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Kumara and Sasi

2014

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Introduction:

The slender loris, *Loris lydekkerianus* is one of the two nocturnal primates found in India. Two subspecies which are recognized so far are the Mysore slender loris, *Loris lydekkerianus lydekkerianus* and the Malabar slender loris, *Loris lydekkerianus malabaricus* inhabiting the dry and wet forests of the Eastern and Western Ghats respectively. The distributions are said to overlap each other which has never been really tested. Although the distribution and abundance of the species is known for the state of Karnataka and some parts of Tamil Nadu, Kerala and Andhra Pradesh (Singh et al. 1999, 2000; Kumara et al. 2006; Radhakrishna et al. 2011), full distributional extent of the species in southern India, population densities and factors affecting its abundance still remain largely unknown. The dry forest sub-species are thought to be occurring in higher abundance in Eastern Ghats and eastern fringes of Western Ghats, its full distribution extent and conservation status is unknown. And none of the remnant forests of Eastern Ghats of Tamil Nadu have protected area status. As the wet forest sub-species of loris occur in lower densities in the Western Ghats, understanding the distribution pattern them and the quality of the remaining forests certainly helps in prioritizing the forest patches for conservation and planning in crucial areas.

Historical biogeography indicates that the species is limited by River Tapti on the west coast and River Godavari on the east coast based on the secondary information and from the collection localities of museum specimens. The south eastern and south western limits of distribution of lorises are still unclear and the distribution pattern poses problems because of the complexity in the geomorphology of Southern India. Discontinuous Eastern Ghats, geographical barriers in the Western Ghats such as Palghat Gap and other discontinuities that form barriers such as plateaus, escarpments in addition to historical land use practices have led to the fragmented wildernesses in the South India.

Of the two sub species, comprehensive information is available on the behavior of the Mysore slender loris. The problem had been partially addressed by studying the distribution, habitat correlates and conservation of slender lorises in Karnataka (Kumara et.al. 2006), southern Andhra Pradesh and parts of Tamil Nadu (Singh et.al. 1999,2000; Kumar et.al.

2002) and central and northern Kerala (Radhakrishna et.al. 2011). Systematic surveys of slender lorises in the remaining habitats of southern India was initiated during which half of the actual distributional limits of the loris were surveyed in the first phase which covered the states of Maharashtra, Goa, parts of Kerala and Tamil Nadu states of India. Only half of the distributional areas of lorises were covered in the states of Tamil Nadu and Kerala (Fig. 1a, b) owing to time and resource constraints. In the first phase of the study, 45 forest Ranges of 15 forest divisions in Tamil Nadu were surveyed. The abundance of the slender lorises ranged from 0.11 to 2.11 lorises/km. In the state for Kerala, 36 forest ranges in 17 forest divisions were surveyed and the animal abundance was ranged between 0.02 and 1.44 lorises/km (Radhakrishna et.al. 2011). The surveys had covered the southern half of Tamil Nadu and North-central regions of Kerala. As a second phase of the study, survey was conducted in the remaining forested areas of Tamil Nadu and Kerala (Fig. 1a, b).

Objectives of the study:

- To survey the slender loris in southern Kerala and northern Tamil Nadu

- To assess the abundance of slender loris in forest units

- To assess the habitat parameters and threats

- To spatially characterize and configure the landscape of suitable habitats for conservation prioritization

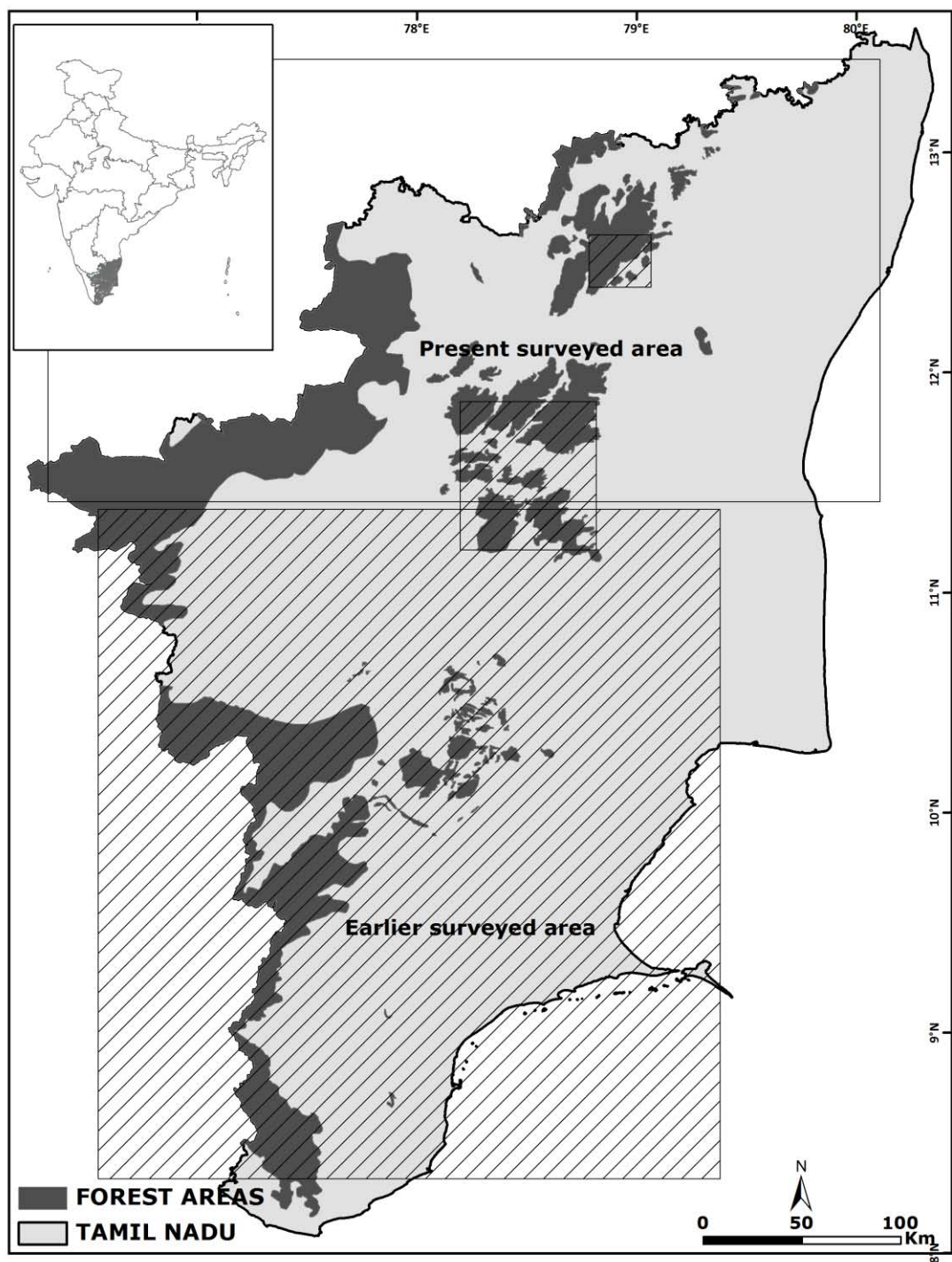


Figure 1a Targeted area for the survey for slender loris in Tamil Nadu

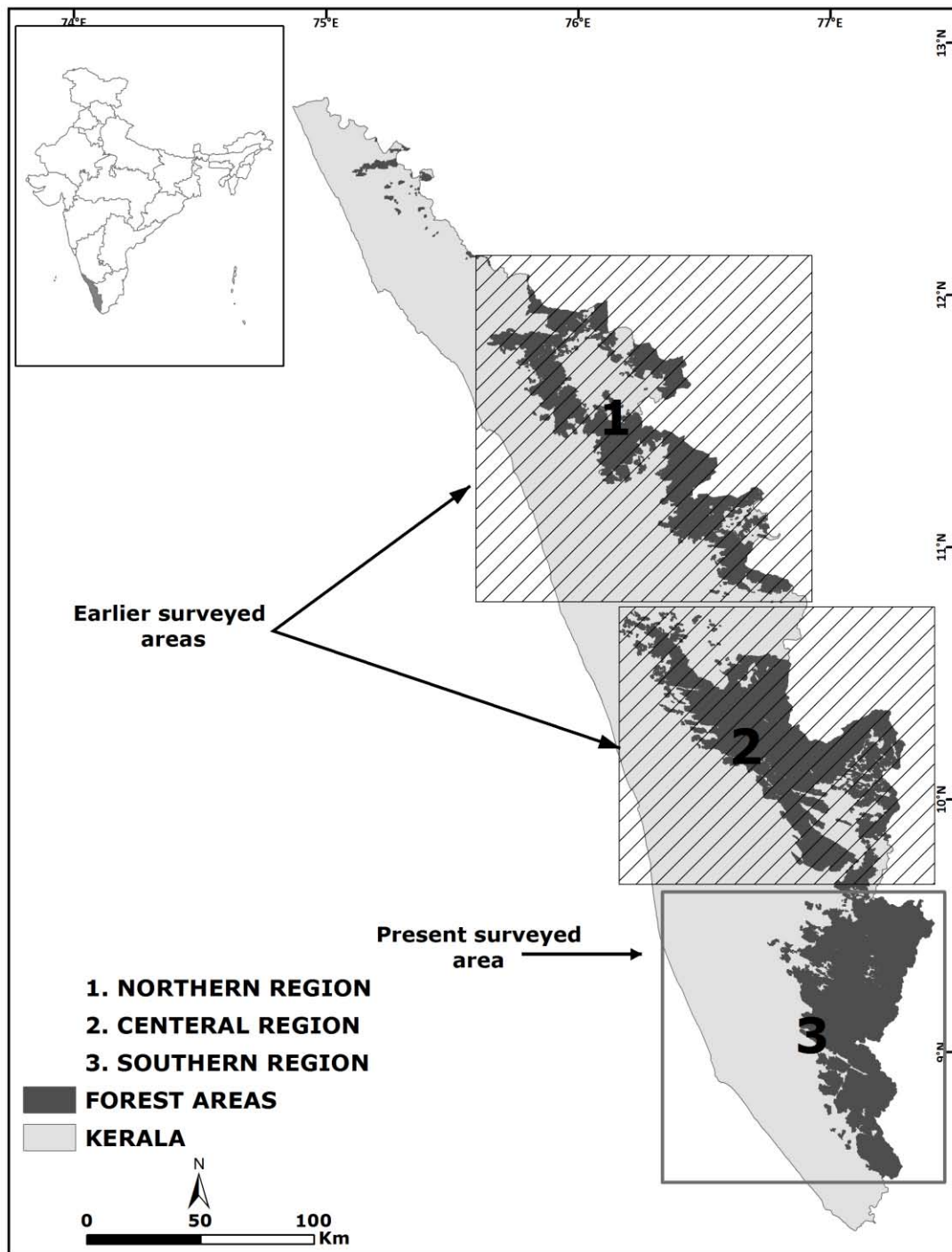


Figure 1b Targeted area for the survey for slender loris in Kerala

Study Area:

The survey was carried out in the forests of southern Kerala and northern Tamil Nadu (Fig. 1a, b). The forest divisions surveyed in the both states are provided in the Table 1. Over 16 forest divisions in Tamil Nadu and nine forest divisions in southern Kerala were surveyed for slender loris. In each forest division, all the major forest patches in each of the forest range of the division was surveyed.

The major vegetation of southern Kerala include evergreen forests at the western slopes of Western Ghats, semi-evergreen forests and degraded evergreen or semi-evergreen forests, and deciduous forests in some of the regions which is contiguous with the rain shadow areas of Western Ghats. The rain shadow areas of Western Ghats in Tamil Nadu are predominantly deciduous and scrub forests, except at some higher altitude regions where forests are relatively wet 'semi-deciduous or semi-evergreen and evergreen forests'.

Table 1 Different forest divisions surveyed in Tamil Nadu and Kerala

State	Forest Divisions surveyed	Total
Tamil Nadu	Chennai, Kanchipuram, Vellore, Tirupattur, Tiruvannamalai, Villupuram, Hosur, Dharmapuri, Harur, Kallakuruchi, Salem, Erode, Sathyamangalam	16
Kerala	Munnar Wildlife (Part), Periyar, Ranni, Konni, Achenkovil, Punalur, Thenmala, Shendurney and Thiruvananthapuram	9

Methods:

Possible sites for the survey were selected based on extent of forest cover within each forest range of forest division. We used (i) field sightings of the species during night transects, and (ii) information from Forest Department personnel and local villagers, to confirm the presence of lorises in an area. Apart from forests, slender lorises also inhabit adjacent plantations and orchards (Singh et.al. 1999, 2000). Hence these habitats in the fringes were also surveyed for the presence of lorises. Night surveys were conducted between 20:00 h and 04:00 h on pre-determined transects using flashlights and headlamps. Existing natural trails were used as transects in the forests for the surveys following best

recommendations (Sterling and Ramaroson 1996; Walsh and White 1999). The eyes of slender lorises gives a typical orange-red shine in response to a flashed light that can be seen from a distance of over 100 m and this was used to detect the presence of the loris (Singh et.al. 1999, 2000). Vehicle survey or the foot transect was adopted and followed depending on the access and topography of the terrain for the surveys (Singh et.al. 1999, 2000; Nekaris and Jayawardene 2004). Vehicle speed was maintained at an average of 5 km/h (Singh et.al. 1999), whereas foot transects was done with an average speed of 1 km/h (Sterling and Ramaroson 1996). Actual density estimation requires transects to be replicated to fulfil the statistical assumptions and are rarely met (Brockelman and Ali 1987). Time and resources did not permit further replications and an alternative index 'relative abundance' was estimated for the loris populations. The relative abundance index was calculated as the number of animals observed per unit distance, and same has been used to compare animal populations over time or in different areas (Sterling and Ramaroson 1996). In the present study, slender loris relative abundance is projected as the number of animals surveyed per km. A handheld global position system was used to calculate the distance covered during the survey, and geographical location of the sighted animals. For each sighting of a loris, number of individuals, subspecies, height from ground, substratum and tree species used, and habitat type was noted. Morphological characteristics like body size, coat colour and shape of circumocular patches distinguish the Mysore slender loris from the Malabar slender loris (Kumara et.al. 2006). Sighted loris individuals were closely observed in order to distinguish the identity of the subspecies. Additionally, photos were taken where the confusion was there in the identity of the subspecies, which helped us to indentify the sighted loris precisely at subspecies level.

The survey was carried out between November 2012 and December 2013. A total of 782 km and 641 km of vehicle transect or walk was made to survey in Tamil Nadu and Kerala respectively.

Results:

Status of slender loris in Kerala: A total of 23 forest ranges in 11 forest divisions in southern Kerala were surveyed (Fig. 2). The survey areas include one tiger reserve, three wildlife sanctuaries and seven reserve forests. A total of 47 lorises were sighted during the 641 km of walk or vehicular transects (Table 2).

Table 2 Sampling efforts, number of sightings and encounter rate of slender loris in different forest divisions of Southern Kerala

Forest Division	Forest Range	Official Status	Km Walked/ Motored	No. of Lorises	Sightings/km (\pm SD)	Subspecies Identity
Kottayam	Kumily (1)	RF	9	3	0.05	<i>L. l.?</i>
	Erumeli (2)	RF	8	1	0.12	<i>L. l.?</i>
Periyar TR	Thekkady (3)	TR	24	0	-	-
	Vallakadavu (4)	TR	56	1	0.03 (\pm 0.09)	<i>L. l.m.</i>
	Periyar (5)	TR	19	0	-	-
	Azhutha (6)	TR	12	0	-	-
	Pampa (7)	TR	10	0	-	-
Ranni	Goodrickal (8)	RF	120	0	-	-
	Vadasserikkara (9)	RF	43	0	-	-
Konni	Naduvathumuzhy (10)	RF	10	5	0.50	<i>L. l.m.</i>
	Mannarappara (11)	RF	1	1	0.05	<i>L. l.m.</i>
Achenkovil	Kallar (12)	RF	22	4	0.18	<i>L. l.m.</i>
	Kanayar (13)	RF	20	0	0.10	<i>L. l.m.</i>
	Achenkovil (14)	RF	51	3	0.04 (\pm 0.04)	<i>L. l.m.</i>
Punalur	Pathanapuram (15)	RF	25	3	0.07 (\pm 0.11)	<i>L. l.m.</i>
Thenmala	Thenmala (16)	RF	8	0	-	-
	Arienkavu (17)	RF	18	1	0.05	<i>L. l.m.</i>
Shendurney WLS	Shendurney (18)	WLS	22	2	0.09 (\pm 0.01)	<i>L. l.m.</i>
Thiruvananthapuram	Kulathupuzha (19)	RF	40	2	0.05 (\pm 0.07)	<i>L. l.m.</i>
	Palode (20)	RF	32	5	0.21 (\pm 0.24)	<i>L. l.m.</i>
	Paruthipally (21)	RF	12	6	0.50	<i>L. l.m.</i>
Peppara WLS	Peppara (22)	WLS	48	5	0.21 (\pm 0.29)	<i>L. l.m.</i>
Neyyar WLS	Neyyar (23)	WLS	36	4	0.12 (\pm 0.14)	<i>L. l.l.</i>
	Total		641	47	0.07 (\pm0.13)	

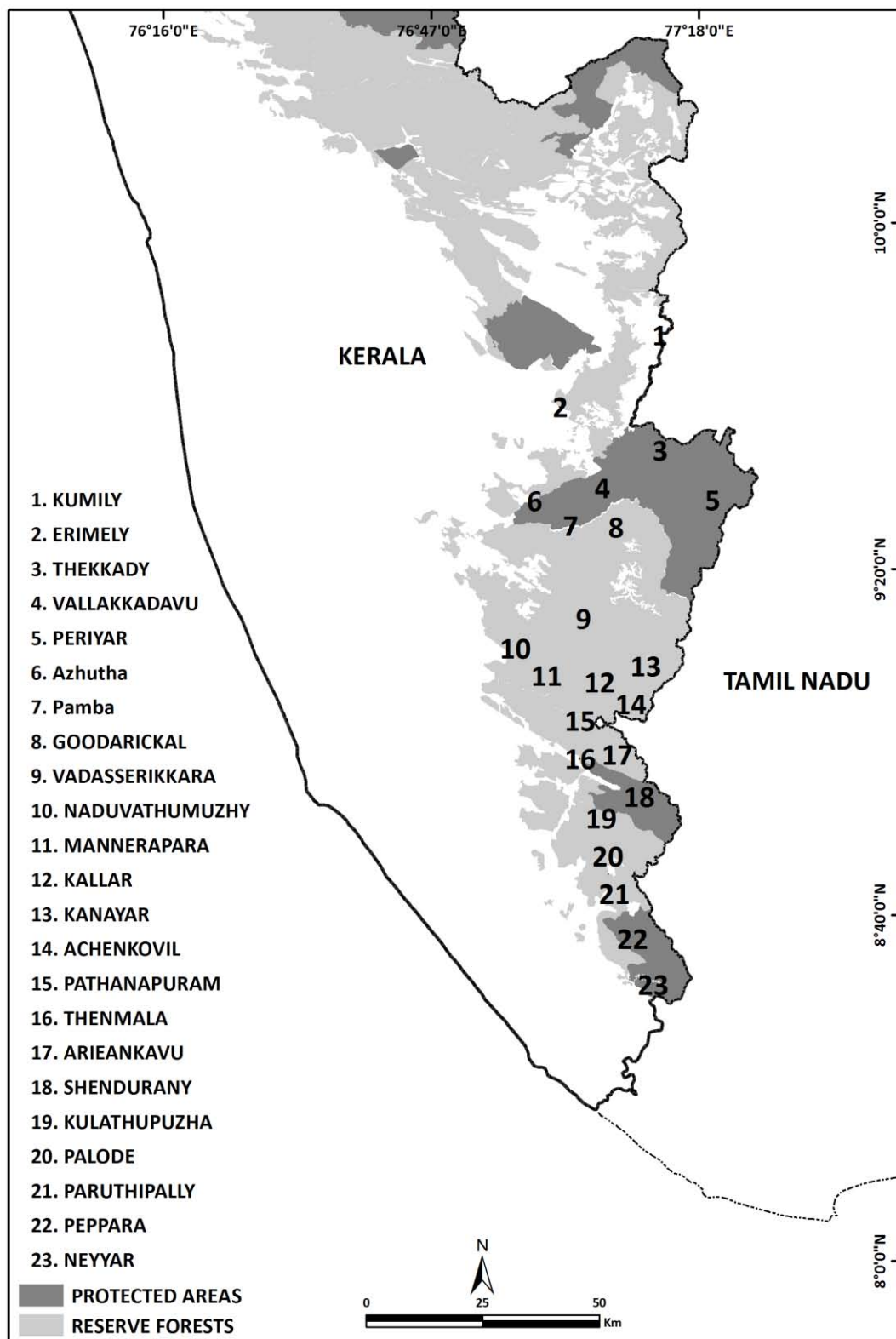


Figure 2 Forest ranges surveyed for slender loris in southern Kerala

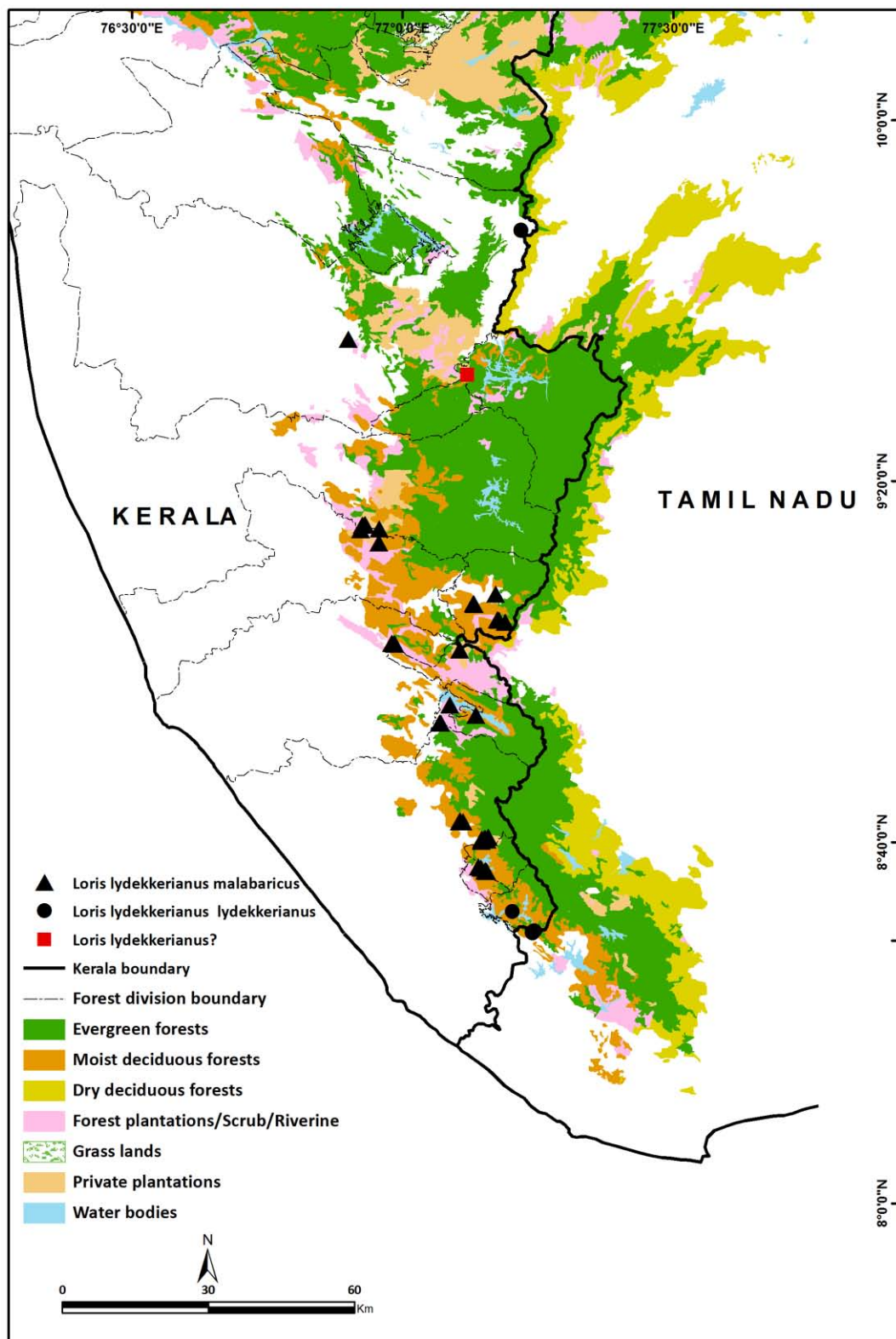


Figure 3 Sightings of subspecies of slender loris in southern Kerala

Slender loris was sighted in all the forest divisions except Ranni division (Fig. 3). The encounter rate was highly varied between the ranges (Table 2), the highest encounter rate was in Naduvathumuzhy range (0.50) of Konni forest division and Paruthipally range (0.50) in Thiruvananthapuram, which was followed by Palode range (0.21 ± 0.24) in Thiruvananthapuram forest division and Peppara (0.21 ± 0.29) in Pappara WLS. The overall encounter rate was 0.07 (± 0.13). Four lorises sighted in Kottayam forest division were not deduced to subspecies level, where as all other sightings in other forest divisions were of *Loris lydekkerianus malabaricus*, except in Neyyar WLS where the subspecies was *L. l. lydekkerianus*.

The relative abundance of lorises in moist deciduous forests (0.31 ± 0.05 SE) was significantly (Kruskal-Wallis, $\chi^2 = 25.32$, $df = 2$, $p < .001$) higher than in the evergreen forests (0.02 ± 0.01 SE) and plantations (0.04 ± 0.02 SE) (Fig. 4). Of the 47 lorises sighted, 36 sightings (77 %) were in the altitude < 300 m asl, where other 11 sightings (23 %) were between 301 and 1200 m asl (Fig. 5).

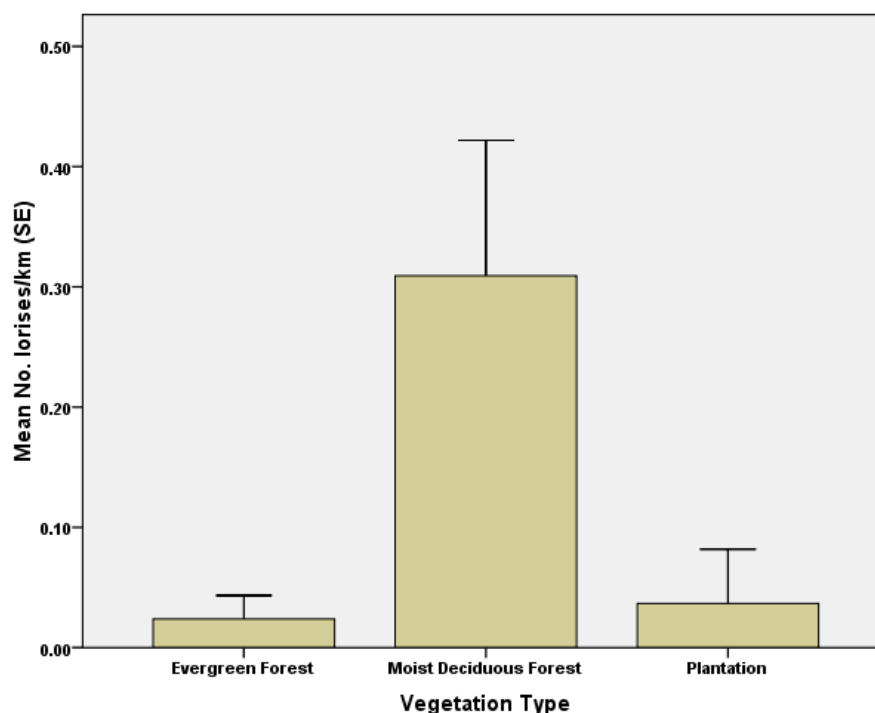


Figure 4 Mean number of lorises sighted in different vegetation types of southern Kerala

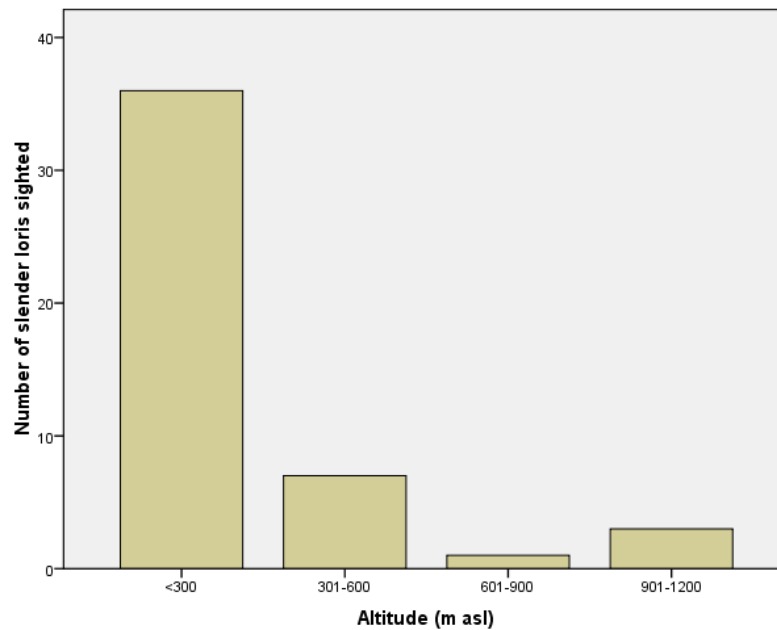


Figure 5 Number of lorises sighted in different altitudinal range in southern Kerala

Overall Kerala:

We compiled the information of the earlier study (Radhakrishna et.al. 2011) with the preset study to provide the overall spectrum of distribution and relative abundance of slender loris in Kerala (Fig. 6). Slender loris was recorded in all along the forests of Western Ghats (Fig. 7), from Neyyar WLS in the south to Aralam WLS in the north. In spite of large sampling effort, loris was not sighted at large stretches of evergreen forests of Periyar TR and Parambikulam TR. Among all the forest divisions and forest ranges, the highest encounter rate was in Aralam WLS (1.44 ± 1.07), which is followed by Chimony WLS (0.06 ± 0.57), Naduvathumuzhy range (0.50) of Konni forest division and Paruthipally range (0.50) in Thiruvananthapuram. The overall encounter rate for the state was $0.12(\pm 0.31)$ lorises/km.

Lorises were recorded largely from the moist deciduous forests in southern Kerala, where it was in evergreen forests at central and northern Kerala. The overall relative abundance was higher in the evergreen forests (0.18 ± 0.07 SE), which is followed by moist deciduous forest (0.14 ± 0.03 SE), dry deciduous forest (0.10 ± 0.03 SE) and plantations (0.07 ± 0.02 SE) (Fig. 8), however, the mean relative abundance of lorises did not differ across the vegetation types (Kruskal-Wallis, $\chi^2 = 4.17$, $df = 3$, $p = 0.244$). The standard deviation was very high due to less or no detections in many of the sampling trails. Lorises were recorded between 65 and

1871 m asl, however, 55 % (N = 81) of the sightings were at <300 m asl (Fig.9). The mean relative abundance of lorises in protected area (0.14 ± 0.04) and reserve forest (0.11 ± 0.02) did not differ significantly ($t = 0.682$, $df = 181$, $p = 0.496$) (Fig. 10).

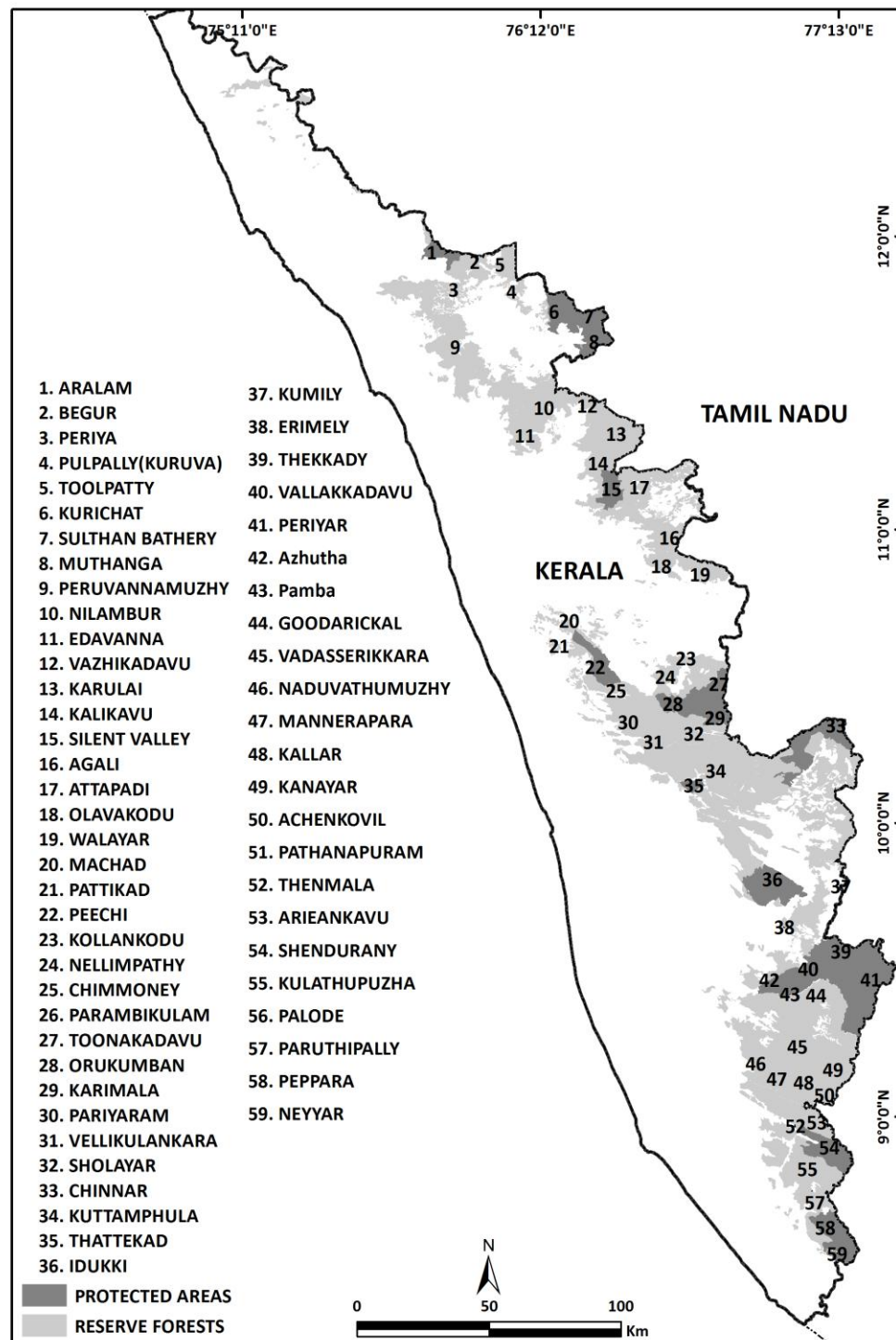


Figure 6 Forest ranges surveyed for slender loris in Kerala

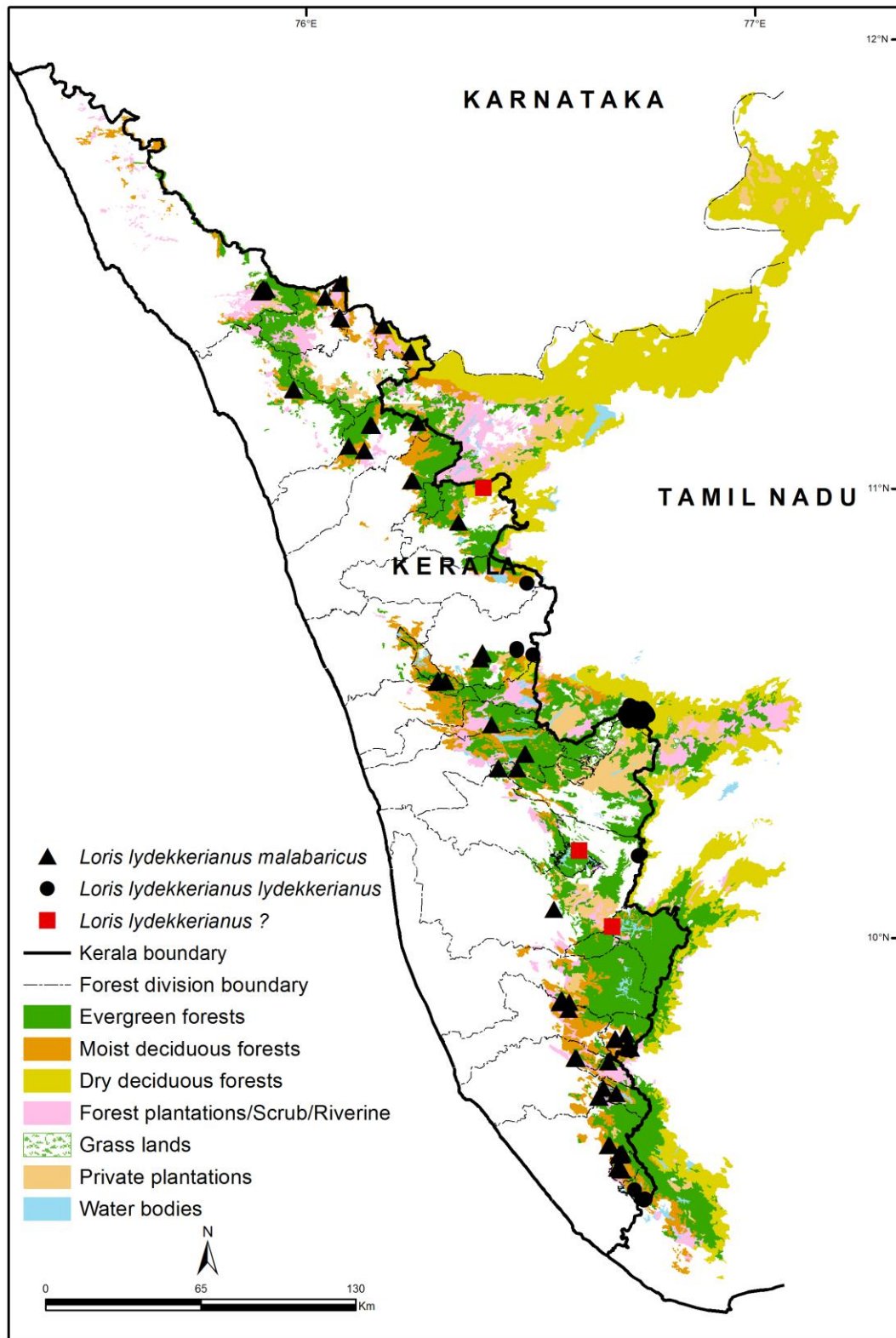


Figure 7 Sightings of different subspecies of slender loris in Kerala

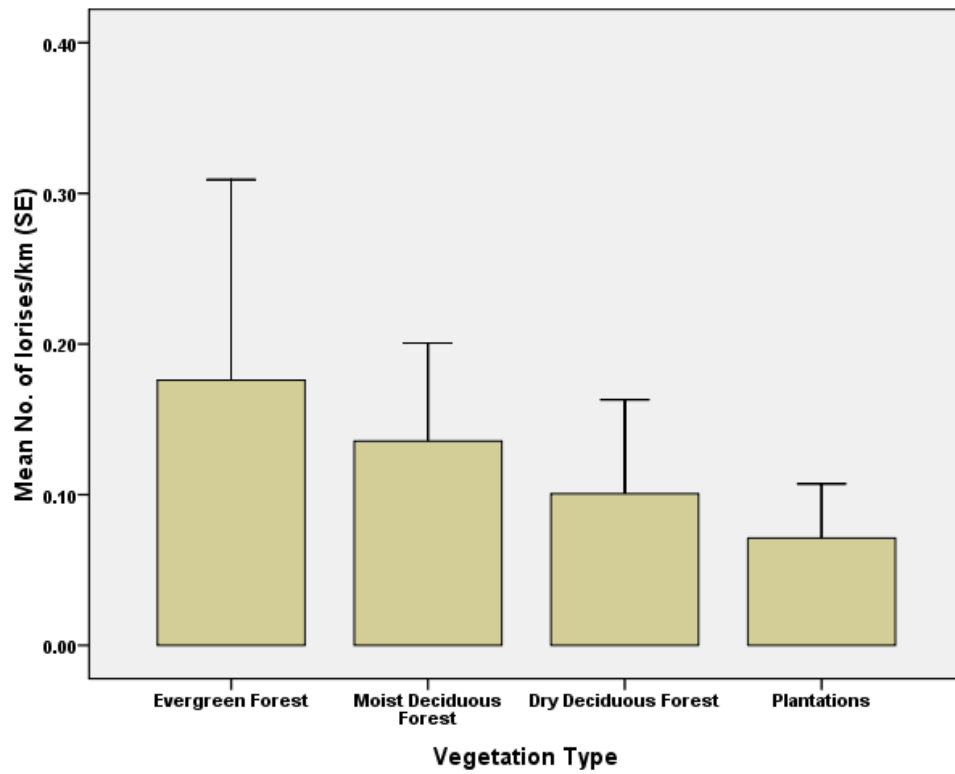


Figure 8 Mean number of lorises sighted in different vegetation types in Kerala

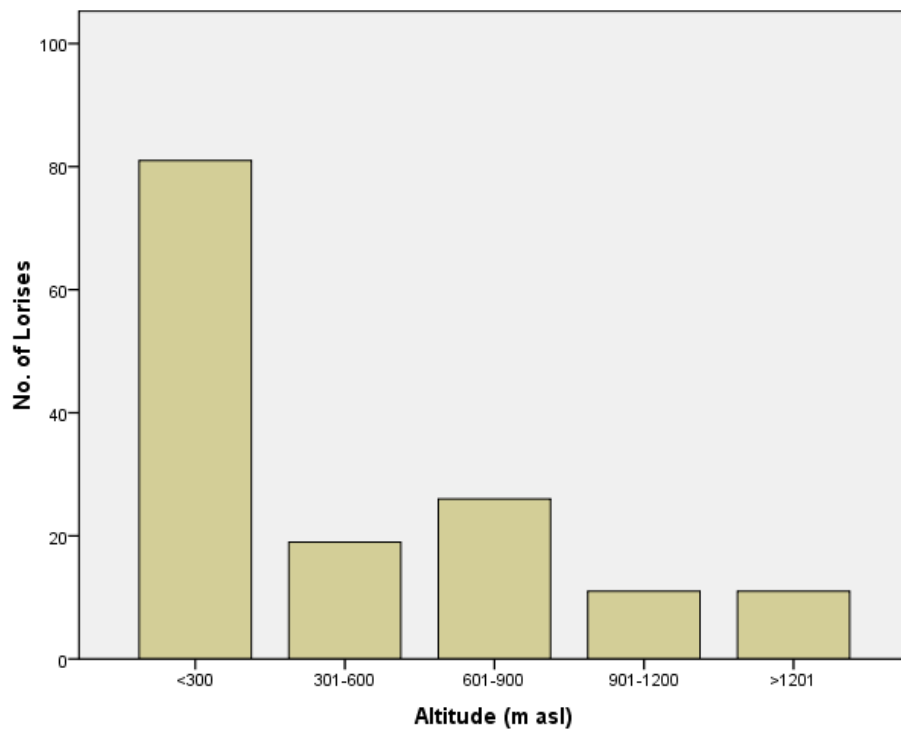


Figure 9 Number of lorises sighted in different altitudinal range in Kerala

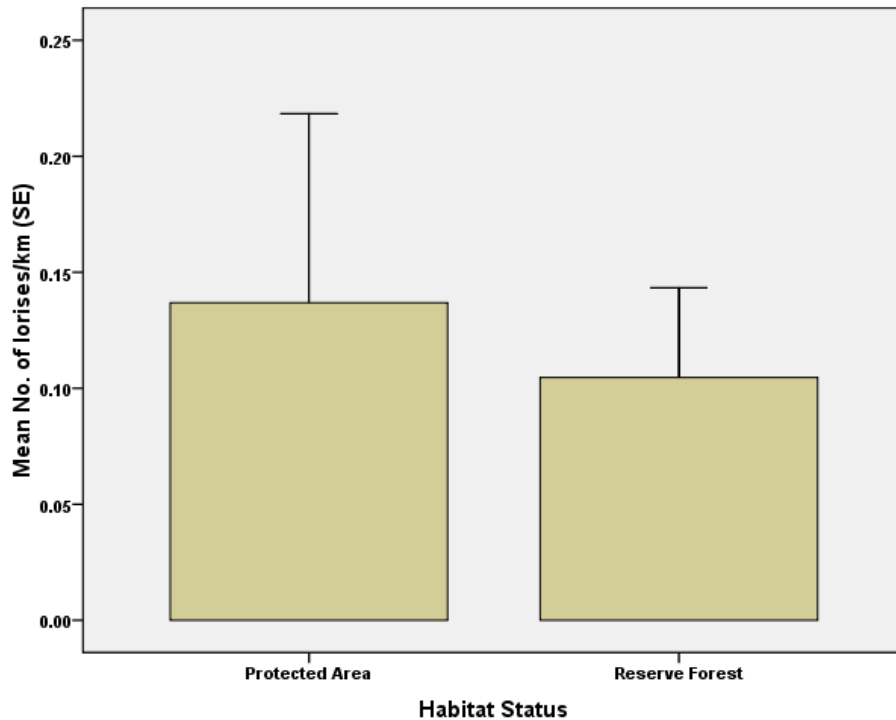


Figure 10 Mean number of lorises in the habitat with different protection status in Kerala

Status of slender loris in Tamil Nadu:

A total of 12 forest divisions were surveyed in the Tamil Nadu (Fig. 11), among them only one is Biological Park which is a protected area, where all other surveyed areas were outside the protected area. A total of 782 km of walk or vehicular sampling was made and during this a total of 60 lorises were sighted in all the forest divisions except Pondicherry and Nagapattinam (Table 3). All the lorises sighted in during the present survey in Tamil Nadu were identified as *L. l. lydekkerianus*.

The overall encounter rate of loris was 0.08 lorises/km. The encounter rate highly varied between the forest divisions. The encounter rate was high in the Krishnagiri forest division (0.25-0.71 lorises/km), which was followed by Dharmapuri division (0.21 lorises/km).

Table 3 Sampling effort, number of sightings and encounter rate of slender loris in different forest divisions of northern Tamil Nadu

Forest Division	Forest Range/ Area	Official Status	Km walked/ Motored	No. of Lorises	Lorises/ km (\pm SD)	Subspecies Identity
Nilgiris	Mettupalayam-Ooty	RF/Private	40	0	-	-
	Gudalur- Ooty	RF/Private	35	0	-	-
	Masinangudi- Siriyur	RF	50	1	0.02	<i>L. l.l.</i>
	Masinangudi- Moyar	RF	18	0	-	-
Erode	Mettupalayam-Bhavanisagar	RF	40	3	0.08	<i>L. l.l.</i>
	Bhavanisagar-Mettupalayam	RF	12	4	0.33	<i>L. l.l.</i>
	Bhavanisagar-Puliyampatti	RF	40	2	0.05	<i>L. l.l.</i>
Salem	Yercaud-Athiyur	RF	30	0	-	-
	Yercaud-Taisolai	RF	20	2	0.10	<i>L. l.l.</i>
Dharmapuri	Harur-Siteri	RF	50	10	0.20(\pm 0.05)	<i>L. l.l.</i>
	Siteri-Karumandurai	RF	24	5	0.21(\pm 0.05)	<i>L. l.l.</i>
Villupuram	Tirukoilur-Rishivandiyam	RF	40	1	0.03	<i>L. l.l.</i>
	Tirukoilur-Tandarpattu	RF	28	2	0.07	<i>L. l.l.</i>
	Kurumbaram RF/Marakanam	RF	20	0	-	-
	Nadukuppam	Private	10	0	-	-
Pondy cherry	Pondy cherry University	Private	5	0	-	-
	Pondy cherry	Private	6	0	-	-
Krishnagiri	TVS Factory	Private	8	4	0.50(\pm 0.35)	<i>L. l.l.</i>
	Hosur-Krisinagiri	RF	12	7	0.58	<i>L. l.l.</i>
	Hosur-Thally	RF	8	2	0.25	<i>L. l.l.</i>
	Toppuir	RF	7	5	0.71	<i>L. l.l.</i>
Tiruvallur	Sriperubadur-Tiruvallur	Private	60	2	0.03	<i>L. l.l.</i>
	Redhills	Private	20	1	0.05	<i>L. l.l.</i>
	Gudiam	RF	20	2	0.10	<i>L. l.l.</i>
	Poondi	Private	20	1	0.05	<i>L. l.l.</i>
Nagapattinam	Sirgali-Putur	Private	20	0	-	-
	Poolamedu	Private	17	0	-	-
	Kumaratchi	Private	13	0	-	-
	Kunnam	Private	11	0	-	-
	Themmur	Private	14	0	-	-
Chennai	Vandalur	PA	24	2	0.08	<i>L. l.l.</i>
Tirupattur	Yelagiri	RF	60	4	0.07(\pm 0.07)	<i>L. l.l.</i>
Total			782	60	0.08	

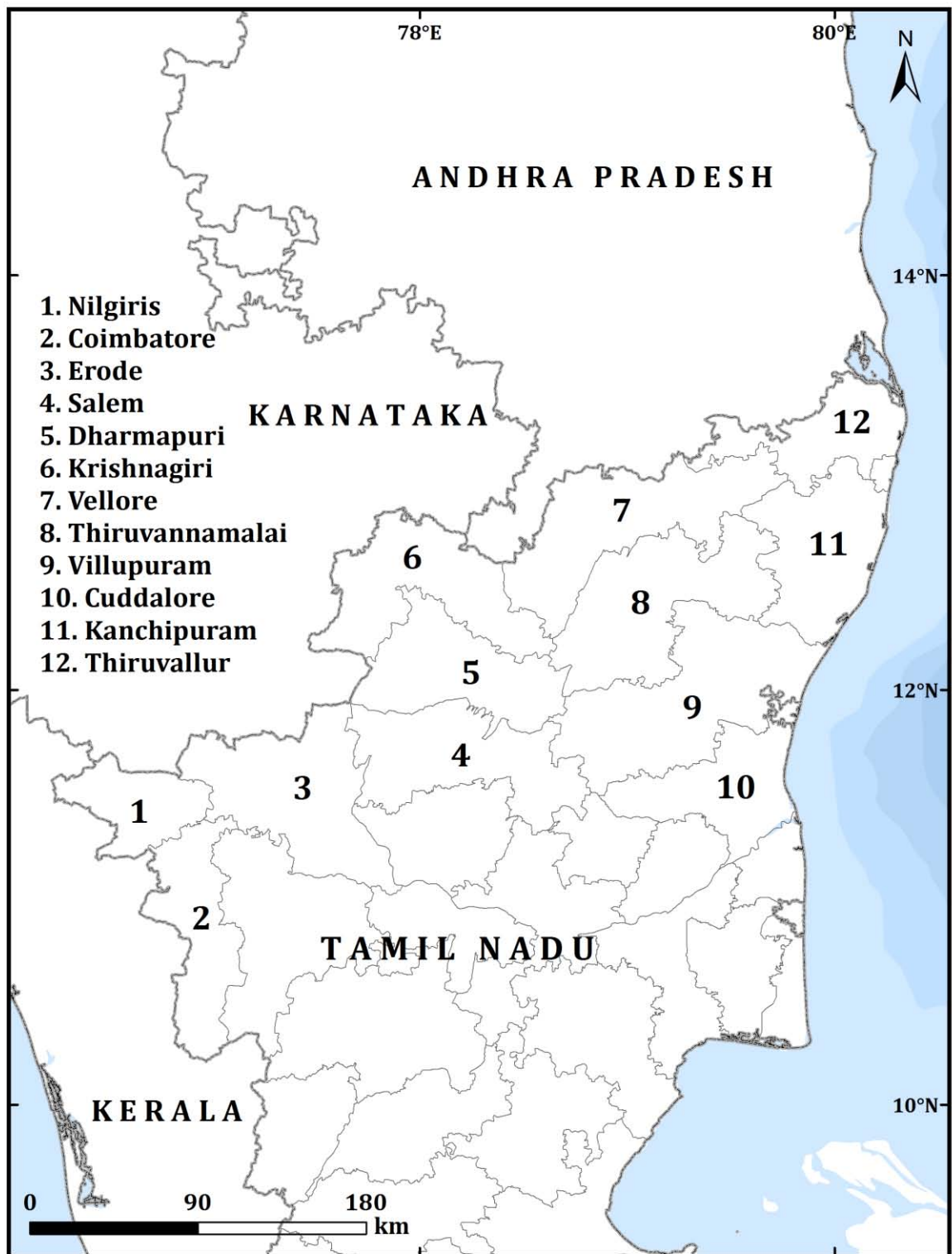


Figure 11 Forest divisions surveyed for slender loris in northern Tamil Nadu

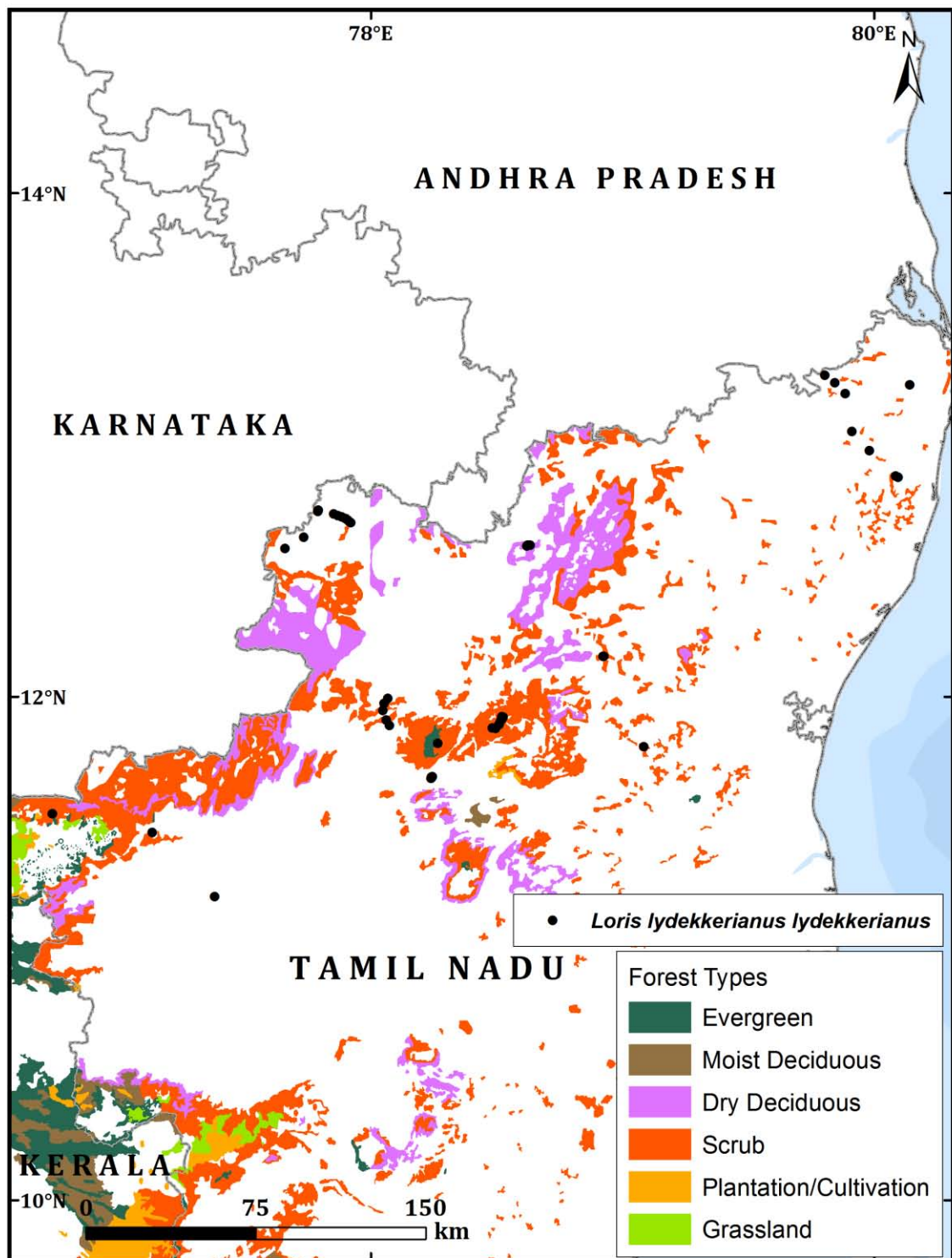


Figure 12 Sightings of lorises in northern Tamil Nadu

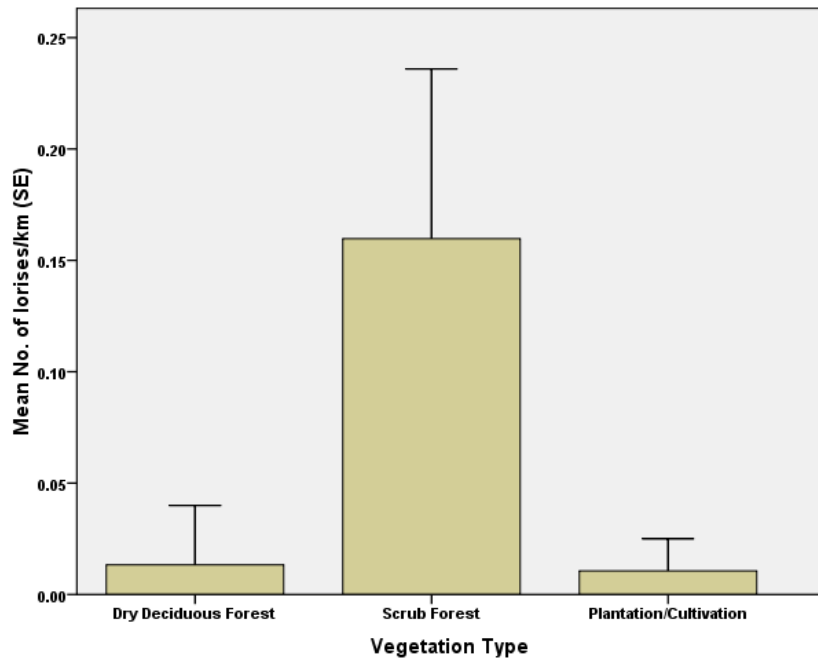


Figure 13 Mean number of lorises in different vegetation types of northern Tamil Nadu

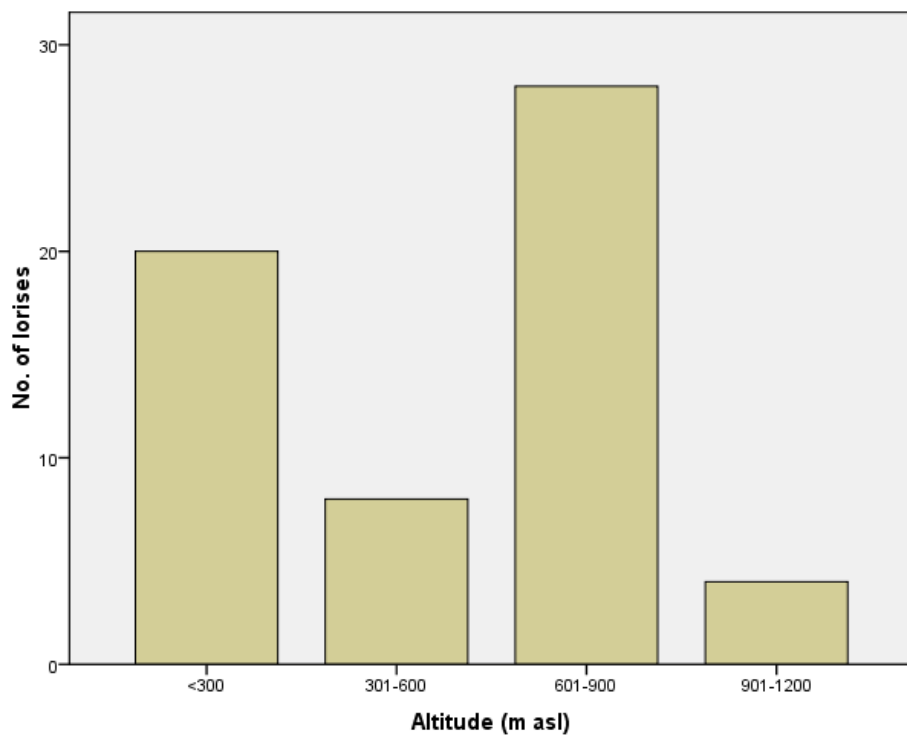


Figure14 Number of lorises sighted in different altitudinal range of northern Tamil Nadu

The proportion of evergreen forest and moist deciduous forest was very less in the present surveyed area, therefore the sampling effort was also negligible in these vegetation types. Though few lorises were sighted in the moist deciduous forests, we excluded these vegetation types from the present comparisons. The mean relative abundance was significantly higher (Kruskal-Wallis, $\chi^2 = 11.42$, $df = 2$, $p < .01$) in the scrub forests (0.16 ± 0.04 SE) than in the dry deciduous forests (0.01 ± 0.01 SE) and plantation-cultivated areas (0.01 ± 0.01 SE) (Fig. 13). Lorises were distributed between 30 and 1000 m asl, however, about 47 % of the sightings were between 600 and 900 m asl (Fig. 14).

Overall Tamil Nadu:

Of the 32 districts of the Tamil Nadu state, 27 districts were totally surveyed for the occurrence and abundance of slender loris which include the surveys by Radhakrishna and Sinha (2010), Singh et.al. (1999) and Kumar et.al. (2002). We compiled all the information together to provide overall spectrum on status of slender loris in Tamil Nadu (Table 4 and Fig. 15). Few coastal districts were not surveyed since they did show little forest cover (less suitable habitat), and also the secondary information by local people revealed that the occurrence of slender loris was merely absent. Among the 27 districts, occurrence of slender loris was recorded from 22 districts (Fig.16), where lorises were not recorded in other five districts Pondicherry, Nagapattinam, Ramanathapuram, Thanjavur and Thoothukudi.

The mean relative abundance of lorises varied between 0.03/km and 2.21/km. The highest abundance was in Tiruchirapalli (2.21 ± 1.19 SE), which was followed by Pudukottai (1.96 ± 1.04 SE), Dindigul (1.48 ± 0.72 SE), Sivaganga (1.41 ± 0.58 SE) and Karur (1.23 ± 0.23 SE). The mean relative abundance varied significantly across the districts ($F_{26,112} = 3.600$, $p < .001$). The mean relative abundance of lorises was relatively higher in the scrub forest (0.51 ± 0.10 SE), which is followed by dry deciduous forest (0.35 ± 0.08 SE), plantation-cultivated area (0.30 ± 0.13 SE) and evergreen forests (0.10 ± 0.05 SE) (Fig. 17), however the abundance did not differ significantly between the vegetation types ($F_{3,135} = 0.820$, $p = 0.485$). Lorises were sighted between 30 and 1257 m asl (Fig. 18), where 49% (N=148) of the sightings were at below 300 m asl, and ~ 95 % of the sightings were between 30 and 900 m asl. Though the relative abundance was higher in the reserve forests (0.35 ± 0.08 SE) than in the protected areas (0.35 ± 0.08 SE) and privately owned plantations or croplands (0.35 ± 0.08

SE) (Fig.19), but the abundance did not differ significantly between the habitat with different protection status ($F_{2,136} = 0.701, p = 0.498$).

Table 4 Sampling efforts, number of sightings and encounter rate of slender loris in different forest divisions of Tamil Nadu

Forest Division	Km sampled	No. of lorises sighted	No. lorises/ km (SE)
Chennai	24.00	2	0.08±0.00
Coimbatore	342.00	37	0.16±0.05
Dharmapuri	74.00	15	0.20±0.02
Dindigul	280.00	313	1.48±0.72
Erode	92.00	9	0.13±0.07
Kanniyakumari	22.50	3	0.15±0.15
Karur	6.80	9	1.23±0.23
Krishnagiri	35.00	18	0.51±0.11
Madurai	44.80	30	0.75±0.21
Nagapattinam	75.00	0	0
Namakkal	21.00	6	0.26±0.12
Nilgiris	170.00	1	0.01±0.01
Pondy cherry	11.00	0	0
Pudukkottai	14.70	28	1.96±1.04
Ramanathapuram	16.50	0	0
Salem	58.00	14	0.28±0.09
Sivaganga	35.00	43	1.41±0.58
Thanjavur	8.00	0	0
Theni	203.00	63	0.25±0.08
Thoothukudi	30.90	0	0
Tiruchirapalli	18.00	41	2.21±1.19
Tirunelveli	10.00	0	0.83±0.83
Tiruvallur	80.00	3	0.04±0.03
Tiruvannamalai	15.00	14	0.90±0.20
Vellore	109.00	12	0.25±0.13
Villupuram	98.00	3	0.03±0.02
Virudhunagar	39.50	8	0.20±0.09
Total	1933.70	672	0.43±0.07

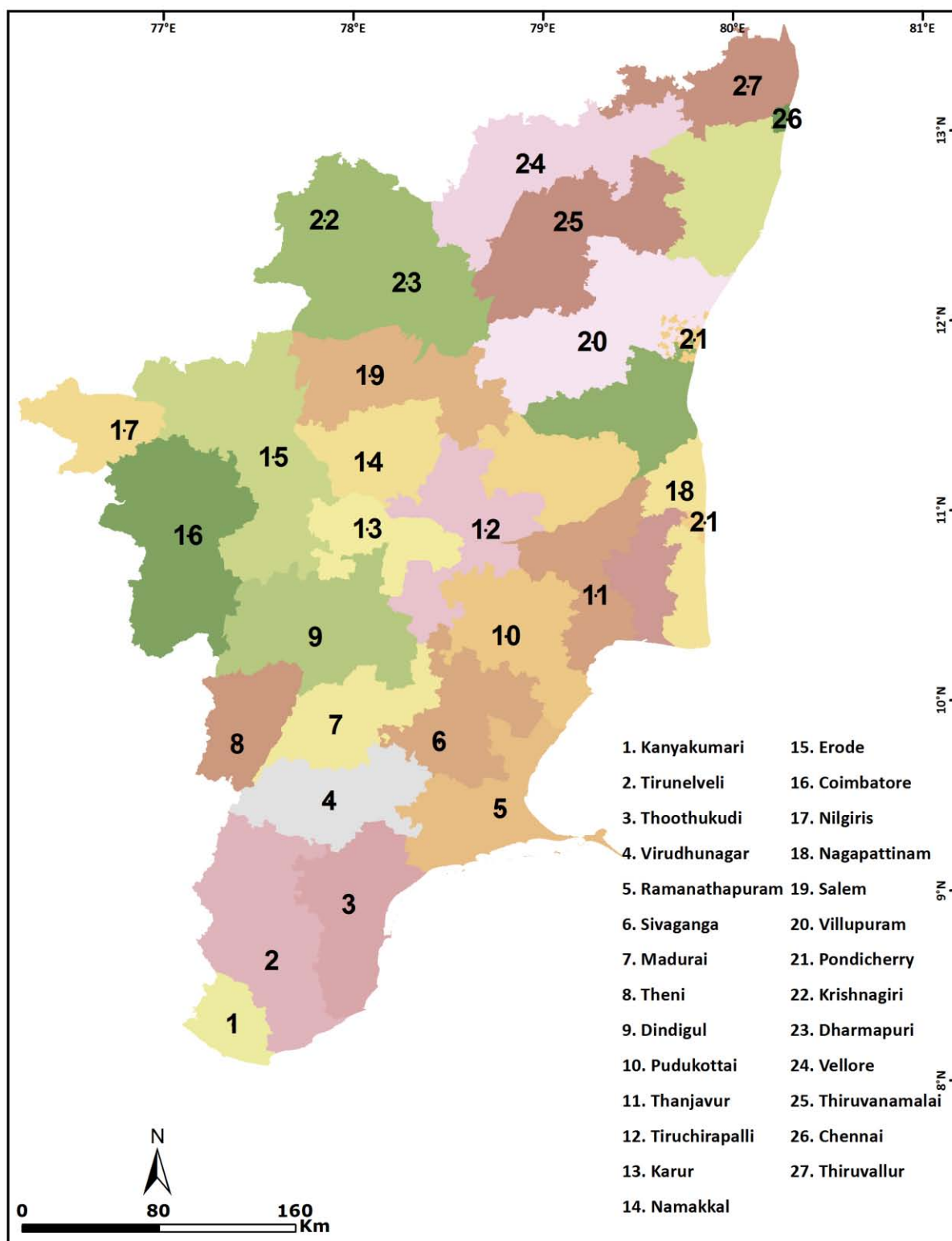


Figure 15 Forest divisions surveyed for slender loris in Tamil Nadu

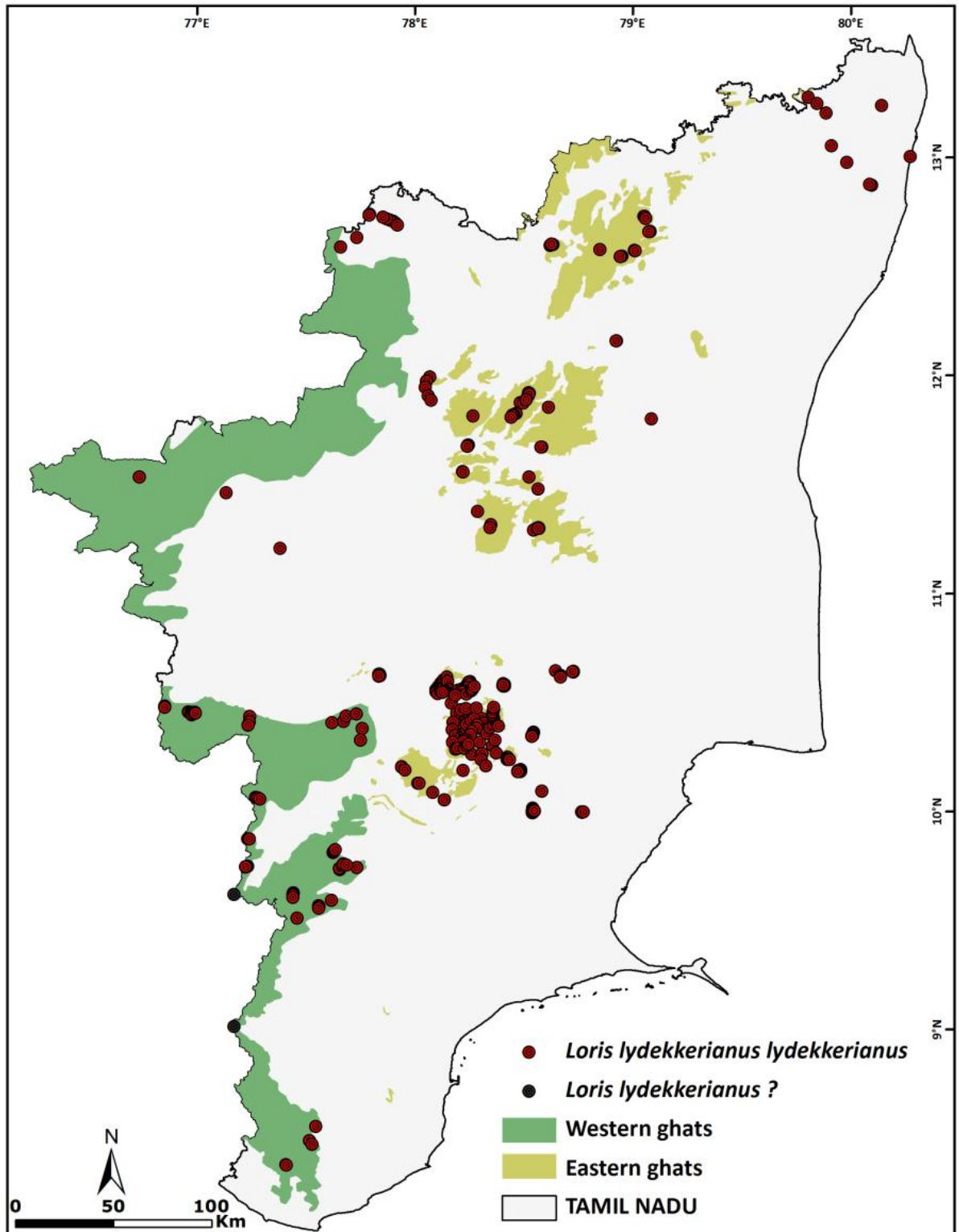


Figure 16 Sightings of slender lorises in Tamil Nadu

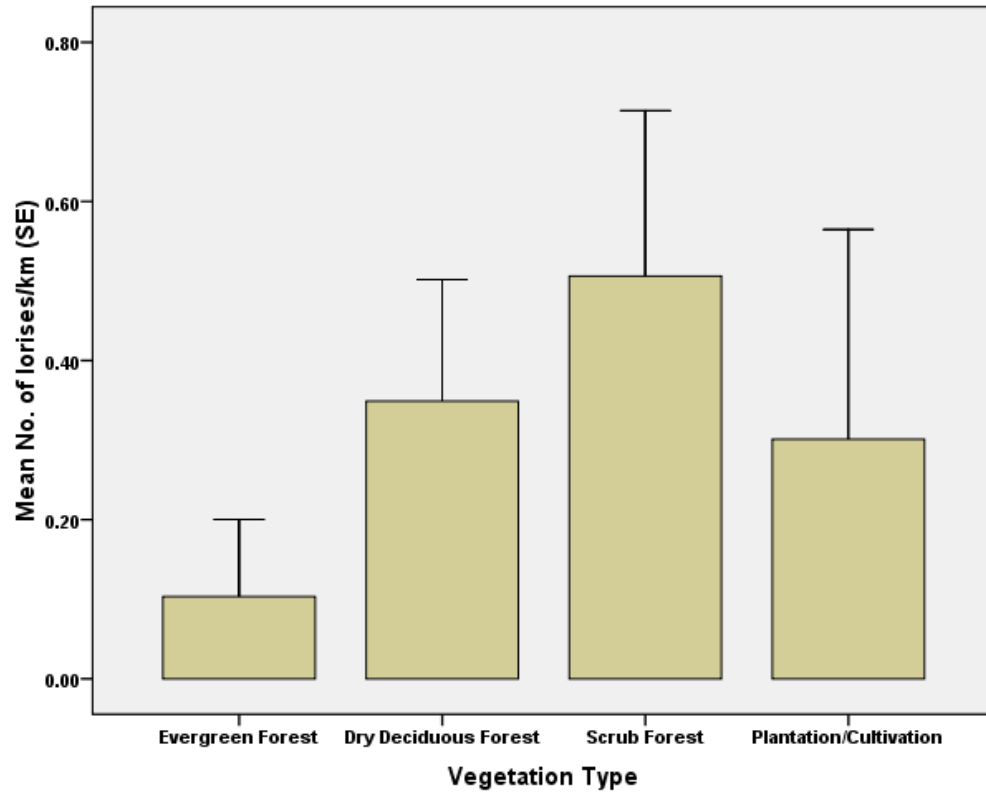


Figure 17 Mean number of lorises in different vegetation types in Tamil Nadu

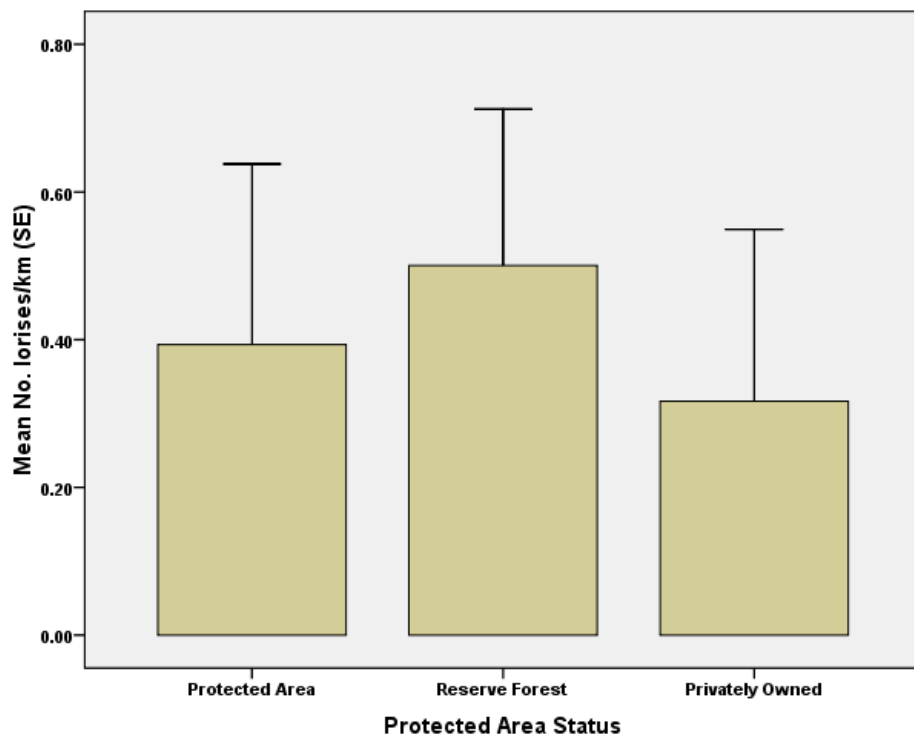


Figure 18 Mean number of lorises in habitat with different protection status in Tamil Nadu

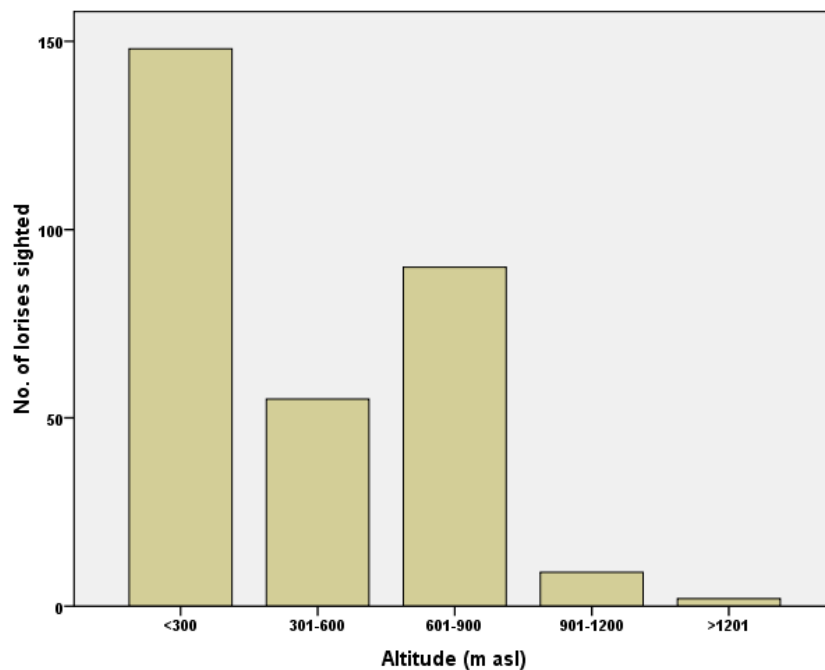


Figure 19 Number of lorises sighted in different altitudinal range in Tamil Nadu

Discussion:

The findings from the present study along with the existing data from the previous surveys (by Singh et.al. 1999; Kumar et.al. 2002; Radhakrishna et.al. 2011; Kumara and Radhakrishna 2013) provide complete distribution pattern and abundance of *L. l. lydekkerianus* and *L. l. malabaricus* for Kerala and Tamil Nadu states.

The distributional range of *L. l. malabaricus* is confined to the western slopes of the Western Ghats. Ariankavu pass and Palghat gap has created a major barrier over a period of time for the movement of animals across these gaps resulting in separate populations for *L. l. malabaricus*. Thus the population of *L. l. malabaricus* in Kerala can be considered as three populations i.e. Neyyar WLS in the southern tip to the south of Ariankavu pass, population present north of Ariankavu pass up to south of Palghat Gap and north of Palghat gap up to Aralam WLS. The population of Aralam WLS is contiguous with the population in Karnataka (Kumara et.al. 2006). It is interesting to investigate how these populations are genetically distinct.

In spite of large efforts, lorises were not sighted in the large tracts of evergreen forests of Parambikulam TR and Periyar TR, but the population may be contiguous through low elevation forests of the region. Though some of the reports show the presence of lorises in these forests (Easa and Balakrishnan 1990; Nameer 2000; Nameer et al. 2007) it was not based on the confirmative sightings. Thus we conclude that the lorises may be present in these forests but may be in low abundance and contiguous through low elevation forests. Lorises in Kerala are highly confined to the forest areas or department owned plantations. We presume that the lorises outside these patches have been eliminated over a period of time, or might be persisting in a low numbers along the fringes of forests and privately owned plantations - cultivated areas.

The relative abundance of *L. l. malabaricus* in most of the forest divisions of Kerala remain <0.2 lorises/km except at Aralam WLS, Konni, Thiruvanthapuram, Nemmara and Chimmoney, which are spatially distributed in all the three population areas. We presume some of the micro habitat characteristics to be determining their high abundance than the spatial variables. These high abundant areas have degraded evergreen forest with shrub cover, probably an important factor which enhances the availability of food resources like insects. However, high abundance should not be kept as a criterion for planning the conservation initiatives, since they are highly confined to only the forested areas of the state, the overall habitat protection should be the major goal to protect lorises in Kerala.

L. l. lydekkerianus is confined to forests around Palghat gap, Chinnar WLS, Kumily Range and Neyyar WLS. All these areas have got relatively dry forests as they are situated in rain shadow areas (eastern slopes) of the Western Ghats. The forests of all these areas are contiguous with the dry forests of the eastern slopes. The population in Chinnar WLS may not be contiguous with the nearest population of *L. l. malabaricus*, where the population of *L. l. lydekkerianus* present in south of Palghat and Neyyar WLS is contiguous with the population of *L. l. malabaricus* since the habitat is contiguous. Further study on these two populations might throw a light on various issues on overlap of range between the subspecies, their possible hybridization and interactions.

In Tamil Nadu, lorises are confined to the forests of Western Ghats, Eastern Ghats and its adjoining forests. The population of lorises are contiguous with the population in Karnataka

and Andhra Pradesh in north. In Western Ghats lorises are restricted to eastern slopes of the Ghats predominated with dry forests. The large efforts in the wet forests of Anamalai Tiger Reserve did not yield a single sighting of loris, similarly tribal people in Kalakad-Mundanthurai TR revealed no sightings of lorises in the wet forests. Therefore, we presume that lorises might be absent in the high altitude wet forests of the Western Ghats. Lorises were also absent in the coastal areas of the state, which were having relatively less or no suitable habitat.

Population contiguity of lorises is dependent on habitat contiguity, the loss of suitable habitat probably has resulted in the fragmentation of large population of them into many small populations. Apart from the population found along the Western Ghats, other major populations include -1) Karur- Dindigul- Madurai- Tiruchirapalli- Pudukottai, 2) Shevroy hills of Salem, 3) Krishnagiri, 4) Vellore- Thiruvannamalai, and 5) Chennai-Thiruvallur.

The subspecies *L. l. malabaricus* was not recorded from any parts of Tamil Nadu including forests of Western Ghats, thus the subspecies found in the entire state is *L. l. lydekkerianus*. Though few individuals were recorded in evergreen forests, but identity at subspecies of them were not clear. The type of forests in the plains of Tamil Nadu is low elevation dry forests largely dominated with scrub forests, which is interspersed with the croplands. *L. l. lydekkerianus* was recorded from all such habitats, thus the abundance was equally good in privately owned agricultural land.

The habitat loss may be the important threat for the conservation of lorises in Tamil Nadu as habitat loss has already driven the population into isolation. Thus conserving the scrub forests of Eastern Ghats can only help the long-term conservation of lorises. We recommend that the existing remnant forest patches of the Eastern Ghats should be effectively protected and upgraded for loris conservation.

Limitations: In Tamil Nadu, for unexpected administrative reasons, the survey was redesigned with the limited objective of collecting only a baseline data on the presence and relative abundance of lorises. Every forest areas in the state, has good network of public road, and also villages are spread around. We interviewed local people for the presence of lorises and walked along the public road for the direct sightings of lorises. Indeed there will be some impact on the rate of detection due to bias in the selected surveyed area (largely

edges). Nevertheless, it has provided the basic and relative information on presence and abundance of them. However, many other variables could not be collected, which held back us from the further modelling work as proposed in the approved proposal.

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