

## STATUS AND DISTRIBUTION OF NILGIRI TAHR *HEMITRAGUS HYLOCRIUS* IN KERALA PART OF THE WESTERN GHATS

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*plus web supplement of 2 pages*

### ABSTRACT

A survey of the threatened and endemic Nilgiri Tahr was conducted in the Western Ghats in Kerala to identify locations of distribution and to assess its status in 2001. This study reveals that the population of tahr in Kerala is highly fragmented. A total of 998 animals were estimated in 11 populations. The largest population of 696 individuals was in Eravikulam National Park. The habitat in Varayattu Mala in Neyyar is extensive and rich in food species, though the number sighted was low. The Kochu Pamba area in the fringes of the Periyar Tiger Reserve is a promising location in terms of vastness and lack of disturbance. The areas in Nelliampathi Hills are rich in terms of food abundance and extent of grasslands. However, human disturbance poses a major threat to these populations.

### KEYWORDS

Distribution, Eravikulam National Park, Hemitragus hylocrius, Kerala, Nilgiri Tahr, status, Western Ghats

The Nilgiri Tahr *Hemitragus hylocrius* Ogilby, 1838 is restricted to the hills of southern India, at an altitude range of 1100-2695m (Images 1-4<sup>w</sup>). The Nilgiri Tahr has a short grey-brown or dark coat. Facial markings are particularly distinct in mature males and consist of a dark brown muzzle separated from a dark cheek by a white stripe running down from the base of horns. It is listed in Schedule I of the Indian Wildlife (Protection) Act 1972 and categorized as Endangered by the IUCN (IUCN, 2006). Uncontrolled hunting and conversion of habitat to plantations and other human related pressure have resulted in the decline of the population (Schaller, 1977; Davidar, 1978). Its habitat has been reduced to less than one-tenth of the total range of the species in the past (Schaller, 1977).

Information on the habits and biology of the Nilgiri Tahr is mostly confined to hunting accounts and description of encounters with the animals. Systematic observation has been limited to Schaller's study in 1971. Rice (1984) was the first to make an extensive study on the ecology and behaviour of Nilgiri Tahr. Several papers on the biology and management of Nilgiri Tahr in captivity have also been published (Pillai, 1963; Potti, 1966; Chandran, 1980; Wilson, 1980; Swengel & Pichner, 1987). Rice (1988) and Murugan (1997) discussed the population dynamics and habitat requirements of Nilgiri Tahr in Eravikulam and the Nilgiris in Tamil Nadu, respectively. Rice (1986) and Easa (1995) discussed the prey-predator relations in Eravikulam with particular stress on tahr. Sumitran (1993) studied the ecology of the tahr in the Nilgiris, and Mishra and Johnsingh (1994) compared the habitat and population in Anamalai and Parambikulam wildlife sanctuaries. Alembath (2002) discussed

management options for the species. Madhusudan (1995) and Madhusudan and Johnsingh (1998) reported sexual segregation and habitat choice, respectively.

Fragmented populations of the tahr in its range have been reported earlier by Davidar (1978). There have also been observations and reports of such populations from other parts (Fletcher, 1911; Davidar, 1976, 1978; Daniel, 1987). Schaller (1971), Daniel (1971), Davidar (1963, 1971, 1975, 1976, 1978) and GREENS (2000) have given the locations and the size of tahr populations. Anonymous (1993), Easa and Jayaraman (1998), and Easa *et al.* (2002) reported the numbers in Eravikulam National Park. Easa and Sivaram (2002) reported the status as a part of developing a habitat suitability index for the species. The Management Plan for Eravikulam National Park gives the details of the population in the Park (Anonymous, 2002). However, there have been no recent efforts to identify and assess the status of the tahr populations in the entire state. The present survey was undertaken to locate and assess the status of fragmented populations of tahr in Kerala and to identify threats.

### METHODS

The published literature was referred for information on locations of hitherto reported populations and personnel involved in tahr conservation were consulted to get more recent information on distribution and status in such areas. These areas were thoroughly searched during April-May and August-October, 2001 for the presence of the animal. The details collected include herd size and the age-sex classification suggested by Rice (1984) as given below

Young (0-1 years)	Light brown coat
Yearling (1-2 years)	Grey brown coat
Adult Female (2+ years)	Grey brown coat, Shoulder height above 70cm
Light brown male (2-4 years)	Grey brown coat Horns thick facial markings distinct
Dark brown male (5 years)	Grey brown coat- dark brown Larger than Adult female
Saddle back male (6+ years)	Dark brown, Shoulder height 110cm Saddle on the back, white knee patch

The indirect evidences were also recorded. The latitude and longitude of the locations, altitude, extent of the area and number of cliffs were recorded. A qualitative assessment of the food species in the area, based on the observations of Rice

<sup>w</sup> see Images in the web supplement at [www.zoosprint.org](http://www.zoosprint.org)

(1984) in Eravikulam, was also made. Information on the adjacent areas and sources of disturbances was documented.

Bounded count technique proposed by Regier and Robson (1966) was followed to estimate the population in Eravikulam. In this technique, repeated independent efforts are made to census the population. In any census, the observers are not likely to detect all the individuals in the area. The construction of an estimate of population size is based solely on the numbers observed in repeated incomplete counts. Twelve blocks based on the home range, as suggested by Rice (1984), were taken as the basic unit for population estimation. The blocks were repeatedly covered on foot for a fixed period recording the animals sighted for five days in April and October 2000 and in December 2001 in Eravikulam National Park.

The unknown population size N was estimated by

$$\hat{N} = X_{(m)} + [X_{(m)} - X_{(m-1)}],$$

where  $X_{(1)} \leq X_{(2)} \dots \leq X_{(m-1)} \leq X_{(m)}$  represent the numbers observed in consecutive days, arranged in increasing order.

The lower and upper confidence limits of N are

$$N_L = X_{(m)}$$

$$N_U = X_{(m)} + [X_{(m)} - X_{(m-1)}] [1 - \alpha / \alpha']$$

Where  $X_{(m)}$  and  $X_{(m-1)}$  are the largest and second largest counts obtained respectively,  $\alpha'$  is the type-I error. In this study,  $\alpha'$  is fixed as 20 per cent. Useful descriptions of this technique are found in Seber (1973) and Routledge (1982).

The Park boundary and the block boundary were visited and the latitude and longitude of various locations were recorded using a GPS receiver. A digital map of Eravikulam National Park was prepared using GPS data with the help of MapInfo Professional and topo sheets. The area of each block was calculated and the figures obtained were used to estimate density in each block.

**RESULTS**

**STATUS AND DISTRIBUTION**

The locations of tahr sightings during the present survey are plotted in Figure 1. The details of animals sighted in different locations with populations are given in Table 1.

**New Amarambalam - Anginda**

Anginda (76°28'E & 11°20'N) is above Silent Valley National Park and New Amarambalam Reserve Forests is in Nilambur South Division. The tahr population in these areas is contiguous with the adjacent tahr habitat of Mukurthi National Park and do not face any major threats.

**Siruvani-Muthikulam Hills**

The Siruvani hills are contiguous with Attappady. This range is to the south of Nilgiri hills and north of Palghat gap (10°55'N

**Table 1. Group composition of Nilgiri Tahr in various locations other than Eravikulam**

Location (District)	AM	AF	SAM	SAF	Y1	Total*
Elival mala (Palakkad)	2	5	1	3	-	11
Parambikulam (Palakkad)	2	7	2	4	2	17
Nelliampathi hills (Palakkad)	4	14	6	8	5	38
Chinnar (Idukki)	-	3	-	-	-	3
Meesappuli Mala (Idukki)	-	-	-	-	-	64
Gundumala (Idukki)	-	-	-	-	-	60
Mangaladevi (Idukki)	-	6	2	4	-	12
Kochupampa (Idukki)	4	7	2	5	4	22
Varayattu Mala (Thiruvananthapuram)	6	-	-	-	-	58
Ponmudi hills (Thiruvananthapuram)	-	-	-	-	-	18
<b>Total</b>						<b>303</b>

\* Total need not tally across rows because of the unknown age group composition; AM - Adult Male; AF - Adult Female; SAM - Sub Adult Male; SAF - Sub Adult Female; Y1 - Yearling

& 76°45'E ). It is one of the smallest hill ranges in the Western Ghats. The peaks - Vellingirimala, Kunjaramala, Peria Kunjaramala, Ayyappanmudi and Elivalmala rise sharply from the basin reaching heights between 1500 and 2100m. Smaller grass-covered hills are found in this area.

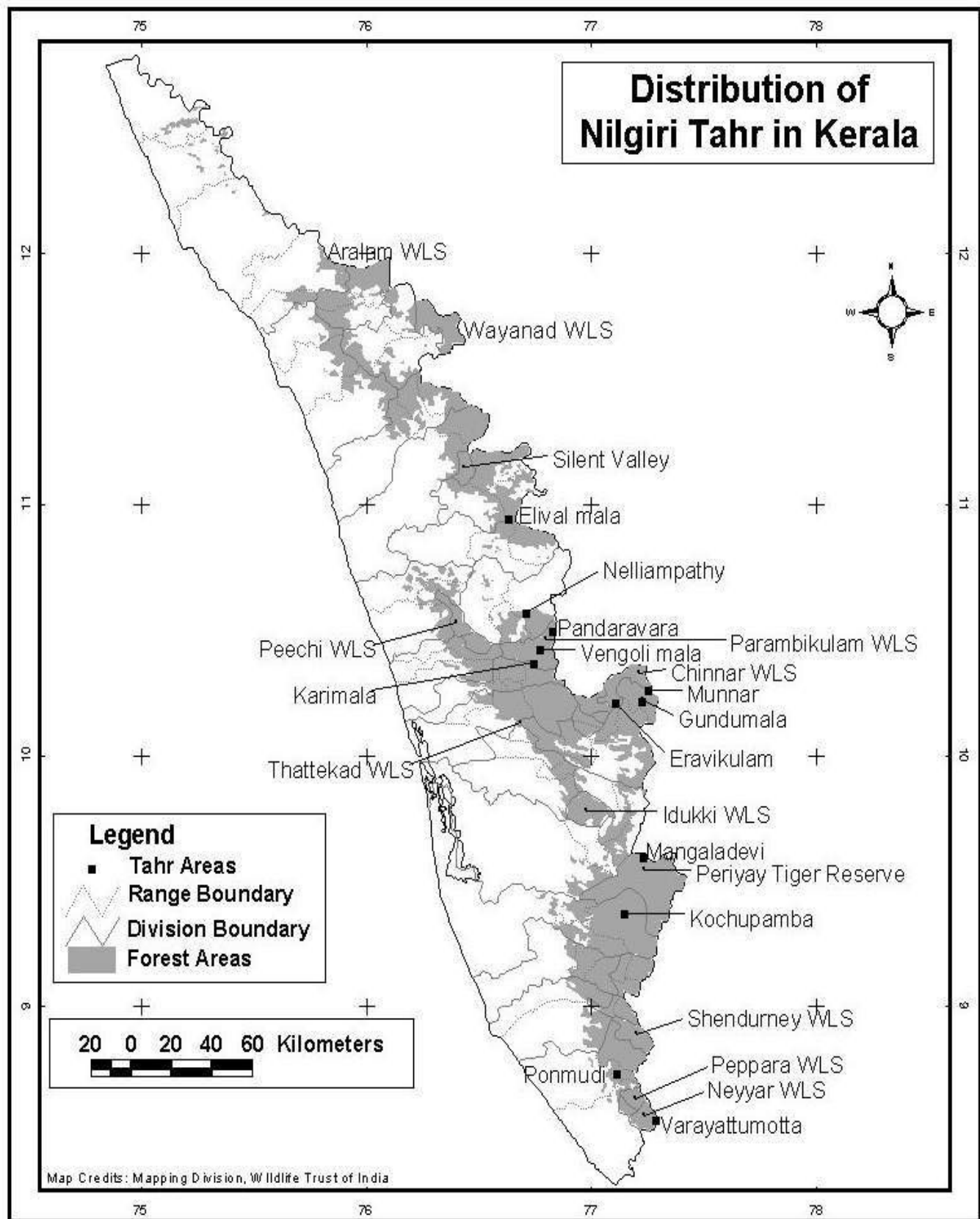
Elivalmala lies to the north and west of the Palghat gap and south of Muthikulam (between 10°56.206' & 10°56.103'N and between 76°38.267' & 76°38.05'E). The extent of the grassland in Elivalmala area is about 10ha and is bordered by evergreen forests on the northeast and south and rocky cliffs on the western side. Eleven animals were seen during the visit. One was a lone saddleback, about 6yr old. A group was sighted very near to the cliff and had six adult females, two sub adult males and two sub adult females. They moved away in two groups comprising of six and four. The forest officials of the Singappara Forest station had observed a herd of 30 in December 2000. The abundance of tahr pellets clearly indicated use of this area by more than one herd.

Another tahr habitat is Kuncharmala, which borders Kerala-Tamil Nadu in the southern end of the Siruvani dam. It is contiguous with the Ayyappanmudi and is about 1km<sup>2</sup> in extent. The middle land grassland extends to over 2ha area. A major part of the area is steep cliffs. Stunted evergreen forests border the top portion of the hill. No animal was sighted during the present visit, but fresh droppings indicate that the animals are using this area. The grasslands in the area are quite good.

Degradation factors: The Elival area is under heavy pressure due to various factors. The adjacent human habitation is a threat to the population. The tribes depend on the shola forests nearby for non-wood forest produce resources. The population is also subject to poaching, as per information from the tribes.

**Parambikulam Wildlife Sanctuary**

The forests in Parambikulam, well known for its rich wildlife, were worked heavily during the last century. The sanctuary area ranges in altitude from 459 to 1439m. The tahr were seen in Pandaravara, Shettivara Hills and Karimalagopuram.



**Pandaravara:** Pandaravara (between 10°29.4' & 10°29.566'N and between 76°49.417' & 76°49.520'E) is a prominent ridge running north to south. The ridge is in three sections, Pandaravara in the middle, which is the highest point (1300m), Naduva and Kattadi mala on either side. The inter-state boundary cuts through the centre of the peak, leaving a third of the peak in Tamil Nadu. The grassland and cliffs occupy about 6 to 8km<sup>2</sup>. The presence of date palm (*Phoenix humilis*) indicates low altitude grasslands.

Two adult females and two yearlings were observed on the north side of the Pandaravara resting on a rocky cliff. There was sufficient indirect evidence to prove that this area was intensively used by tahr in the past. Davidar (1978) conducted a survey and observed 22 tahr in Pandaravara and adjacent areas. This area is utilized by Gaur and Nilgiri Tahr.

Degradation factors: The extent of grassland is on the decrease and is highly eroded with frequent fires. The food species were also found to be very low in abundance.

**Shettivara hills:** The portion of Vengoli hills in Kerala, known as Shettivara hills, faces the forest settlements in Thunakadavu across the lake. The hill ranges lie between 10°25.330' & 10°25.378'N and between 76°46.384' & 76°48.035'E with the highest altitude of 903m. During our visit to this area, we observed only one saddle back in the lower base of the hill at about 600m altitude. The abundance of pellets indicates a small group of tahr in the area. Davidar (1978) surveyed the entire stretch up to Tamil Nadu and estimated a population of 20-25 animals. The animals are said to move occasionally to the Valparai area and is believed to be contiguous.

Degradation factors: The area has changed drastically in the recent past. The food species are almost lacking and the area is already covered with shrubs.

**Karimalagopuram:** Karimalagopuram consists of two peaks, the Karimala (1445m) and Kalyanathy mala (1418m) on the southern part of Parambikulam Wildlife Sanctuary. Karimalagopuram is an ideal habitat for Nilgiri Tahr with sheer cliffs on one side and undulating grasslands extending to 3-4km<sup>2</sup>. The area lies between 10°21.534' & 10°22.3'N and between 76°45' & 76°44.35'E. Nine animals were seen during the visit in the Kalyanathy mala, five adult females and four sub adults. No tahr were seen in Karimala. However, the presence of pellets indicates that this area is highly utilized by tahr. Davidar (1978) reported about 120 tahr in this area. The food species *Themeda tremula*, *Arundinella mesophylla* and *Heteropogon contortus* are abundant in this area.

Degradation factors: Lemon grass, *Cymbopogon flexuosus* covers almost all parts. Though the three food species are abundant, observations indicate very low population of tahr.

**Kuchi Mudi:** Kuchi mudi is located in the northern part of Parambikulam Wildlife Sanctuary (76°50'E & 10°50'N). The area is dominated by dry deciduous forest intermixed with bamboo

thickets. The hills rise abruptly in the north to an altitude of 1290m. Thick undergrowth of *Cymbopogon flexuosus* and hill date palm is dominant in this area. During the present study, no animals were seen but indirect evidences indicate that more than two tahr use this area. Mishra and Johnsingh (1994) reported seven animals in this area. The area is contiguous with Nelliampathi hills. The labourers in the nearby estate reported sightings of 15 animals during forest fire in the grasslands.

Degradation factors: The estate nearby is a source of disturbance due to human pressure and the area is subjected to fire every year as a result of human activity. The population moves to other areas in Nelliampathi and hence escapes from much of the anthropogenic pressures.

**Nelliampathi Hills:** Two surveys were conducted in Nelliampathi Reserve Forests of Nemmara Forest Division. A total 38 animals were sighted in Kurisumala-Hilltop (37) and Mampara (1). The workers of the estates nearby reported sightings of about 80 animals at Kurisumala-Hilltop area. The sighting of five yearlings in the herd during the present survey also indicates recruitment to the population. Though the actual tahr habitat is not very large, there could be at least 2km<sup>2</sup> of area utilized by the species.

Degradation factors: The grasslands at Hilltop are extensive with cliffs and abundant food species, but the area is highly disturbed due to various human activities, which lead to fires in the summer. Poaching is also reported from the area. Cattle grazing is the major degradation factor.

#### **Chinnar**

Three animals were sighted in Chinnar Wildlife Sanctuary (between 10°15' & 10°22'N and between 77°05' & 77°17'E) during the present survey. The tahr habitat is a small hill called Jamba Mala (Kasi Mala) near Mangappara settlement. The grassland is approximately 2km<sup>2</sup>. James Zacharias (pers. comm.) sighted 18 animals in this area in 1988.

Degradation factors: Food species are in low abundance probably due to frequent fire.

#### **Eravikulam National Park**

The estimated population and the density of Nilgiri Tahr in Eravikulam National Park are presented in Table 2. The estimated population of tahr in the area during the three seasons varied and the difference could be attributed to the change in weather affecting direct sightings of animals. It was not possible to draw conclusions on age-sex distribution, as nearly 50 per cent of the population was unidentified.

The block-wise density of Nilgiri Tahr for three seasons are shown in Tables 3, 4 and 5 and Fig. 2. In December 2001, the Umayamala block was clubbed with the Anamudi block. The density estimates show that Umayamala, Anamudi and Rajamala blocks had consistently more number of tahr during the census

**Table 2. Estimated population and density (individuals/km<sup>2</sup>) in Eravikulam**

	April 2000		October 2000		December 2001	
<b>Number</b>	<b>696</b>		<b>559</b>		<b>444</b>	
	LCL	UCL	LCL	UCL	LCL	UCL
	626	906	487	847	431	503
<b>Density</b>	<b>6.27</b>		<b>5.03</b>		<b>4.0</b>	
	LCL	UCL	LCL	UCL	LCL	UCL
	5.63	8.16	4.38	7.63	3.88	4.53

LCL - Lower Confidence Limit; UCL - Upper Confidence Limit

**Table 3. Density (individuals/km<sup>2</sup>) of Nilgiri Tahr in Eravikulam during April 2000**

Block	Estimate	(LCL - UCL)
Anamudi	12.9	(10.3 – 20.9)
Rajamala	26.8	(24.4 – 34.2)
Umayamala	34.3	(19.3 – 79.5)
Poolamala	9.0	(8.7 – 9.6)
Varayattumudi	17.7	(13.1 – 31.6)
Karikombu	9.1	(7.9 – 13.0)
Samban Kolukkan	2.3	(1.4 – 5.1)
Erumapetty	9.6	(9.5 – 10.0)
Kattumala	6.0	(3.7 – 13.0)
Perumal mala	3.1	(2.1 – 6.3)
Kumarickal	4.1	(3.9 – 4.6)
Poovar	2.4	(1.6 – 4.9)

**Table 4. Density (individuals/km<sup>2</sup>) in Eravikulam during October 2000**

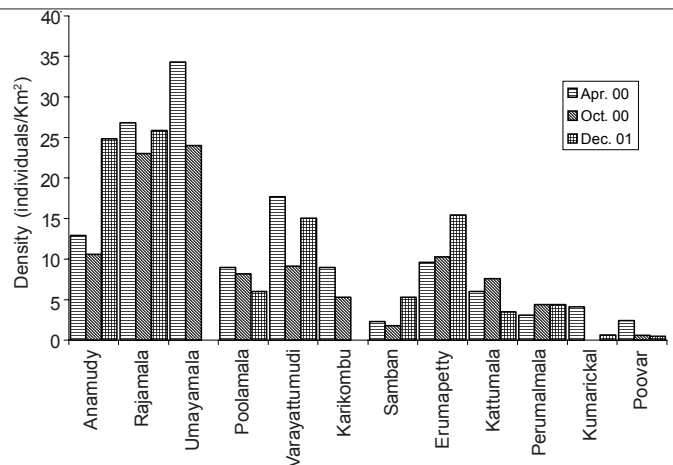
Block	Estimate	(LCL - UCL)
Anamudi	10.6	(9.7 – 13.1)
Rajamala	23.0	(19.5 – 33.5)
Umayamala	24.0	(16.7 – 46.0)
Poolamala	8.2	(7.6 – 10.0)
Varayattumudi	9.1	(6.8 – 15.9)
Karikombu	5.3	(3.3 – 11.1)
Samban Kolukkan	1.8	(1.3 – 3.2)
Erumapetty	10.3	(9.0 – 14.0)
Kattumala	7.6	(4.9 – 15.9)
Perumal mala	4.4	(2.2 – 4.7)
Kumarickal	-	-
Poovar	0.6	(0.3 – 1.4)

**Table 5. Density (individuals/km<sup>2</sup>) in Eravikulam during December 2001**

Block	Estimate	(LCL - UCL)
Anamudi	24.82	18.61 – 39.89
Rajamala and Umayamala	25.86	13.93 – 30.17
Poolamala	6.00	04.00 – 16.16
Varayattumudi	15.06	12.15 – 26.70
Karikombu	5.30	-
Samban Kolukkan	-	-
Erumapetty	15.44	11.66 – 43.43
Kattumala	3.48	3.2 – 4.2
Perumal mala	4.4	-
Kumarickal	0.7	0.41 – 1.6
Poovar	0.5	0.27 – 1.2

\* Rajamala and Umayamala blocks clubbed in 2001

<sup>w</sup> See Image 5 of Eravikulam National Park with all the blocks demarcated on the web at [www.zoosprint.org](http://www.zoosprint.org)



**Figure 2. Block-wise density of tahr in different seasons in Eravikulam National Park**

periods (Image 5<sup>w</sup>). The lowest number was observed in Kolukkan, Samban and Poovar areas.

**Meesappuli Mala**

The area in Silent Valley plateau in Munnar is one of the ideal habitats of tahr in terms of food species, extent of area and lack of disturbance (77°05'E & 10°23'N). The count in the area confirms at least 64 animals.

Degradation factors: There are actually no factors observed as degrading the habitat. However, there have been serious doubts on the safety of animals from the southern part from human disturbances.

**Gundumala**

The area is near the Tertian plateau in Munnar with a population of about 60 tahr (77°03'E and 10°21'N). Food is abundant and the area is extensive with not much human pressure.

**Mangala Devi in Periyar Tiger Reserve**

The Periyar Tiger Reserve ranges in altitude from 900 m to 2019 m above sea level. The Mangala Devi lies between 9°36'4.2" and 9°36'N and between 77°13'13.1" and 77°12'52.2"E. The area is 1337m and is contiguous with Tamil Nadu, where the animals spend most of their time. The total extent of the area would be about 1km<sup>2</sup>. The area is accessible from Karadikavala forest station. Low altitude grasslands with rocky patches is the major vegetation type. Twelve animals were seen going down to the lower dry deciduous forest in the Tamil Nadu side.

Degradation factors: The area has abundant food species but is frequented with fire.

**Kochupamba**

This area falls under the Goodrickal Reserved Forests of Ranni Forest Division. The tahr habitat is a fragmented area about 10km long and 1km wide. The area lies between 9°22.450' & 9°22.250'N and between 77°08.406' & 77°08.443'E. The altitude ranges between 1180 and 1200m. Twenty-two animals were

sighted during the visit. This included four saddlebacks seen on the southern extremity of the area. The number of cliffs is more on the western side of the ridge. There was reliable count of about 42 by James Zacharias (pers. comm.) in 2000. However, recent observations by others confirm the present survey result of 22. Though the extent of cliffs is small, about 3km<sup>2</sup> of area is being utilized by tahr.

**Degradation factors:** The area is good in terms of extent, abundance of food species and the number of cliffs. It is not much disturbed except for cattle grazing in some portions and fire in the summer.

#### **Ponmudi Hills**

Ponmudi hills lie between 8°43.509' & 8°43.951'N and between 77°6.127' & 77°6.057'E and is a continuation of the Agasthyamala region. The major vegetation types are evergreen, semievergreen, moist and dry deciduous forests. The valleys are interspersed with evergreen forests. Grasslands are found on the top of the hills dominated by date palm. The highest peak is the Ponmudi peak with an altitude of 1080m. There are private plantations of tea and rubber in the outer areas of this mountainous region. Tahrs were seen on two peaks, Sarkar Motta and Ponmudi. Eighteen tahrs were seen during the present survey. The animals could not be classified as they were sighted from a distance. GREENS (2000), a voluntary organization, sighted two groups of tahr consisting of 13 and 18 individuals with five yearlings in 2000.

**Degradation factors:** The area, though rich in food species is highly disturbed due to human interference from the adjoining plantations. It is also subject to frequent fires.

#### **Varayattu Mala**

The Varayattu Mala is located on the top of Neyyar Wildlife Sanctuary with the crestline height of the ghats not exceeding 1500m (77°08'E & 08°54'N). This forest is a known type locality for a large number of plant species with extremely restricted distribution. Two visits were made to document the tahr habitat in the region. Extensive grasslands are spread along the rim of the valley starting from Kodayar reserve forest to Agasthyar peak. Fifty-eight animals were observed in the area. Only six could be classified. The grasslands are dominated by *Imperata* sp., date palm and *Themeda* sp. This area is adjacent to Kalakkad-Mundanthurai Tiger Reserve of Tamil Nadu.

**Degradation factors:** The area is rich in food species and has extensive cliffs. Human pressure, mostly from Tamil Nadu has been reported. Poaching has also been reported to be a problem, especially from Tamil Nadu.

#### **DISCUSSION**

Minimising the extinction rate of threatened species is a major challenge in conservation biology. Risk of extinction is reported to be greater for populations with a few individuals than those having many (Pimm *et al.*, 1988). It has also been argued that very large reserves are required to maintain viably large populations of target species with large habitat requirements

(Soule *et al.*, 1979; Shaffer, 1981; Shaffer & Samson, 1985). Boecklen and Gotelli (1984) suggested that a shift in the attention from area alone to more specific autecological factors may be more successful to conserve threatened species. Nilgiri Tahr, one of the threatened endemics is in highly fragmented habitats and the total of 998 was in 11 populations with the largest population of 696 in Eravikulam National Park. Eravikulam, with a large extent of suitable habitats could be considered as the best bet to maintain a large viable population for long term conservation. The total number in the population does not seem to fluctuate much. This population which has additional access to habitats in the Indira Gandhi Wildlife Sanctuary obviously has the most potential for conservation efforts. The area in Varayattu Mala and Ponmudi in southern part is extensive and rich in food species. The number of animals sighted in these areas is also considerably large. These areas are part of a larger landscape with almost undisturbed habitats including those of the Kalakkad-Mundanthurai Tiger Reserve in Tamil Nadu. Kochu Pamba area in the fringes of Periyar Tiger Reserve is a promising location in terms of vastness and lack of disturbance, though the number sighted was low. Gundumala with a higher number of animals is however, almost an island with no possibility of connectivity to the adjoining populations. Meesappuli is more promising because of the possibility of maintaining connectivity with the habitat in Palni Hill areas. The areas in Nelliampathi Hills are rich in terms of food abundance and extent of grasslands. However, human disturbance poses a major threat to the population. These habitat patches could be considered as parts of larger landscapes. In landscapes with highly fragmented habitat, the spatial arrangement of habitat patches is very important. Moreover, the effect of patch size and isolation depend not only on the proportion of original habitats in the landscapes, but also on the suitability of the surrounding habitats (Andren, 1994). Tahr, being a species capable of dispersal between islands, given the opportunity, could be capable of reversing the impacts of isolation in one refuge by dispersal and movement from a nearby source. The reduction in the number of animals in Kuchimudi, Shettivara and Karimalagopuram in Parambikulam Wildlife Sanctuary since Davidar (1978) is evident from the numbers and observations.

The population estimation in different seasons shows that there is a seasonal variation in the density of tahr in Eravikulam. Density was found to increase with an increase in altitude. The extent of cliffs has an important role in the distribution of tahr. The relationship between density and extent of cliffs indicates that the density increases with the increase in the extent of cliffs. Among the food species, availability of *Chrysopogon zeylanicus* and *Eulalia phaeothrix* has a positive relation with the density. Considering these findings, the areas that could contribute to the maintenance of a viable population include the Varayattu Mala and Ponmudi areas in Neyyar, Kochu Pamba, Meesappuli Mala and the Nelliampathi Hills, other than the Eravikulam National Park and the New Amarambalam-Anginda populations. There is a dearth of required data for designing conservation reserves and formulating strategies to meet the ecological requirements of the species in these areas. It would

be valuable to consider the available information on the species and its requirements while planning programmes. These plans should incorporate the habitat and resource requirements of the species and ensure space for movement and dispersal to maintain a viable population.

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## ACKNOWLEDGEMENT

The authors are grateful to Kerala Forest Department for funding this work. The forest officials in all the areas extended assistance and provided information. The Wildlife Warden and the staff of Eravikulam National Park were extremely co-operative and provided logistic support throughout. The Director, Kerala Forest Research Institute was encouraging. We have benefited from the discussions with a number of people especially Mr. James Zacharias and Mr. Mohan Alembath, the former Wildlife Wardens of Munnar Wildlife Division.

