

# Primate distribution in southern india



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## Primate distribution in southern India

The Western Ghats of India is one of the biological 'hot spots' of the world (Myers *et al.*, 2000). The western slopes and the ridges of these hills are covered with evergreen tropical rainforests. The eastern slopes and the adjoining Deccan plateau harbor mainly deciduous forests. The Western Ghats are divided into two regions: the southern and the northern Western Ghats, south and north of the Palghat Gap respectively. The rainforest regions are particularly rich in arboreal mammals and avifauna. Among the mammals, the most obvious species are primates and squirrels. The distribution of nonhuman primates varies in the two regions of the Western Ghats. Lion-tailed macaques occur from the southern tip of the Western Ghats, up to north of Sharavathy River, where the rainforests of the medium altitude end. Bonnet macaques and Hanuman langurs occur throughout the Ghats. The distribution of Nilgiri langur from the southern tip of the Western Ghats ends in the north at Brahmagiri, the region which also marks the end of *Cullenia* dominated forests (Pascal, 1988).

South of Brahmagiri Hills, all four primate species are found in the forests of the Ghats. Primarily, bonnet macaques and Hanuman langurs are found in the dry deciduous forests of the eastern slopes, whereas lion-tailed macaques and Nilgiri langurs are found in the rainforests at the ridge and the western slopes. Each major forest type, therefore, is inhabited by a macaque which is a frugivorous species, and a langur which is a folivorous species. In certain areas of the southern Western Ghats, the bonnet macaques seasonally intrude into the rainforests and become transiently sympatric with lion-tailed macaques and Nilgiri langurs (Sushma, 2004).

## Habitat specialists and habitat generalists

Species that make use of a wide range of resources or habitats are generalists and they tend to be widely distributed, whereas species that make use of a narrow range of resources or habitats are specialists and they often have a limited distribution (Brown, 1984; Hanski, 1982; Hanski and Gyllenberg, 1997). According to Hanski and Gyllenberg (1997), the biogeographic distribution patterns of specialists are the result of their using relatively smaller habitats than those exploited by generalist's species.

Generalists and specialists use different cues to locate their habitat and necessary resources. The ecological niche occupied by a species results from trade-offs in the fitness gained in different habitats or on different resources, and the level of specialization of an organism should reflect these trade-offs (Bonsall et al. 2004). Generalists have an advantage in exploiting a wider range of resources, whereas specialists are assumed to be more efficient at using a particular resource (Strickler 1979).

To survive and reproduce organisms must extract energy from substances present in the environment. However, not all organisms extract the same energy from the same sub-stances. Different organisms may specialize in the type of food they eat. The internal food-processing mechanism of an organism (gut, colon, metabolism, etc.) tends to become adapted to the particular diet in such a way that the quantity of energy the organism is able to extract from each food type is determined evolutionarily.

Langurs

Langurs could be considered a model for the study of social organization since they inhabit variety of ecological conditions (Sterck, 1999; Karanth et al, 2010; Karanth, 2010). They are known to exploit diverse habitats from thick forests to human dominated landscapes (Fooden, 1980; Prater, 1993; Kumara et al, 2009; Sharma et al, 2009). Even though certain traits such as male dispersal (Rajpurohit, 1987; Rajpurohit and Mohnot, 1988; Sommer and Rajpurohit, 1989; Rajpurohit and Sommer, 1993; Launhardt et al, 2001; Borries et al, 2004; Sharma et al 2009;), female philopatry (Sterck, 1997; Sterck, 1998; Koenig, 2000; Koenig et al 2004; Sterck, 2005), infant transfer (Poirier, 1968; McKenna, 1979; Scollay, 1980; Stanford, 1992; Kumar, 2005; Brent, 2008) etc. are common to all langur species, striking habitat related differences are observed in their group composition and social organization (Sterck, 1998; Koenig et al, 1998; Sterck, 1999; Harris, 2006; Snaith & Chapman, 2007; Wich & Sterck, 2007). Hence studies on inter-specific differences in behavioral ecology of langurs can provide insight into some of the crucial questions of social systems and individual behavior patterns of these species.

#### Hanuman langurs / Nilgiri langurs

South Asia is home to 15 species of langurs (Walker & Molur, 2007). Nilgiri langurs are usually found in tropical evergreen forests of the Western Ghats at an altitude of 500 meter above sea level (Sunderraj, 2001; Sunderraj & Johnsingh, 2001) whereas the Hanuman langurs are distributed all over the Indian subcontinent-including several species/subspecies such as *S. e. achates*, *S. e. hypoleucos/S. hypoleucos*, *S. e. priam/S. priam priam* (Kumara et al, 2009; Sharma et al, 2009; Karanth et al, 2010; Karanth, 2010). Nilgiri

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langurs are known to be largely habitat specialists (Singh et al 1997; Sunderraj, 1998) and Hanuman langurs are habitat generalists (Kumara et al, 2009; Sharma et al; 2009). Because of a restricted range of occurrence, it is expected that the Nilgiri langurs show less genetic variability and thus less flexibility than the Hanuman langurs. Nilgiri langurs are mainly arboreal (Poirier, 1968; Sunderraj, 2001) whereas Hanuman langurs tend to be more terrestrial (Roonwal & Mohnot, 1977). Hanuman langurs are more adaptable influenced by availability and distribution of food (Chhangani & Mohnot, 2006). Home ranges of Hanuman langurs are larger and they overlap extensively (Chalise, 1995; Chhangani, 2000; Chhangani & Mohnot, 2006). Nilgiri langurs are more territorial and occupy smaller home ranges (Poirier, 1968; Sushma, 2004). In Hanuman langurs, the groups can be one male bisexual, multimale bisexual or all male band groups (Borries, 1997; Koenig et al, 1997; Sharma et al, 2009) and Nilgiri langurs are primarily one male bisexual groups (Poirier, 1968; Sunderraj, 2001).

Behavioural studies on Hanuman langurs have been intensively carried out at various locations in India, Nepal and Sri Lanka (Mohnot and Srivastava, 1992; Rajpurohit et al. 1994). However, in India, these studies have been conducted mainly in arid environment (Rajpurohit et al. 1994) and in dry/moist deciduous forests (Vasudev, 2006). Hanuman langurs are successful in their ability to adapt to a wide variety of habitats showing high social flexibility making them the ideal species for studies. However, very little has been known about the rainforest Hanuman langurs except for one study on feeding ecology (Singh et al, 2011; Roy et al. 2012). It will be of interest to explore the social adaptations in the rainforest Hanuman langurs

and to see how their behavior have evolved in comparison to arid environment.

Studies on Nilgiri langurs suggest that the social structure and relationships and their behavioural patterns resemble that of Hanuman langurs (Poirier, 1968; Tanaka, 1965). Changes in ecological factors like habitat destruction and fragmentation, langur habitats may have been reduced leading to changes in group composition and social system (Sunderraj and Johnshingh, 2001). The present study will be conducted to better understand both langur species' behavioural patterns and social systems to explore and carry out comparative analysis on differences in their present environmental conditions. The aim of the present study is to employ same methodology to study the behavioral ecology of Nilgiri langurs and Hanuman langurs and attempt a quantitative comparative analysis. Hence, the study has been designed with the following title.

Looking for behavioral flexibility

#### TRAITS TO BE STUDIED

Life history traits

On the base of the above mentioned differences between the two species. The life history of hanuman langur is expected to be more of r-type and Nilgiri langur to be more of K-type. Being primarily the dwellers of rainforests, Nilgiri langurs are expected to be more efficiency oriented whereas Hanuman langurs, being habitat generalists, are expected to be more reproductive efficiency oriented. This may result in differences in birth

dynamics such as net reproductive rates, duration of infant dependency on the mother and infant development patterns. It is also suggested that different habitats and group dynamics may have an influence on reproductive (Rajpurohit et al, 1994) or competitive efficiency.

### Social system

Large interspecific variation in group size is seen in Hanuman langurs (Sterck, 1998; Sterck, 1999; Sharma et al, 2009) whereas Nilgiri langurs tend to cluster around the mean (Joseph & Ramachandran, 2001; Sunderraj, 2001). Female between group aggressions and infanticide (Rajpurohit et al, 2003; Rajpurohit & Chhangani, 2003; Sharma et al, 2009) has been recorded only in Hanuman langur (Sterck, 1998) and not in any other langur species (Van schaik1992). Although the moving range of Nilgiri langur and Hanuman langur are found to be similar (0. 1km and 0. 15km respectively), Nilgiri langurs are said to travel less due to availability and abundance of food resources in their habitat (Tanaka, 1965).

The Nilgiri langur has a unimale social system which is formed when juvenile males in a group mature to adulthood and then the group fissions into smaller unimale groups. In Hanuman langurs, group composition is formed according to the availability and distribution of food and space. There are three types of groups in Hauman Langurs, which are unimale, multimale and all male groups. A linear hierarchy exists amongst the females in Nilgiri langur where as in Hanuman langurs dominance hierarchy among females is less definitive than among males. Dominance hierarchies in Hanuman

langurs were found to be significantly linear and relatively stable, but less so with increasing group size (Koenig, 2000).

### Individual behaviour

Compared to *Macaca*, langurs show less frequent individual behavior differences (Tanaka, 1965). Although Nilgiri langur and Hanuman langur are relatively similar in their group size, composition and organization and also in behavioural patterns, intra- and inter- group activities are seen less in Nilgiri langurs when compared to Hanuman langurs. Behaviors like grooming, mounting and presenting, juvenile plays, etc were observed to be less frequent among Nilgiri langurs. Sugiyama (1965) observed that langurs travel widely when the food availability was sparse. In Nilgiri langurs, the habitat is usually forage abundant and good quality resulting in lesser travel. In Hanuman langurs the range size differs on the availability and quality of food in their distributional habitat/zone. As a result, more varied vocal communication is expected in Hanuman langurs than Nilgiri langurs.

### STUDY GROUPS

One group each of Hanuman Langur and Nilgiri langur has been selected.

Hanuman langur – Many intensive studies have been carried out on the populations of Hanuman langurs in arid, deciduous and semi-evergreen habitats. Since there is a lack of systematic and long-term study on rainforest Hanuman langurs, the present study will be carried out in rainforests of the Western Ghats at Gerusoppa, Uttara Kannada district. A



unimale group (total 17) with 8 females, 5 juveniles/subadults and 3 infants has been selected.

Nilgiri langur- For comparative analysis, a study group in Nelliampathy, Kerala (Western Ghats) has been selected. A unimale group (total 14) with 8 females, 3 juveniles and 2 infants has been selected.

## STUDY AREA

The study area is low altitude degraded coastal evergreen rainforest in the Western Ghats of north Karnataka in Uttara Kannada district (Gerusoppa). Forest is mainly *Dipterocarpus-Holigarna-Persia* species with an average altitude of 650 m with an average annual precipitation of 4200mm with relatively high humidity of 95%. Ecologically this stretch of forest is important because, this is the northern most distribution of lion tailed macaque ( *Macaca silenus* ) which is sympatric with bonnet macaque ( *Macaca radiata* ) and western hanuman langur ( *Semnopithecus entellus aches*) (Kumara and Singh, 2004).

Nelliampathy is a Hill Station on the Western Ghats mountain ranges in Palakkad, Kerala. The green lush forest covers the whole hill area with coffee, tea, cardamom, vegetable and orange plantations. Nelliampathy plateau lies at an altitude of 500-1000m. Major vegetation is evergreen, semi evergreen and moist deciduous. The forest mainly comprises of *Cullenia*, *Mesua* and *Palaquim* (Ramachandran and Joseph 2000). Three species of primates namely Bonnet Macaque, Lion tailed Macaque and Nilgiri langur are found in this habitat.

## Study Parameteres

1. To study the general activity pattern of the study species
  - a. What are the different types of activity they do?
  - b. What is the duration of different observed activities of each species?
2. To study the different social behaviour within a single group of each species
  - a. Which are the socio-positive behaviour (like play, groom, inter- individual distances etc.) within a single group?
  - b. Which are socio-negative behaviour (aggression, fight, bark etc.) within a single group?
  - c. What kind of reproductive behaviour are shown in the adult individuals of a single group?
3. To study the inter-group interaction of each study species
  - a. What is frequency of inter-group interaction with the neighbouring group of each study species?
  - b. What kind of inter-group interaction they show with their neighbouring group?
4. To study the demography and social structures of the study species
  - a. What is the group size of each study species?

b. What is the age-sex ratio of the respective groups?

## OBSERVATIONAL METHODS

Three methods have been adopted in this study for data collection they are:

### 1. *Ad libitum sampling*

The data is in the form of notes for events as and when they occur. We simply note down whatever is visible and seems relevant at that time. The events include identity of the individual and direction of agonistic encounter like threat, attack, dominance mount, subordinate present and displacement among individuals of a group. It is useful during preliminary observation or for recording rare but important facts.

### 2. *Focal animal sampling*

One individual was the focus of observations during a particular sample period of 5 minutes-Usually for several different categories of behaviour. What is recorded here is the behaviour of those individuals that are most easily observed. The choice of the focal individual is determined prior to the observation. During this period the time spent by the individual on different activities is recorded. It is also important to record certain aspects of other individual's behaviour such as interaction with others and to whom a behaviour is directed. When the focal individual moves completely out of sight the recording would be stopped until it is visible again.

### 3. *Scan Sampling*

Instantaneous sampling or scan sampling was used here to study the different activity pattern of the individual animals. The methods involved

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collecting data on all visible individuals of the group. This was done for a period of 5min in which each individual was observed and data was collected through a pre-formatted data sheet. Data on distance between the individuals (any two particular individuals, one is nearest and other is distant one at an instant of time) was collected through scan sampling.

- During a scan, the data was gathered on: Date; Time; Individual (with identity); Activity (including Resting, Ranging, Foraging; Feeding on insects, Feeding on plant (specify the plant part being used), Social behavior; Substratum used (while feeding on insects); Place (tree or ground); Height of the tree; Height at individual was seen; Plant species (when the individual fed on plant food).
- Definition of Activities: Resting - Passivity lasting at least 5 seconds; Ranging - Travel and movement; Feeding - Ingestion of plant or animal food; Foraging - Searching for food; Social behavior - Any interaction between/among conspecific individuals.

### Study Period

The study on Nilgiri langurs was carried out in Nelliampathy reserve forest, nenmara forest division in Palakkad district of kerala. We observed the group of Nilgiri langurs from December 2010 to April 2011 and from April 2012 to January 2013 as a part of a large study on the behavior of primates in the Western Ghats. The amount of time spent on focal animal sampling was 235 h and 915 scans were collected.

The study on *S. hypoleucos* was carried out in Gerusoppa forest division in the state of Karnataka. We observed the group of *S. hypoleucos* from January

2011 to April 2012 as part of the same study. The amount of time spent on focal animal sampling was 270 h and 1070 scans.