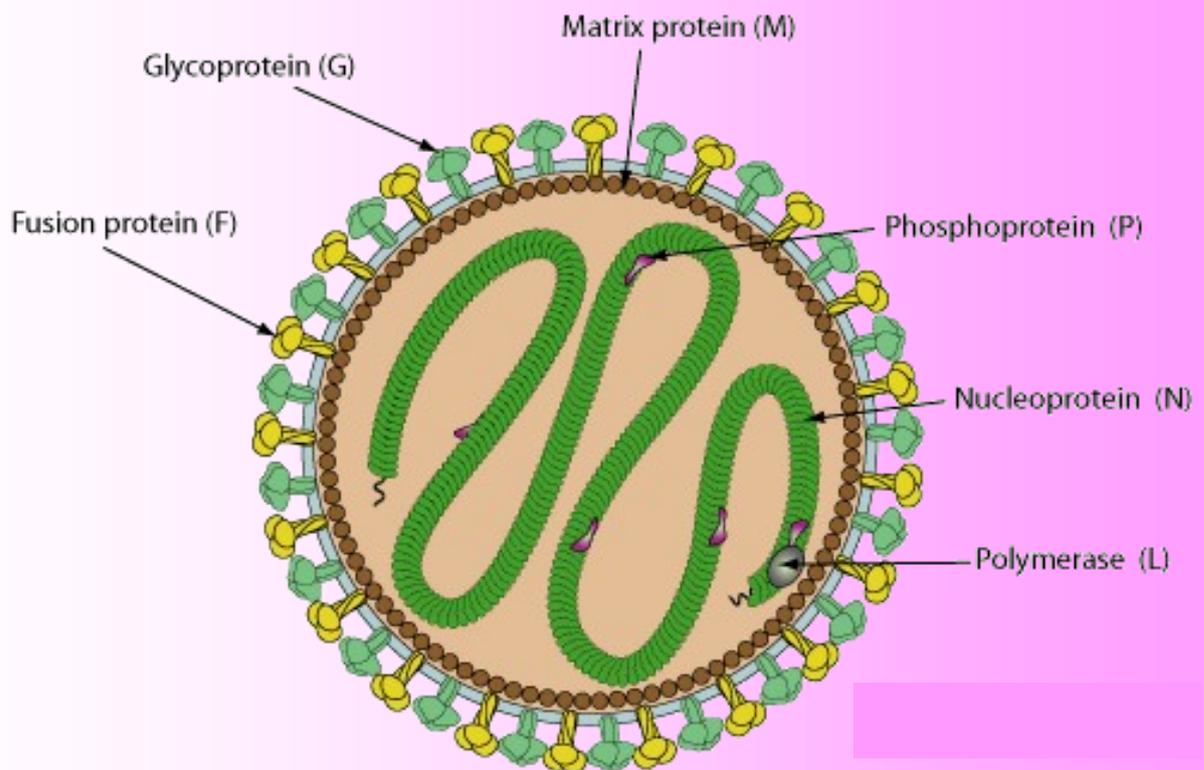




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## Summer Activity and Feeding pattern of Captive Red panda (*Ailurus fulgens fulgens*) at Padmaja Naidu Himalayan Zoological Park, Darjeeling, India

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### Abstract

Red panda (*Ailurus fulgens fulgens*) an endangered species inhabits foothills of eastern Himalayas are less studied and deprived in scientific documentation, costing its conservation efforts to be faint. Behavioural pattern is fundamental to understand species and improve the conservation practices. Activity and feeding pattern of eight captive red pandas housed at two different places *viz.*, display and conservation breeding centre; total of 55% captive population, were studied at Padmaja Naidu Himalayan Zoological Park, Darjeeling, India for three consecutive months of summer acquiring 384 hours of observation. The percent mean activity and feeding behaviour was taken out per hour of observation. Red panda's activity pattern ( $\chi^2 = 48.540$ ,  $p = 0.000$ ) and feeding pattern ( $\chi^2 = 31.716$ ,  $p = 0.000$ ) found to be significant across the day length, they are more active at dusk ( $58.83 \pm 4.330$ ), intermediately active at day time ( $39.69 \pm 2.113$ ) and less active at dawn ( $15.17 \pm 2.367$ ). While feeding have been recorded considerably high at dusk ( $8.73 \pm 1.958$ ) then at day time ( $1.99 \pm 0.328$ ) and dawn ( $1.19 \pm 0.679$ ). The mean feeding found to be insignificant between the two housing places ( $U = 1.692E4$ ,  $p = 0.660$ ) but mean activity found to be significant ( $U = 1.379E4$ ,  $p = 0.001$ ). Overall the captive red panda were highly active at dusk with showing intermediate activity at day time and preferring feeding at dusk. The study helps to understand species closely and provides baseline data for ex-situ red panda conservation programme at the park and rest of the world.

**Keywords:** Red panda, Activity pattern, Captivity, Conservation breeding, Eastern Himalayas, Endangered species,

## Introduction

First panda known to world was red panda (*Ailurus fulgens*) discovered by F. Cuvier 1825. There are two living subspecies of red panda named as *A. f. fulgens* and *A. f. styani* (Wei et al. 1999a; Choudhury 2001). They inhabit whole eastern Himalayan ranges consisting of Nepal, Bhutan, India, China and Myanmar (Roberts & Gittleman 1984; Johnson et al. 1988; Wei et al. 1999a). India typically hosts the *A. f. fulgens* in its northern eastern region; West Bengal, Sikkim, Arunachal Pradesh, Meghalaya (Finn, 1929; Prater, 1948; Gee, 1964; Choudhury, 1996, 1997) Arunachal Pradesh believes to have the largest population of red panda (Choudhury, 2001). The species is inhabits high altitude montane forests (oak mixed; mixed broad-leaf conifer; and conifer) with dense bamboo-thicket understorey (Roberts and Gittleman 1984) with altitude range of 1500-4000m ASL (Catton, 1990 and Prater, 1988). Being an endangered species on IUCN Red List (Choudhury 2001; Hilton-Taylor, 2000), it has given protection under The Indian Wildlife Act, 1972 (schedule I). Due to its shy and arboreal nature this little wonder of nature is least study and deprived in scientific documentation. Habitat destruction and poaching are big threats to its survival pushing the species towards extinction (Glatston, 1994; Choudhury, 2001). Ex-situ conservation efforts are made globally to support the species through captive breeding with

the elite aim of reintroduction (Glatston and Leous, 2005). To make such conservation effort successful detail knowledge of species is necessary. Activity pattern are important criteria to deal with the species conservation (Zhou et al. 2007). Different food types, environmental conditions and human disturbance are known to affect the activity pattern of the species (Amstrup & Beecham 1976; Roth & Huber 1986; Machutchon 2001; Winne & Kech 2004; James et al. 2006) which may lead to adverse health condition of species. Feeding pattern is essential tool to assess and maintain the health of species for successful breeding and hence maintaining healthy stock population. Very much less is known about red panda conservation and its feeding (Wei et al., 1999a; Choudhury 2001; Wei et al., 1999b; Wei et al., 1999c). Few successful efforts are made before to study activity pattern of wild red panda (Hodgson, 1847; Johnson, 1988; Reid, 1991; Zhang et al., 2011), but no study has been reported from the captivity. It is equally important to know the status and activity pattern of captive red panda to accelerate its fading ex-situ conservation efforts. To support the captive breeding programme of endangered species like red panda knowing inside of activity and feeding pattern are must. Here we studies captive red panda population at Padmaja Naidu Himalayan Zoological Park, Darjeeling India with purpose to find out their activity and feeding pattern. The findings will help to main-

tain healthy population of red panda at park and will serve as base line data for its ex-situ conservation efforts.

### Methodology

**Study area:** The Padmaja Naidu Himalayan Zoological Park (PNHZZP) formally known as Himalayan Zoological Park was established on 14<sup>th</sup> August, 1958. The zoological Park is situated at an altitude of 7000 ft (2150 mts) in Jawahar Parbat (Brichill) on northern fringe of Darjeeling town. The zoological park is situated in the lower Himalayas in 27°3'N and 88° 18'E, at the confluence of Ethiopian, Palaeartic, Mediterranean and Indo Malayan Flora and Fauna. Of the total 78.5 acres with the Zoological Park 67.56 acres is presently under zoological park management. During summer the temperature raises up to 25°C whereas lowest recorded temperature during winter is sub zero. The mean annual rainfall fluctuates from 2500mm – 3000mm. The humidity varies from 80% - 90% in general all round the year. The park is composed of natural woods that originally existed in the area which corresponds to Champion's type 11B/CI (Northern Montane/ Eastern Himalayan wet temperate Forest). The park consists of a variety of eastern Himalayan fauna, and is home to some of the endemic and exotic species of the eastern Himalayan. The study area was divided into different sites, first, zoo display and second, conservation breeding centre.

**Study method:** The study involved sampling of eight captive red

**Table 1.1: Details of captive red panda individual studied**

Individual* ID	Age	Sex	Enclosure# code
M1	16	♂	1
M2	2	♂	2
M3	4	♂	2
F1	7	♀	3
F2	5	♀	3
F3	5	♀	4
F4	3	♀	5
F5	2	♀	5

\*All individuals are captive born.

#All enclosures are open type.

pandas (Table 1.1) using focal sampling method (Altmann, 1974), housed at five different enclosures in Padmaja Naidu Himalayan Zoological Park, Darjeeling, West Bengal, India, carried out over a period of three months from May to July 2017. The subject number represents 55% of the captive red panda population housed at the park. Animals that were with major health issues were excluded from the study. The red pandas were housed either singly, or in pair at two different places *viz.*, zoo display (5 individuals) where visitors were allowed to view the animal and Conservation Breeding Centre (3 individuals) where visitors were restricted. The study subjects were observed in enclosure from 06:00 to 18:00 h. Observations of 48 hours per individual were carried out in this study totaling 384 hours of observation.

**Table 1.2: Percent mean behaviour per hour of captive red panda**

Behaviour	Dawn	Day Time	Dusk	$\chi^2$	$p$
Feeding	1.19±0.679	1.99±0.328	8.73±1.958	31.716	0.000
Active	15.17±2.367	39.69±2.113	58.83±4.330	48.540	0.000
Inactive	84.83±2.367	58.75±2.140	38.04±4.209	56.323	0.000

**Data analysis:** We tabulated the observed behaviour data by hours of the day and categorized behaviour as feeding, active and inactive. Mean were computed for activity and feeding behaviours. Data could not be normalized even after transformation hence we used non-parametric tests. Non-parametric test *viz.*, Mann-Whitney Test and Kruskal-Wallis Test were used to check statistical significance of categorical data for two and three categories respectively. Significance level was set to  $p = 0.05$ . Data are represented by mean  $\pm$  Std. Error. All the data analysis is done in SPSS for windows (*version 16.0*) developed by SPSS Inc.

### Results

Activity pattern of captive red panda across the day length was statistically significant ( $\chi^2 = 48.540$ ,  $p = 0.000$ ). On average, red panda were more active at dusk (58.83±4.330), intermediately active at day time (39.69±2.113) and less active at dawn (15.17±2.367) (Table 1.2 & Figure 1.1). Feeding behaviour also was statistically significant ( $\chi^2 = 31.716$ ,  $p = 0.000$ ), considerably high at dusk (8.73±1.958) as compare to day time

**Table 1.3: Percent mean feeding and active behaviour of each study individual per hour**

Individual ID	Feeding	Active
M1	4.93±2.313	39.99±5.704
M2	3.21±1.063	35.53±5.339
M3	1.84±0.698	34.85±3.971
F1	1.64±0.548	26.21±3.829
F2	3.32±1.164	28.19±4.050
F3	2.61±0.970	42.50±5.134
F4	2.59±0.746	42.92±5.053
F5	3.69±1.282	59.17±4.953

**Table 1.4: Percent mean active and feeding behaviour at two different study sites**

Behaviour	Conservation Breeding Centre	Zoo Display	$U$	$p$
Feeding	2.71±0.546	3.14±0.602	1.692E4	0.660
Active	45.65±2.816	34.68±2.198	1.379E4	0.001

**Table 1.5: Percent mean active and feeding behaviour between the sexes**

Behaviour	Male	Female	$U$	$p$
Feeding	3.33±0.880	2.77±0.437	1.654E4	0.362
Active	37.12±2.906	39.80±2.196	1.602E4	0.232

(1.99±0.328) and dawn (1.19±0.679) (Table 1.2 & Figure 1.2). The mean feeding behaviour per hour between two housed condition *viz.*, display and conservation breeding centre were found to be insignificant ( $U = 1.692E4$ ,  $p = 0.660$ ). On the other hand the activity pattern found to be significant between two places ( $U = 1.379E4$ ,  $p = 0.001$ ) i.e. % Mean activity at display (34.68  $\pm$  2.198) and conservation breeding centre (45.65  $\pm$  2.816) (Table 1.4). No significant difference was

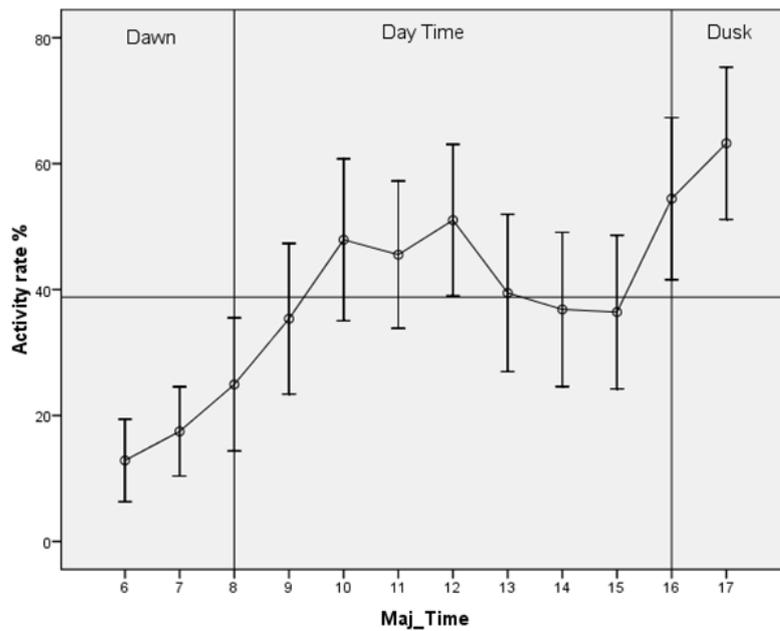


Figure 1.1: Activity rate % for eight red panda (*Ailurus fulgens fulgens*) at PNHZP by hours of the day (data are Means±SE; the horizontal line is the % mean activity rate)

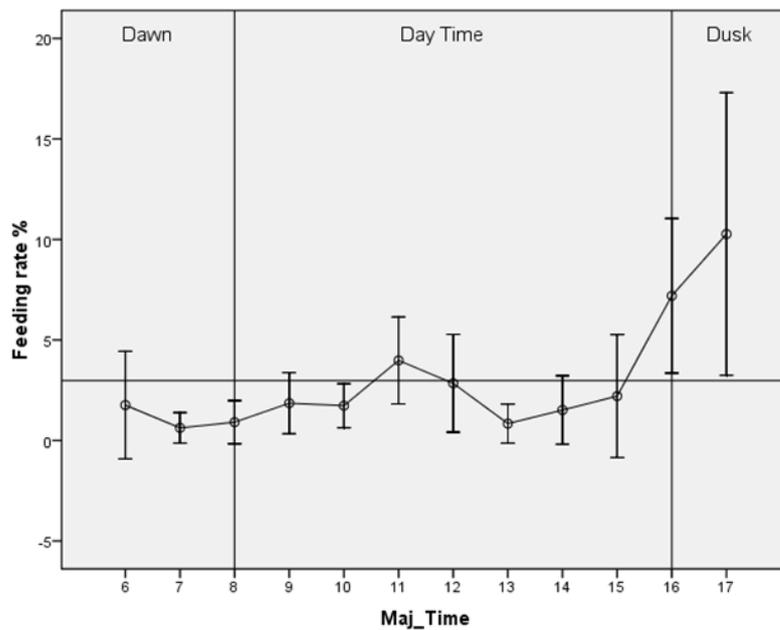


Figure 1.2: Feeding rate % for eight red panda (*Ailurus fulgens fulgens*) at PNHZP by hours of the day (data are Means±SE; the horizontal line is the % mean feeding rate)

found among the study individual in their % mean feeding and activity per hour (Table 1.3). Behaviour between sexes also was insignificant (Table 1.5).

### Discussion

Red panda believe to be noctur-

nal and active mostly at dusk and dawn, the activity pattern varies according to temperature, feeding regimes and presence of young, they exhibit poly-phasic pattern (Hodgson, 1847). Zhang et al. (2011) reported that red panda are more active at day time. Figure 1.1 explains that the red pandas are quite active at dawn and highly active at dusk and intermediately active at day time hence supporting the literature. The activity varies at midday might be due to presence of visitors in high numbers at the park. As red panda in this study found to be highly active at dusk thus feeding pattern (Figure 1.2) are high at dusk too, suggesting that the red panda preferred to forage or feed at dusk or when there is dark. As there is no study on

feeding pattern of red panda further studies are required to comment on feeding pattern of the species. Visitors and temperature are known to affect the wellbeing and behaviour of captive animals (Hosey, 2008; Swaisgood and Shepherdson, 2005; Nimon and Dal-

ziel 1992; Collins and Marples, 2015) with this regard further detail study is needed with respect to visitors on red panda to conclude the activity and feeding pattern. Our future direction is to work on effect of temperature and visitors on activity and feeding pattern of captive red panda.

### Conclusion

Through this study we can conclude that the red panda activity varies through-out the day and they show diurnal activity pattern. Though red panda feeding activity varies across day they mostly preferred to feed at dusk or when it is dark in captivity. This is may be due to visitor's disturbance. Red panda are more active in conservation breeding centre then those in display enclosure, might be due to absence of visitors in conservation breeding centre. Further study across seasons and effect of temperature and visitors are to be needed to strongly conclude the activity and feeding pattern of captive red panda. Never the less this study provides the base line data for the species and will surely help in management practices across the zoos.

### References

Altmann, J. 1974. Observational study of behavior: Sampling methods. *Behav.* XLIX.  
Amstrup, S. C. and Beecham, J. 1976. Activity patterns of radio-collared black bears in Idaho. *Journal of Wildlife Management*, 40: 340-348.  
Choudhury, A. U. 2001. An overview of the status and conservation of the red panda *Ailurus fulgens* in India, with reference to

its global status. *Oryx*, 35, 250-259.  
Choudhury, A. U. 1996. Red panda in Garo hills. *Environ*, 4, 21.  
Choudhury, A. U. 1997. Red panda *Ailurus fulgens* F. Cuvier in the north-east with an important record from Garo hills. *Journal of the Bombay Natural History Society*, 94, 145-147.  
Collins, C. K. and Marples, N. M. 2015. Zoo playgrounds: a source of enrichment or stress for a group of nearby cockatoos? A case study. *Journal of Applied Animal Welfare Science* 18: 375-387.  
Corbet, G. B. and Hill, J. E. 1992. *The Mammals of the Indomalayan Region: A Systematic Review*. Oxford University Press, Oxford.  
Cuvier, F. 1825. *Histoire Naturelle des Mammiferes avec des Figures Originales. Colores, Desinees d'Apris des Animaux Vivants*, 1824-42, vol. 2, pp. 1-3.3 Paris.  
Finn, F. 1929. *Sterndale's Mammalia of India*. Thacker, Spink, Calcutta & Simla.  
Gee, E. P. 1964. *The Wild Life of India*. Collins, London.  
Glatston, A. and Leous, K. 2005. *Global Captive Breeding Master Plan for the Red-panda *Ailurus fulgens fulgens* and *Ailurus fulgens styani**.  
Glatston, A. R. (1994). *Status Survey and Conservation Action Plan for Procyonids and Ailurids: The Red Panda, Olingos, Coatis, Raccoons, and their Relatives*. IUCN, Gland, Switzerland.  
Hilton-Taylor, C. 2000. *2000 IUCN Red List of Threatened Species*. IUCN, Gland, Switzerland and Cambridge, UK.  
Hodgson, B. H. 1847. On the cat-toed sub-plantigrades of the sub-Himalayas. *Journal of the Asiatic Society* 16:1113-1129.  
Hosey, G. 2008. A preliminary model of human-animal relationships in the zoo. *Applied Animal Behaviour Science* 109: 105-127.  
James, E. O., Sian, W. G. and John, D. A. 2006. Effects of food availability on temporal activity patterns and growth of Atlantic salmon. *Journal of Animal Ecology* 75:677-

- 685.
- Johnson, K. G., Schaller, G. B., and Jinchu, H. 1988. Comparative behavior of red and giant pandas in the Wolong Reserve, China. *Journal of Mammalogy*, 69(3), 552-564.
- Machutchon, A. G. 2001. Grizzly bear activity budget and pattern in the Firth River Valley, Yukon. *Ursus* 12:189-198.
- Nimon, A. J. and Dalziel, F. R. 1992. Cross-species interaction and communication: a study method applied to captive siamang (*Hylobates syndactylus*) and long-billed corella (*Cacatua tenuirostris*) contacts with humans. *Applied Animal Behaviour Science* 33: 261-272.
- Prater, S. H. 1948. *The Book of Indian Animals*. Bombay Natural History Society, Bombay
- Reid, D. G., Hu, J. C. and Huang, Y. 1991. Ecology of the red panda *Ailurus fulgens* in the Wolong Reserve, China. *Journal of Zoology*, London 225:347-364.
- Roberts, M. S. and Gittleman, J. L. 1984. *Ailurus fulgens*. *Mammalian Species* 222: 1-8.
- Roth, H. U. and Huber, D. 1986. Diel activity of brown bears in Plitvice Lakes National Park, Yugoslavia. *International Conference of Bear Resource and Manage* 6:177-181.
- Swaigood, R. R. and Shepherdson, D. J. 2005. Scientific approaches to enrichment and stereotypies in zoo animals: what's been done and where should we go next? *Zoo Biology* 24: 499-518.
- Wei, F. W., Feng, Z. J., Wang, Z.W. and Hu, J.C. 1999a. Current distribution, status and conservation of wild red pandas *Ailurus fulgens* in China. *Biological Conservation* 89:285-291.
- Wei, F. W., Feng, Z. J., Wang, Z. W. and Li, M. 1999b. Feeding strategy and resource partitioning between giant and red pandas. *Mammalia* 63:417-430.
- Wei, F. W., Feng, Z. J., Wang, Z. W., Zhou, A. and Hu, J. C. 1999c. Use of the nutrients in bamboo by the red panda (*Ailurus fulgens*). *Journal of Zoology*, London. 248:535-541.
- Wei, F., Feng, Z., Wang, Z. and Hu, J. 1998. Assessment on the current status of the red panda in China. *Small Carnivore Conservation*, 18, 1-4.
- Winne, C. T. and Kech, M. B. 2004. Daily activity patterns of Whiptail Lizards (Squamata: Teiidae: *Aspidoscelis*): A proximate response to environmental conditions or an endogenous rhythm? *Function Ecology* 18:314-321.
- Zhang, Z., Hu, J., Han, Z. and Wei, F. 2011. Activity patterns of wild red pandas in Fengtongzhai Nature Reserve, China, *Italian Journal of Zoology*, 78:3, 398-404, DOI: 10.1080/11250003.2011.563248
- Zhou, Q. H., Wei, F. W., Huang, C. M., Li, M., Ren, B. P. and Luo, B. 2007. Seasonal variation in the activity patterns and time budgets of *Trachypithecus francoisi* in the Nonggang Nature Reserve, China. *International Journal of Primatology* 28: 657-671.

