

# Population status and distribution assessment of Nicobar Long-Tailed Macaque *Macaca Fascicularis Umbrosus* (Miller, 1902) in Nicobar Group of Islands

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## Abstract

*Macaca fascicularis umbrosus* also known as Nicobar long tailed macaque is a subspecies of long-tailed macaque. It has a restricted distribution in the three islands namely Great Nicobar, Little Nicobar and Katchal of Nicobar Island groups. This species is the only non-human primates found in Nicobar group of islands. The species has been classified as 'Vulnerable' in IUCN Red list due to its restricted distribution, and susceptibility of its habitat to natural calamities. The study has been carried out during December 2015 and April 2016 in two islands viz., Katchal and Great Nicobar out of the three islands where the species is distributed to estimate the present status of *Macaca fascicularis umbrosus*. Based on the two systematic surveys conducted in the known habitats of the species, a total of n=28 groups comprises of n=958 individuals were observed and out of which n=193 individuals were observed in Katchal island and n=765 individuals were observed in Great Nicobar Island. The group encounter rate was higher in Great Nicobar i.e.  $0.59 \pm 0.1$  groups/km (ER  $\pm$  SE) where the group encounter rate in Katchal island was  $0.36 \pm 0.2$  (ER  $\pm$  SE).

**Keywords:** Conservation, Distribution, *Macaca fascicularis umbrosus*, Nicobar long tailed macaque

## Introduction

Long tail macaque (*Macaca fascicularis*) is known to be widely distributed throughout the south-east Asian range. Out of 10 subspecies which have been recognised, most of them were isolated populations (Groves 2001). *Macaca fascicularis umbrosus* also known as Nicobar long tailed macaque is a subspecies which have a restricted distribution in the three islands namely Great Nicobar, Little Nicobar and Katchal of Nicobar Island groups. This subspecies is the only non-human primates found in Nicobar group of islands (Umapathy *et al.*, 2003). The species has been classified as 'Vulnerable' in IUCN Red list due to its restricted distribution, and susceptibility of its habitat to natural calamities (Ong, 2008). The subspecies is also accorded the highest protection under 'Schedule-I' of the Indian Wildlife Protection Act, 1972. This species is one of the least studied species among all primate species distributed in geographical space. The

available information on the species is largely related to the status surveys and short term investigations covering habitat ecology aspects (Molur *et al.*, 2003; Umapathy *et al.*, 2003; Sivakumar, 2010; Rajeshkumar & Raghunathan, 2014; Velankar *et al.*, 2016). However, the other subspecies have been studied significantly covering different ecological aspects (Sussman & Tattersall 1981; Zain *et al.*, 2010; San & Hamada, 2009; Eudey 2008; Yeager 1996; Kondo *et al.*, 1993; Hamada *et al.*, 2005; Nila 2014). Almost all populations of the long-tailed macaque distribution range are on decline due to habitat loss. The Bangladesh population got complete extirpation largely due to increasing shrimp cultivation and shipbuilding activities (Molur *et al.*, 2003). Its distribution range in other countries including Myanmar, Thailand, Cambodia, Laos, Vietnam, Sumatra, Borneo, Java, Philippines is getting contracted due to increasing pressure on habitat, illegal hunting (Molur *et al.*, 2003). In India also it is experiencing tremendous pressure

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due to land use change in its distribution range. The 2004 tsunami has significantly impacted its range in all three islands of Nicobar and resulted in drastic decline in its population. However, as per the latest study the population of the species has recovered from the severe decline caused by tsunami and the recovery has been attributed with recovery of native vegetation due to land vacated by human as much of human population earlier residing in coastal region have moved to interior parts of the island (Velankar *et al.*, 2016).

In India as per the latest assessment a total of 79 groups were recorded from three islands (Katchal, Little Nicobar and Great Nicobar) with mean group size of 39 and 43 individuals in Great Nicobar and Katchal islands (Velankar *et al.*, 2016) after the 2004 tsunami episode. However, before tsunami a total of 88 groups with mean size of 36 individuals were recorded in Great Nicobar, Little Nicobar and Katchal islands (Umaphathy *et al.*, 2003). Typically long-tailed macaque mostly occupies seashores, mangrove forests, river banks and swamp forests and can live successfully on edge habitats, often found near to human settlements in fields and plantations. It is an opportunistic feeders, omnivorous but primarily frugivorous and occasionally consume leaves and other plant parts, invertebrates (crustaceans, bivalves) and on the seashore, they select and transport rocks to crack open oysters to eat.

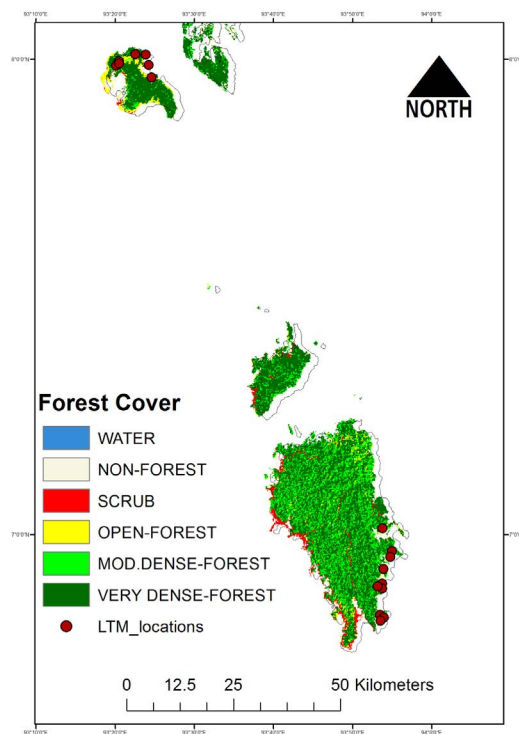
Considering the fact that the species prefer habitats near to seashore and low elevation areas it is vulnerable to the impacts of frequent extreme event such as tsunami because this part of world lies in high-seismic zone. In near future a tsunami of similar magnitude of 2004 can result in complete eradication of the species. Moreover, the futuristic climate prediction models are also predicting severer negative impacts in the coastal regions of the South-Eastern Asia (Rignot *et al.*, 2011; Brecht *et al.*, 2012). The present status survey has been carried out during December 2015 and April 2016 in two islands viz., Katchal and Great Nicobar out of the three islands where the species is distributed. The Little Nicobar island was not visited due to logistic constrains. The present survey was conducted with major objectives to assess the population status of Nicobar long-tailed macaque to understand the distribution range of the species in Katchal and Great Nicobar islands.

## Study Area

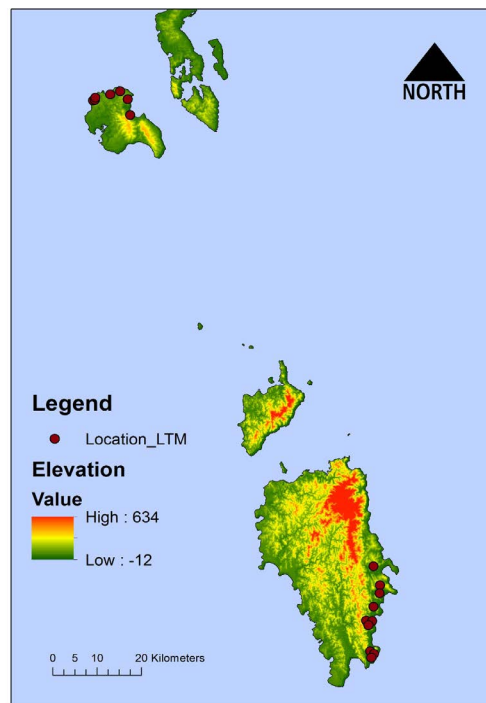
For the population status and distribution assessment of the long-tailed macaque the study was conducted in two islands out of the total three islands viz., Great Nicobar and Katchal in Nicobar group which represent the entire distribution range of the species, having an area of about 1,841 km<sup>2</sup>. The Nicobar group of islands are located in Bay of Bengal and falls under the 11 (island) bio-geographic zone. These islands form the southernmost extent of India and much of its area is designated as the Great Nicobar Biosphere Reserve. The landscape possesses high level of endemism and significantly rich in biological diversity (Tikader & Das, 1982). The vegetation in the study islands is classified as Tropical rainforest (Tropical wet evergreen, Tropical Moist Scrub and Mangrove scrub) with mixed floral elements of Indian, Myanmar, Malaysian and endemic floral elements (Tikader & Das, 1982). Considering the rich biodiversity and high level of endemism the Nicobar group of islands is also a part of Sundalands biodiversity hotspot (Tikader & Das, 1982). The Nicobar group of island together with Andaman group of islands forms Andaman and Nicobar archipelago which as constellation of about 574 islands and their spatial extent is of about 800 km. The two island groups are separated by the Ten-degree Channel which is about 150 km wide and 400 fathoms deep. The annual temperature in the landscape ranges from 24° C to 28° C and with an annual average precipitation of 3000 mm to 3500 mm making the climate warm and humid for most of the year. The major threats for the local biodiversity include degradation of land, agricultural expansion, mining and illegal hunting of wild animals. The study area map showing sampling points in contrast with the forest cover types (Figure 1) and in contrast with the elevation of the landscape (Figure 2).

## Methodology

For achieving the objectives with respect to assess the population status and distribution of long-tailed macaque in Nicobar group of islands a reconnaissance survey was conducted before marking line transects in the study area for collecting species abundance data in the study area.



**Figure 1.** Forest cover map of study area. Showing the different forest types across the Nicobar group of Islands. Forest cover map has been classified in to open-forest, moderate-dense forest, very dense forest, Scrubland, no forest and water bodies.



**Figure 2.** Elevation map of study area. SRTM 1-Arc Sec. Global data sets depicting elevation profiles across the Nicobar group of Islands. The colour ramp signifies the ranging from high to low elevation across the landscape, where red colour indicates the high elevation ranges and green showing the lower elevation ranges.

## Population status of Nicobar Long-tailed Macaque

These transects were laid systematically in all representative habitats where the presence of the species is reported by previous assessments (Umapathy *et al.*, 2003; Velankar *et al.*, 2016). In total 18 transects were laid and surveyed for species presence and abundance estimation in two islands with a minimum distance of 2 Km apart. Habitat parameters such as habitat type, altitude, aspect and slope were recorded for every sighting and sign of long-tailed macaque was recorded. For every sighting, in addition to the habitat parameters, data on time, sighting distance, sighting angle, troop size, age and sex were also recorded.

We have used line transects of varied length from 2 km to 8 km for sampling the species abundance *viz.*, Great Nicobar and Katchal. The Little Nicobar was not studied during the study due to logistic constraints. Out of the total 18 transects, 15 transects were marked in Great Nicobar and three in Katchal Islands. The surveys were conducted in morning and evening hours of the day and each transect was visited twice during the survey period (January 2015 (28 days), April 2016 (21 days)). The population demography data of the species was collected by following (Fittinghoff, 1972), and (Napier, 1967). Considering the fact that the species is shy observations were made in a way without disturbing the species. All groups observed during the study were systematically screened for the classification of individuals into different sex, age classes.

## Result

### Population status of Nicobar Long-tailed Macaque in Nicobar group of islands

Based on the field data collected during two survey periods the Nicobar long-tailed macaque individuals were identified using the morphological characters which

includes body size and sex. All the individuals of the population were grouped in different age classes such as adult, sub-adults, juveniles and infants. The individuals mainly sucking or breast feeders were classified as infants. The juvenile individuals were bigger in size than infants, independents and smaller in size to sub-adult animals. The sub-adults were identified as individuals smaller in size to adults and with developing secondary sexual characters. The adult males were fully grown animals with well-developed sexual characters such as animals with red colour scrotum. Whereas, the large sized females with pendulous breasts were classified as adult females in the population.

Based on the two systematic surveys conducted in the known habitats of the species, a total of n=28 groups comprises of n=958 individuals were observed and out of which n=193 individuals were observed in Katchal island and n=765 individuals were observed in Great Nicobar island. The group composition of the long tailed macaque does not differ significantly ( $P > 0.005$ ), ( $P = 0.738$ ) (Table no.1).

The mean group size was  $35.48 \pm 4.3$  (Mean  $\pm$  SE) for both the populations in Nicobar group of islands and the group size ranges from eight individuals to 97 individuals. Among all transects surveyed the largest group of 98 individuals was observed on Govind nagar transect and the smallest group composed of eight individuals was observed on Vijoy nagar transect. The mean adult males to adult female ratio in the total groups observed was 0.56 male: 1 adult female in both the populations (Table 2). Whereas, the mean number of infants per adult female ratio was 0.47 infant: 1 adult female. The percentage of adult male, adult female, juveniles and infants among Katchal and Great Nicobar population did not differ significantly ( $P > 0.005$ ) ( $P = 0.653$ ).

The group encounter rate was higher in Great Nicobar *i.e.*  $0.59 \pm 0.1$  groups/km (ER  $\pm$  SE) where the group encounter rate in Katchal Island was  $0.36 \pm 0.2$  groups/km (ER  $\pm$  SE) (Table 2).

**Table 1.** The group composition of long tailed macaque individuals in two study sites *i.e.* Katchal and Great Nicobar islands. N= average number of individuals and in brackets is the percentage of the group

Study sites	Adult male	Adult female	Subadult	Juvenile	Infants
Katchal	8 (16.58)	14.25 (29.53)	7.5 (15.54)	10.25 (21.24)	8.25 (17.10)
Great Nicobar	5.86 (17.64)	10.69 (32.15)	4.9 (14.77)	6.9 (20.91)	4.8 (14.50)
<b>Total</b>	<b>6.18 (17.43)</b>	<b>11.22 (31.63)</b>	<b>5.29 (14.93)</b>	<b>7.44 (20.98)</b>	<b>5.33 (15.03)</b>

**Table 2.** Table provides number of adult male to females and number of infants to adult female ratio.

Islands surveyed	Adult Female	Male-Female ratio	Infant-Female ratio
Great Nicobar	1	0.55	0.39
Katchal	1	0.57	0.57
<b>Total</b>	<b>1</b>	<b>0.56</b>	<b>0.48</b>

**Table 3.** A competitive analysis of the number of *M. f. umbrosus* groups encountered per kilometre during the four previous studies. (Umapathy *et al.*, 2003, Sivakumar, 2010, Velankar, *et al.*, 2016, Rajeshkumar & Raghunathan, 2014) and the present study in Nicobar group of islands

Islands	Pre Tsunami			Post tsunami											
	Year 2000 study by Umapathy <i>et al.</i> 2002			2006 study by Sivakumar 2010			Velankar <i>et al.</i> 2014			Rameshkumar and Raghunathan 2014			Present study		
	No. of trails	n of groups	Group/km	No. of trails	n of groups	Group/km	No. of trails	n of groups	Group/km	No. of trails	n of groups	Group/km	No. of trails	n of groups	Group/km
<b>Great nicobar</b>	16 (227.9)	53	0.23	41 (211.8)	22	0.104	26 (119.5)	36	0.30	14	29	0.592	14 (62.9)	24	0.59
<b>Little nicobar</b>	12 (62.7)	17	0.27	23 (99.1)	10	0.101	9 (14.1)	5	0.35	0	0	0	0	0	0
<b>Katchal</b>	12 (92.5)	18	0.19	17 (76.5)	8	0.105	20 (78.5)	38	0.48	0	0	0	4 (15)	4	0.36
<b>Total</b>	40 (383.1)	88	0.23	81 (387.4)	40	1.03	51 (212.1)	79	0.14	14	29	0.592	18 (77.9)	28	0.35

## Discussion

In the year 2004, the study area has experienced devastating tsunami which has greatly impacted the coastal habitats at most, however, much of the forested habitats of these islands got disturbed (Ramachandran *et al.*, 2005; Porwal *et al.*, 2011). The catastrophic event like tsunami has potential to significantly impact the population of the species of the area by way of completely destroying the habitat or may change the micro-environmental characteristics of the habitat. The Nicobar Longtailed macaque has also experienced the negative impacts of the tsunami but the population of the species has shown signs of recovery (Velankar *et al.*, 2016).

The *M. fascicularis* is one of the widely distributed and densely populated primate occupying areas close to human habitations. As per an estimate by (Fooden, 1995) about 3 million individuals exists with several isolated population of its sub-species in South-Eastern Asia. The Nicobar long-tailed macaque *M. f. umbrosus* population is comparatively small to other sub-species *M. f. fascicularis* found in Indonesia (3,376,860 individuals) (MacKinnon, 1986) and Peninsular Malaysia (133,403 individuals) (Karuppanan *et al.*, 2014). The island populations of the species are more vulnerable to the main land population

considering the fact that they are geo-graphically isolated and does not have any connectivity and high level of inbreeding can results in loss of genetic vigor (Kondo *et al.*, 1993). Till date no population genetic data is available for the present species from India. Hence, in the light of increase in frequency of extreme events due to climatic variability it is imperative to evaluate the population genetic parameters of the species to understand the long term viability of the species.

During the study period 18 transects covering 77.9 km walked which has resulted in sighting of 958 individuals in 28 groups in both the study areas i.e. Katchal and Great Nicobar islands. The present estimate is more than the estimates provided by (Rajeshkumar & Raghunathan, 2014) (n=882 individuals in 29 groups), (Sivakumar, 2010) (n=814 individuals in 40 groups).

Since year 2000 four studies were carried out by different researchers to understand the population status of the species in Nicobar group of islands and provided different encounter rates. In the present study the mean group encounter rate was 0.35 per kilometre walk which was less than the encounter rate provides by two studies published during 2010 and 2014 by Sivakumar (2010) (ER = 1.03) and (Rajeshkumar & Raghunathan, 2014) (ER = 0.59) and higher than the estimates of (Umapathy *et al.*, 2003) (ER = 0.23)





**Plate 1.** Nicobar Long tailed Macaque in its natural forested habitat.



**Plate 2.** Nicobar Long tailed Macaque near human habitation.

and (Velankar *et al.*, 2016) (ER = 0.14). There is a decline in mean group size in the present study was  $34.48 \pm 4.37$  with respect to the previously estimated  $41.30 \pm 20.02$  (Mean  $\pm$  SE). Furthermore, as per (Velankar *et al.*, 2016) previously reported mean group size were also not significantly different. The estimated numbers of individuals in both the population in the present study were showing positive trends. The male to female ratio in the present study was 0.56:1 which comparatively lower than the ratio reported by (Rajeshkumar & Raghunathan, 2014) (0.80:1). Furthermore the number of infants to adult female in the present study was 0.42:1 which was lower than reported by (Rajeshkumar

& Raghunathan, 2014). The lower number of males and infants in the present study is not a good indication for the species for its long term viability.

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