Park, Darjeeling was chosen as the place for the reintroduction as it is the only national park in the vicinity of the zoo which supports a wild population of the red pandas. Selection of the reintroduction was based on the pre-release survey conducted by the Wildlife Wing of the Forest Department, Government of West Bengal, in collaboration with the staff of the PNHZ Park. It was the area with the highest density of the red pandas in the region and is an important factor as it increased the likelihood that the two female would find mates. The National Park had a dense vegetation of *Castanopsis hystrix, Quercus lamellate, Machilus odoritissima, Michelia sp, Rhododendrons sp, Arundinaria maling, Rubus sp, Daphne cannabina* etc., adequate water and wild edibles fruits preferred by the species (Jha, 2011) [6]. A soft release facility was constructed at an altitude of 2626 m with an area of 5 hectres at Gairibans, Singalila National Park, Darjeeling where the two selected female red panda were brought in the middle of the April, 2003. They were housed in a small enclosure ($10m^2$) situated within the soft release facility during the first month and then gradually released into the whole area of the soft release facility. After continuous observation for seven month in the soft release facility, the animals were finally released in the wild on 14th of November 2003. Prior to release in the wild, each female was fitted with a radio collar and the information on their behaviour, breeding and the movement were observed. Mating of "Sweety" with wild male was observed on 12th March 2004. Sweety became pregnant and on 7th July 2004, she gave birth to a single cub in a tree hollow nest. Two more females Neelam and Dolma were selected for reintroduction. These animals were taken to the soft release facility in November 2003 and were released in wild in August 2004 and continuous monitoring was done. The reintroduction of the red panda in the wild is the pioneer work in the field of conservation breeding. This was the first reintroduction programme of captive born red panda in the wild in South East Asia. The restocking of four females and the witness of birth has added to an increase in the population and genetic diversity of the red panda in the Singalila National Park.

Post release of Red Panda at the park

After successful reintroduction of four female red panda in the wild the park continued with the scientific and planned breeding of the species in the captivity. In the in situ facility i.e. Singalila National Park, Darjeeling population estimation, habitat suitability, threat assessment was conducted in the different intervals in order to understand the status of the animal. Population Habitat Viability Assessment of the species was conducted by the park with the help of international stud book keeper Ms Angela Glatston and other scientists from different region. New Conservation Breeding Centre is created at Topkey Dara, Darjeeling, 15 km away from the main park.

At present Padmaja Naidu Himalayan Zoological Park, Darjeeling houses 17 red panda. All the animals are captive born and are genetically healthy. The animals are kept at two Conservation Breeding Centres and in the display facility of

the Park. Facilities available for the management of the red panda in Padmaja Naidu Himalayan Zoological Park, Darjeeling are as follows:-

Enclosures and housing facilities

To meet the physical, social, behavioural and physiological needs of the species careful consideration has been taken during designing and construction of the exhibits for red panda. The exhibits are prepared as the replica of the in situ habitat of the species. Enclosures are designed to accommodate all the behavioural aspects of the species like scent marking, a tendency to maintain personal distance except during breeding season, the affinity to climb and hide from disturbances, natural foraging, feeding activities, breeding associated activities, young rearing behaviours, nest building and sleeping. Sufficient trees are planted inside the display arena to enable the red panda to climb and utilize all areas of the enclosure to rest or find shelter. The enclosures are well furnished and the animals are given enough choices so as to carry out species specific behaviour.

Visual barriers like bamboo, log piles, trees, are provided in the enclosures and more than three nesting boxes are provided to allow hiding and sleeping for the animal within the enclosure. These boxes are constructed of wood, covered by tin sheet from outside and are placed at different shaded and elevated location of the enclosure. The park has circular enclosure with 6-7 feet high RCC wall with an inward bend at the top. The total area of the enclosure is 2925.00 sq. m. The animal house has been provided with one night shelter with wooden breeding box. One keeper's gallery of 3.0 m X 2.10 m is also attached to the night cell for processing/ preparing food for the animal. The enclosed area is with many trees and lots of greenery. Nesting boxes have been placed at different places in the enclosure. Closed circuit televisions (CCTV) are installed in different enclosures of the park in order to record the behaviour of the species.

General Husbandry

Continuous behaviour of individual animal is observed for any changes or problems. If any notable events are observed these are recorded. Daily reports are collected from the field concerning health problems, veterinary procedures, treatments administered growth and development, breeding, feed and feeding patterns and other aspects of husbandry. Proper hygiene is an important aspect of maintaining healthy animals in captivity. Cleaning of the night shelters includes dry cleaning to physically removing waste matter, followed by wet cleaning, involving soaking, washing, rinsing and drying are done continuously. Night shelter and display arena are checked and cleaned periodically. Enclosure cleanliness, provision and routine use of hand washing and foot-dipping facilities to reduce the transmission of infectious agents from one area or enclosure to another are encourage in the park. Zoo keepers are given training in the park as well as they are sent to other esteemed zoos so that they can understand the importance of basic hygiene measures in preventing disease transmission.

Record Keeping

Proper records of the animals are maintained in the park. Maintenance of keeper's diary with information on animal's behaviour, feed, enrichment, health etc are done. Feed charts are maintained regularly about the animal's feed, type of feed, feed timings and feed rejection and consumption (quantity). History sheets of individual animal are maintained with information's on health problems, veterinary procedures, treatments administered growth and development, feeding patterns among many more aspects of animal husbandry. Records are also maintained in Species360 software (formerly International Species Information System). Separate registers are maintained for recording temperature, humidity and amount of water obtained from the dehumidifier kept in the enclosure for keeping the humidity level in check.

Health Requirements

All animals are checked in the morning and are then checked again thoroughly while contained in the off limit area. Regular assessment of their movement, feeding and general behaviour which takes place while they are off display and then another assessment are done once out on display to confirm they are in good health condition. The individual animals which are not in normal condition are observed continuously through CCTV camera because an animal which knows it is being watched will try to appear "normal", as a defence against predators. Loss of body weight is investigated even if the animal appears otherwise normal. Monthly faecal sample examination for worm egg floats test**,** faecal examination includes a direct smear, flotation and sedimentation method, examination of faeces for an adult parasite, parasitic egg or ova are done and deworming schedule is followed every three months and if found positive for worms, deworming is done as per the requirement and the condition of the report. Proper records of systematic faecal examination and of anti helmentic treatments are maintained. Precautions for Canine distempers are at most necessary for captive management in the park and special cares are taken to prevent it. During old age of the species animals are kept in the off display facility with fewer disturbances. In case of the death of the animal Necropsy (Post-mortem examination) are conducted and samples are sent to referral centre like Indian Veterinary Research Institute, Uttar Pardesh, India for confirmatory diagnosis of cause of death so to act as a ready reference for the treatments of the animals in future.

Captive Diet

Proper husbandry skill and applied nutritional sciences are the most important aspects for the management of wild animals in captivity. Proper nutrition plays key role in the successful breeding, disease prevention, growth, development and longevity of the animal in the captivity. The feed of the species in the park includes the following items- one piece of egg, one piece of banana, 200 gm of apple, 20 ml of honey, 200ml of milk, 4 kg of fresh bamboo leaves and 1000ml of water are provided to a single animal every day. The feed items are changed to avoid monotony and at different state of affairs such as during breeding and sickness. Feeds are provided at different times of the day. Feeding enrichments are practiced in the park. The feeds are hung or hidden in the enclosure, cut feed items are replaced by whole feed occasionally and bamboos are placed in feeding platform at

different places of the enclosure. Boiled water is provided to the animal both in the enclosure and off exhibit area. Record of feed and water consumption is maintained in a prepared sheet to know the quantity of intake in various seasons.

Breeding of the species

The breeding pair is chosen based on their pedigree of the animals. The pair is kept in an open enclosure prior to two/three month of mating i.e. in the month of October-November. Nesting boxes are placed in different places and nesting materials are provided in the enclosures. Minimum disturbances are maintained in the vicinity of the animals. Proper husbandry and veterinary care is given to the animal. Mating takes place in the month of December to mid of March. During the instigation of mating both male and female move, eat play and rest in the close proximity. Rate of scent marking increases in both the sexes and male spent maximum time in examining the marking of the females. Mating call is heard and allogrooming are observed during the mating season. Copulation last for 3 to 10 minutes which takes place in the ground. After six weeks of mating female becomes less active and special care is given to the pregnant female. Proper hygiene is maintained in the enclosure. Continuous observations are also aided by Closed Circuit Television. CCTV cameras which are installed inside the cubing box to record the birth event and the events there after are done. Before parturition female is frequently seen carrying nest building materials such as leaves, grasses, and sticks for nest building. Dry leaves, twigs are provided inside the enclosure during the gestation period. After the gestation period is 120 to 150 days which is generally too long for an animal of its size gives birth to one to four with a mode of two cubs. During the first week of parturition mother spent maximum time with the cubs. Not much movement are observed in the cubs and are covered by the mother in the curling position. After twelve to fourteen days of birth cubs opened the eye and movement of the cubs increased gradually. Complete of coloration of the cubs are gained after 60 to 70 days of the birth. Complete coloration of cubs occurs after 60 to 70 days of birth. After 90 days of birth cubs starts eating tender bamboo leaves and fruits along with the mother outside the nesting box.

Conclusion

The study attempted to provide ex situ status of the red panda in Padmaja Naidu Himalayan Zoological Park, Darjeeling. The red panda project being a part of the global conservation breeding species constantly requires various forms of interventions specially in the ex situ management of the species like population structure of the captive population, feeding, behaviour, enrichment and veterinary issues. Such form of study provides immense input towards better and scientific management of the species ensuring successful breeding of the species. All the above works conducted and finding will help towards the better management of the species in captivity exhibiting their wild behaviour free from any form of diseases and a wider implication on the global conservation breeding programme. Further inputs in the conservation breeding program can be obtained through in situ studies where feasible ways can be incorporated for ex situ management of the species and a step ahead in preparing the animal for reintroduction.

Acknowledgement

The authors are grateful to the Central Zoo Authority, Ministry of Environment, Forest and Climate Change, Government of India and West Bengal Zoo Authority for providing financial support to the conduct the research work. We are also thankful to the Zoo officials and zoo keepers for providing continuous support during the study.

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