Ecology and Conservation of Nilgiri Langur (*Trachypithecus johnii*)

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Abstract

Nilgiri langurs are endemic to the rainforests of the Western Ghats of South India. A detailed study of the Nilgiri langur was carried out on an isolated population in a low elevation riparian habitat at the Mundanthurai plateau (KMTR) between 1984–88. The present communication highlights their population, demographic parameters and the feeding ecology and compares these with other studies on this species carried out at higher elevations. Threats to this population, largely due to habitat destruction and increasing human populations in the area, are also discussed. Suggestions on the restoration of habitat and the need for greater protection and awareness among the local people, are stressed.

Introduction

Nilgiri langur (*Trachypithecus johnii* Fischer 1829), the black leaf monkey, is endemic to the rainforests of the Western Ghats of Tamil Nadu and Kerala, and to the hills of Coorg in Karnataka. It is one of the 18 species of Asian leaf monkeys belonging to the family; Cercopithecidae and sub-family Colobinae. Its closest relative is one of the 4 subspecies of the Purple-faced leaf monkey, which is *Trachypithecus vetulus vetulus* (Hill 1934) found in the southern part of Ceylon. The Nilgiri langur (NL) is truly arboreal in nature and usually found in tropical evergreen forests at elevations > 500 m. However, in the Tirunelveli Hills of Tamil Nadu, it is even found even in the foothills (McCann, 1933), where the riverine forest is contiguous with the forests of the upper reaches. NLs are seen in the low elevation riverine habitats of the Mundanthurai Plateau (M-plateau), at an elevation of 180 m in the Kalakad–Mundanthurai Tiger Reserve (KMTR) in Tamil Nadu mainly along the perennial Tambiraparani and Servalar rivers, which were earlier contiguous with the evergreen habitat of the higher elevations. The continuity of the habitat was broken by the construction of two reservoirs across these rivers and has lead to the isolation of nearly 200 Nilgiri langurs from the population of the upper reaches.

The NL is vulnerable both at the national (ZSI, 1994) and global (IUCN, 2000) levels. These langurs are threatened due to severe pressure from poaching for supposedly medicinal

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properties of its meat and habitat destruction for timber and firewood extraction. These threats are common for both the upper and foothill populations and still continue to pose a problem both within and outside Protected Areas (Hohmann & Sunderraj, 1990; Sunderraj & Johnsingh, 2001). Even though many studies have been carried out on NLs, most of them are status surveys (Daniel & Kannan, 1967; Krishnan 1972; Kurup 1975; Oates 1978), morphometry (Leigh, 1926) and seasonality in breeding (Tanaka, 1965). There have been only 3 studies on the ecology and behaviour of this primate, and all 3 were carried out at elevations > 1000 m (Poirier, 1970; Horwich, 1972; Oates *et al.,* 1980). There has been only a single, long-term study on the ecology of the isolated population of NLs in the foothills of the M-plateau, KMTR between 1984 and 1988. Most of the ecological information presented in this article is largely from this study (Sunderraj, 1998).

Morphology

The body of the NL is glossy black with thick and long hair. The head is covered by yellowish-brown or golden hair, and the rump and base of the tail are grizzled. The females have a white patch on the inside of the thighs, which is distinct even in a week-old female infant. Newborn infants have pale pink skin covered with reddish-brown hair. The infants attain the colour of the adults at around 3 months of age. The head and body of an adult male measure about 75 cm and of an adult female 58 cm. Nilgiri langurs have a fairly long tail and the length varies from 68.5–96.5 cm. The average male weighs ca. 9.1 kg, while that of the females varies from 10.9–11.3 kg. (Leigh, 1926; Poirier, 1970, 1971). Newborn young weigh about 0.5 kg (Sankhala & Desai, 1969).

Distribution

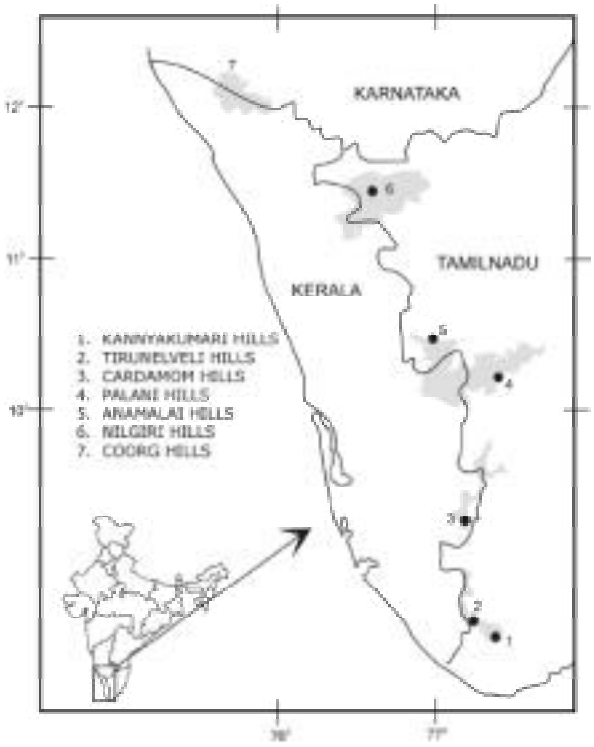
The distribution of the NL is from the Kanyakumari hills in the southern tip of the Indian Peninsula to the Coorg Hills in Karnataka, which form the northern limits of its range. The major areas with langur populations are the Ashambu Hills (which include Kanyakumari and Tirunelveli Hills) Periyar Tiger Reserve, Cardamom, Palani, Anamalai, Nilgiri and Coorg Hills (Figure 1). The distribution is restricted to 8˚–12˚ N and 76˚–77˚ 30' E (Oates, 1979). The present population estimate for its entire distributional range is not available and the status information that is available is restricted to a particular range (Hohmann & Sunderraj, 1990; Ramachandran & Joseph, 2001). Survey of NLs and Lion-tailed macaques in selected areas of Tamil Nadu showed that the langur population corresponds well with the status of protection of the respective areas surveyed (Hohmann & Sunderraj, 1990). Even though evidence of poaching was reported within the Protected Areas, the presence of a high population density suggests that this practice was not a serious threat. Since poaching and habitat destruction still continue within and outside the Protected Areas, the information on the status (a decade old) cannot be overlooked. Details of the population densities estimated for 4 areas are given in Table 1.

Population and Demography

Group size

On the M-plateau, NLs live in small populations, with a mean of 18.5 groups, the group size varying from 5 to 24 with a mean group size of 10 animals/group. However, there was a difference in the range of group sizes when compared to Webb-People (1947) 20–30, Krishnan (1972) 4–12, and Ramachandran & Joseph (2001) 1–14 individuals, The group

Fig. 1. Distribution of Nilgiri langur population



size of the foothills population (M-plateau) was close to the group sizes (3–25 and mean size of 8–9) reported by Poirier (1970). Surveys conducted during the late 80s (1987–1989) in the higher elevations (> 500 m) of the Agastyamalai, Srivilliputtur, Anamalai and Avalanche (Nilgiri, south division) areas also reported a similar range in group size (4–24), with a smaller mean group size of 7.6 individuals (Hohmann & Sunderraj, 1990). Thus, it is evident that NLs live in smaller groups without much variation in group sizes along their distributional range.

Social organization

NL groups are organized into one or uni-male (only one adult male with more of other age and sex classes), multi-male, all-male and all-female groups. On the M-plateau langur groups varied from the multi-male characteristic exhibited by other primate species, with only one adult male in each group. The same social patterns have also been reported in the higher elevations by Poirier (1970) and Hohmann & Sunderraj (1990). However, multi-male and all-female groups are not common in NLs. At the sub-adult stage, when males start fighting for access to females, they are displaced by dominant males and forced to migrate (Dittus,

Table 1. Estimates of *Trachypithecus johnii* population densities in the selected areas of Tamil Nadu (Hohmann & Sunderraj, 1990)

	Areas Surveyed			
	KMTR	**Srivilliputtur**	**Ulandhi (Anamalais)**	**Avalanche (Nilgiri South)**
No. of Groups/km (trail survey)	.39	.76	.08	.15
Mean Group Size	4.36	7.24	5.40	8.00
All Male/Mixed Group Ratio	1:10	1:14	0*	1:9
No. of Groups/km (acoustic survey)				
Population Density–Groups/km^2	1.98	2.15	.52	.29
Extension of Potential Habitat	650	600	150	800
Estimated Population				
No. of Groups	1.290	1288	79	232
No. of Individuals	5,625	9,325	426	1,856

* all mixed groups.

1979). In almost all primate species most emigrants are adult or sub-adult males (Altmann & Altmann, 1979). As only all-male groups were seen on the M-plateau, male emigration rather than female emigration (Ali *et al.,* 1985) may possibly be a characteristic feature of their life-history strategy.

Age and sex ratio

There was no clear pattern in the age and sex composition of the NL populations between the foothill and higher elevation forests. The age–sex composition determined during this study revealed a female-biased sex ratio, with 100 adult females to 40 adult males. A similar proportion was also reported by Ramachandran & Joseph (2001), with 100 females:50 males from the Silent Valley National Park at elevations ranging from 658–2,383 m. This is rather a highly skewed sex ratio when compared with Poirier's (1970) study (100 females:83 males). On the other hand, the adult (Adults and sub-adults) to immature (infants and juveniles) ratio showed a considerably bias towards the adults (100 adults:34 immatures) at higher elevations (Poirier, 1970) compared to that reported from the low elevations/foothills of the M-plateau (100:57).

Birth season

The seasonality of birth in NLs (8 groups observed from 1985 to 1988) showed 2 distinct peaks. The primary peak was in May when 17 brown infants were recorded. The second peak occurred in November with the birth of 11 more infants. These 28 infants formed 45% of the total 63 infants born during the 3 years. Nevertheless, some brown infants were recorded round the year, except during February and August. This seasonality could be related to the seasonality of food availability in the M-plateau. The months of May and November were characterized by fresh leaf sprouts and growth following the southwest and northeast monsoons, and the peak in births coincides with this. Even in rainforests, NLs showed prominent peaks during the same months (Poirier, 1970). Birth seasons of the various populations of the NLs along its distributional range show a general similarity. Observation of birth peak in 2 subspecies of the Purple-faced leaf monkey (*Presbytis senex*), a close relative of the NL was also influenced by the food availability (Rudran, 1973).

Birth, death and population growth rate

A total of 63 infants were born in the 8 groups monitored between 1985 and 1988, with a gross average birth rate of 0.56 infants/female/year. Across the group, the birth rate varied from a low of 0.25 to a high of 0.83 infants/female/year. However, birth rates did not differ significantly between years. Birth rates in the M-plateau population seemed to be low when compared to the population living at higher elevations (0.70; Poirier, 1970). The mean death rate estimated from 10 groups showed the rate of 0.34 animal/year (excluding poaching of 10 animals) and varied significantly between years. When the incidents of poaching were also included (a major threat and one that is most detrimental, directly influencing the population growth), the death rate increased to 0.47 animals/year.

Low birth rate coupled with biotic disturbances, influenced the death rate considerably, resulting in a very low population growth rate in the foothill population. However, the monitoring of 10 groups from 1985 to 88 showed an overall growth rate of 0.07, the groups living in highly disturbed areas showing a decreasing trend.

Feeding

Feeding activity

The annual activity budget of NLs, showed that 43.65% of time was spent on feeding (N = 27,958). Monthly feeding varied from a maximum of 48.61% to a minimum of 37.88%, while no significant difference was observed in feeding across seasons. Diurnal distribution of feeding activity over the year showed clear bi-modal peaks. NLs spent more time on feeding during morning (48.96%) and evening (55.77%) than midday. This can be explained by the fact that the NLs needed to compensate for the long hours of non-feeding during the night to gain the necessary energy levels. A similar pattern was observed in *Presbytis geei* (Wangchuk, 1995; Gupta & Chivers, 2000) and in *T. melalophas* (Curtins, 1980).

Food plants

The NL has the tendency to exploit the maximum resources available within its home range for its food. A total of 102 plant species were identified as food plants used by the 2 groups (24 months observation), with ca. 72% of these plant species available within their home ranges. It is further true, from the higher elevation study that, within 9 months a total of 115 plant species were documented as food plants (Oates *et al.,* 1980). The number of food plants used by NLs varied in the different studies: 39 by Horwich (1972), 52 by Poirier (1969) and 29 by Srivastava *et al.,* (1996). Feeding on diverse food plants by NLs clearly indicates its high adaptability to the given habitat. It has been reported that NLs easily accept new diets when their home ranges change (Poirier, 1968; 1969). In the riverine habitat, the major food resource of NLs comes from trees (74%, 76 species), with few climbers (17%, 17 species) and shrubs (9%, 9 species). NLs on the M-plateau can be judged as generalist–floivore. On the whole, they spent little over half of their time (55.65%) feeding on the top 10 species. A comparison with other Colobines (*P. senex*-Rudran, 1970; *P. entellus and P. senex*-Hladik, 1977; *C. badius*-Marsh, 1981a and *P. phayrei*-Gupta & Kumar, 1994) showed that, the former spent more time feeding on comparatively less number of species, while the rainforest study showed that langurs are more selective in their diet (Oates *et al*., 1980). Comparison of 15 top food species showed that 13 species were common between the years and 9 species between groups. Therefore these 9 species—*Derris pinnata, Terminalia bellerica, Syzygium cumini, Tamarindus indica, Albizia lebbeck, A. amara, Dalbergia paniculata, Acacia pennata* and *Commiphora caudate*—can be considered as key species for the survival of NLs in the riverine forest of the low elevations.

Among these species *Derris pinnata, Terminalia bellerica* were the staple food resources and they were the top 2 species between the years and groups. On the whole they constituted 22.18% of the total feeding records.

Food items

NLs utilized 219 food items from 102 plant species and the major dietic composition consisted of young leaves (44.06%), mature leaves (4.21%), flowers (8.44%), young fruit (10.51%), ripe fruit (4.59%), seeds (18.61%) and other minor food items (9.57%). These minor food items include petioles, bark, pith, insects (mainly termites), soil gum and dead wood. A study of monthly feeding on different food items revealed that the young leaves dominated the diet in most of the months sampled (29 months out of 36 months). Being Colobines, NLs preferred young leaves to

mature leaves, since young leaves usually contain more proteins and less fibre (Diugall & Drysdale, 1964; Struhsaker, 1975; Hladik, 1977; Baranga, 1982). An earlier study on the leaf chemistry of the NL's diet (Oates *et al.*, 1980) showed the preference for mature leaves over young leaves. This difference is mainly due to variation in plant species diversity between the habitats. It has been stated that, where diversity is higher, a large number of species may produce acceptable mature leaves, permitting greater use of those most common items in the forest (Marsh, 1981b).

The second dominant food item in the diet of NLs is seeds. However it was highest only in 4 months, ranking second for 19 months out of 36 months of observations. It has been reported that both *P. rubicunda* and *P. melalohos* (Davis *et al.,* 1988) selected seeds that were highly digestible, while, *C. satanas* (McKey *et al*., 1981) showed a preference for seeds with high N and CDIG level and low fibre (ADF). This could be the reason that seeds dominate the diet of NLs, next to young leaves. The combination of young leaves and seeds with other food items like young fruit, ripe fruit, flower buds and flowers, in the diet of NLs, was to get a balanced and easily digestible diet with high nutritional value. It is a common strategy among Colobines to meet their nutritional requirements by selecting specific diets (McKey, 1978; McKey *et al*., 1981; Struhsaker, 1975; Oates *et al.,* 1980).

Conservation Problems

Habitat Destruction at Higher Elevations

Though NLs use different types of habitats like tropical evergreen forests, moist mixed-deciduous forests, plantations and riverine habitats in the lower elevations, the major ecological niche of the species are the evergreen forests at higher elevations. Since the majority of these NLs populations share their habitat with the Lion-tailed macaques (LTM), the problems identified in terms of habitat fragmentation, timber logging and isolation of populations spelled out for the LTM (in this issue) are fully applicable to the NL populations in the evergreen forests.

Earlier, the cardamom plantations in the rainforests of Tirunelveli Hills had a high proportion of the native species to protect the soil and provide shade for the crops. These plantations also supported good populations of NLs and LTMs. Due to increasing demand for fuel wood, these native tree species have been replaced by fast-growing, and often exotic, species which are no match for native species (Hohmann & Sunderraj, 1990). In addition, illegal timber poaching in the rainforests is common in these areas. This is also a concern in other parts of the distributional range of these species (see LTM article, in this issue).

The NL faces severe pressure from poaching (Mukherjee & Saha, 1974; Daniel & Kannan, 1967; Poirier, 1971; Kurup, 1975; Green & Minkowski, 1977; Krishnan, 1987) because of the belief that certain parts of its body have medicinal value. The langur's flesh and glands are used as food and for preparing a medicine, which is locally known as *Karum Kurangu Rasayanam* used mainly for *Asthuma* (respiratory problem). Some tribes drink fresh and hot blood, which is believed to have rejuvenating powers. Within Wildlife Sanctuaries and National Parks, especially in remote areas some local tribes still use traditional trapping methods for capturing langurs (Hohmann & Sunderraj, 1990).

Habitat Destruction at the Foothills

The NL populations in the buffer areas of Sanctuaries and National Parks, especially in the foothills, are facing anthropogenic problems from the villagers who depend on forest resources to meet their fuel wood demands. Studies on the impact of tree cutting for firewood on the NL foothill population revealed that the tree species preferred by the woodcutters formed the major food resource of NLs. Further, it has been found that, the groups living in highly disturbed areas had a smaller group size, low birth rate and high death rate (Sunderraj & Johnsingh, 2001).

Poaching by local tribes is a problem not only for the NL groups living in the upper reaches of the rainforests, but is also a major threat to the populations outside Protected Areas, particularly in the foothills. The local villagers living near Protected Areas are involved in poaching of NLs. For example, on M-plateau there were two incidences of poaching of 15 animals by the local villagers (personal observation). A survey carried out by our research team in the present Srivilliputtur Grizzled Giant Squirrel Sanctuary, located on the eastern slopes of the South Cardamom Hills, bordering Periyar Tiger Reserve of Kerala, recorded evidence of poaching, fuel wood and timber collection, causing severe damage to the entire region, an ideal habitat for NLs and LTMs.

Lack of Status Information

Even though this species fall under the conservation status of threatened category, there is no recent information available on its population estimates with most status information being outdated and restricted to particular regions. Therefore, its current population status and distribution information throughout its range is very crucial for the complete understanding of its conservation problem.

Management

Restoration and habitat improvement

- Most of the leasing contracts of cardamom plantations in the interior of Mundanthurai (KMTR) have expired, while some plantations have been abandoned. As these areas are now free from human habitations, restoration of these plantations with native species should be taken up seriously, thereby giving a new lease of life to the NL populations.
- Massive restoration programmes should start in both the government and private-owned cardamom plantations, which are still under lease and where major populations of NLs exist.
- It should be mandatory on the part of both government and private authorities to restore forest areas that are degraded.
- It is necessary to identify fragmented habitats of NLs and create corridors between these fragmented habitat populations to reduce the problems associated with isolated populations, and to improve the habitat quality. Restoration of plantation forests and riverine habitats of foothills, which are under severe anthropogenic pressure from the villages can help the foothill populations of NLs.

Protection

- Strict protection is needed to prevent further extraction of fuel wood by the plantation people and illegal cutting of timber by outsiders.
- Even though NL populations in the higher

elevations show a higher birth rate, in the absence of proper demographic information it is very difficult to predict the existing status. Therefore, the prevailing poaching pressure in the remote areas of the upper reaches should be eliminated.

- Hunting of NLs in the foothills following severe wood cutting pressure could lead to the total elimination of the species from that area. It has been speculated that the Srivilliputtur Reserve Forest once supported good populations of NLs and LTMs. Presently, there are very few NLs and no records of LTMs, largely due to the increasing anthropogenic pressure in these areas.
- Regular patrolling of the buffer areas by the special protection force can reduce the poaching problems.
- Local villagers and tribes can be part of the special protection force and they should be provided incentives or monetary benefits.

Awareness

Intensive awareness programmes among the local villagers to emphasize the conservation significance of this species should be taken up at the earliest.

Population monitoring

- Identification of major NL populations in the entire distributional range (including outside Protected Areas) and their monitoring once every 2 years, by the concerned state forest department is very essential.
- NLs should be included in the list of other endangered species like the Tiger and Elephant, for periodical population census.
- Monitoring and creation of population database would help in the understanding of the population growth in the long run.

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