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Demographic Insights Of Nilgiri Langur (Semnopithecus Johnii) In The Periyar Tiger Reserve, Kerala

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Abstract:
The Nilgiri Langur (Semnopithecus johnii), an endemic and vulnerable primate of the Western Ghats, India, was studied in the Periyar Tiger Reserve (PTR), Kerala, to analyze its distribution, demography, and habitat preferences. Surveys were conducted using the Total Count Method within hexagonal grids of five square kilometers, systematically covering various habitats. Data on group location, size, and age-sex composition were recorded for each sighting. A total of 1389 individuals across 118 troops were documented, with the majority found in the Periyar Range. Vegetation analysis revealed a strong preference for Tropical Wet Evergreen Forests (54%), followed by Tropical Semi-Evergreen (30%) and Tropical Moist Deciduous Forests (14%). Nilgiri langurs were primarily observed at mid-elevations (750–1500 m), though their range extended from 750 m to 2019 m. Average group size was approximately 12 individuals, varying with habitat type, with larger groups in evergreen forests. Geospatial analysis confirmed the species' affinity for forested areas with tree cover and flooded vegetation, showing low adaptability to anthropogenically altered landscapes. This study reaffirms the Nilgiri Langur as a habitat specialist. Effective conservation strategies must prioritize the preservation of undisturbed evergreen and semi-evergreen forest patches and maintain habitat connectivity to ensure the long-term survival of this IUCN Vulnerable species.

Key Word: *Periyar Tiger Reserve, Nilgiri Langur, Demography, Troop size.*

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I. Introduction

Primate is one of the most diverse groupings of mammals, with 300 or more species and 600 or more subspecies. Asian primates contain 13 genera, 176 species, and subspecies (Groves 2004). Primates normally live in groups, and Asian colonies are typically structured around a single male social group (Müller & Thalmann 2000). Environmental factors like season, habitat openness, and food availability all have an impact on group size (Roy 2012). Many estimates of group size and composition are derived from sampling transects; however, these estimates frequently underestimate the real values (Jathanna et al. 2003). Primates, because of their physical resemblance to humans, have always fascinated people. The interest of scientists in primates primarily began in the field of physical anthropology and evolutionary biology –tracing human evolution from primate fossils (Diogo, 2018). The systematic study of primate behavior began in the 1940s. Depending on their backgrounds, different scientists were primarily interested in different elements of primate behavior. zoologists focus mostly on underlying structures and physiological processes; anthropologists on behavioral evolution; and psychologists on behavior and cognition (Johnson 2001). By the 1960s, primatology had evolved into an almost full-fledged discipline. Primates are widely spread throughout the tropics. With a diverse range of ecosystems and habitats, India is home to over 30 species and subspecies of primates, including lories, macaques, langurs, and apes. These primate species are found throughout India, with several taxa being restricted to very small areas. India's biodiversity hotspots, the Western Ghats and the North-Eastern Himalayan mountains, are rich in primate variety (Yashmita-Ulman et al. 2021).

Primates and non-primates are two types of animals. Primates and non-primates share most of their anatomy and physiology. The primary distinction between primates and non-primates is that primates have a large and complex forebrain, whereas non-primates have a tiny brain and are adapted to an arboreal lifestyle (Scott McGraw 2023). Some ape species have prehensile tails. The Western Ghats are home to five of India's 17 primates, which is similar to the North Eastern Himalaya in terms of primate richness and endemism. Because of the existence of continuous canopy and the availability of varied fruit-bearing trees throughout the year, the rain forests of the Western Ghats are highly rich in arboreal faunal diversity, notably non-human primates (Kavana et al 2025). The 5 species of diurnal non-human primates are the LTM, Bonnet Macaque, Nilgiri Langur and 2 species of Hanuman Langur: Semnopithecus hypoleucos and S. priam (Ashalakshmi et al. 2015).

Nilgiri Langurs are indigenous to regions of Kerala, India, and are known to reside in groups of about 15 animals. The group size has been observed to vary between 2 and 29. The deciduous woodland has fewer animals (6-8), while the evergreen forest has more (18-20). Additionally, Nilgiri Langur has been investigated on the Western Ghats (Horwich, 1980). Nilgiri Langur, a black leaf monkey, is restricted to evergreen woods. It is often found in both dry and damp deciduous woods in the Western Ghats. Furthermore, it is adapted to live in anthropogenic ecosystems such as eucalyptus and teak plantations. The species is included in Appendix II of CITES. They are also protected under Schedule I, Part I of the Indian Wildlife Protection Act, 1972, and are classed as Vulnerable C2a (i) on the IUCN Red Data List (Umapathy & Kumar 2003).

II. Material And Methods

Survey Design and Data Collection: Nilgiri langurs exist in a range of habitats, and for this study, the entire landscape was divided into hexagonal grids of five square kilometers each, chosen for their spatial efficiency above traditional block designs. The Total Count Method (NRC 1981) was used to conduct systematic walks within each grid, including existing trails and animal corridors of varying lengths. Routes were tracked with a handheld GPS device (Garmin eTrex 30x), and spatial data was plotted and analyzed using ArcGIS software. During these excursions, every primate species encountered was recorded. For each Nilgiri langur sighting, detailed information was gathered, such as the group's location, size, and age-sex composition. More time was spent investigating each Nilgiri langur group to accurately identify individuals and collect reliable data on group structure and demographic composition.

Study Location: The Western Ghats (WG) are a mountain range that runs along the Arabian Sea coast, beginning south of the Tapti River and continuing to Kanyakumari at India's southern tip. This location is recognized as one of the world's richest biodiversity hotspots, and it has worldwide ecological significance. The current study focuses on the Periyar Tiger Reserve, which is located within the Periyar-Agasthyamalai region. This area serves as a watershed for the Periyar and Pamba rivers, which are critical to the livelihoods of many rural and urban residents. The Periyar Tiger Reserve is also a UNESCO World Natural Heritage Site, which recognizes its unique ecological and cultural value. PTR is located in the Western Ghat Hills, specifically the Cardamom and Pandalam Hills in the Southern Western Ghats, between latitudes 9° 17′ 56.04" and 9° 37′ 10.2" N and longitudes 76° 56′ 12.12" and 77° 25′ 5.52" E (Figure 1).

PTR covers 925 Km^2 of fairly undulating terrain, with heights ranging from 81 m above MSL (lowest) to 2016 m (highest), with an average elevation of 1200 m. The temperature is cool and humid, and the average annual precipitation is 2500 mm. The temperature fluctuates from 15°C to 31°C, with the hottest months being April and May and the coolest being December and January. The forest vegetation ranges from highland evergreen forests at higher elevations to all of the major tropical vegetation types on the lower slope.

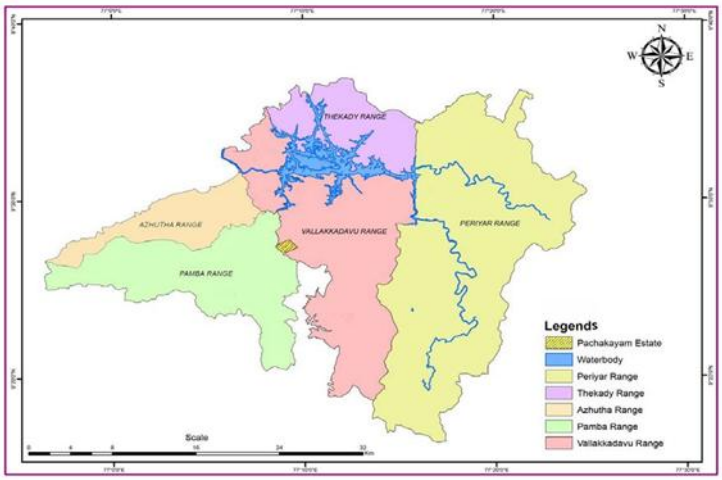

Fig 1. Periyar Tiger Reserve Range Map

III. Result

A total of 1,389 Nilgiri langurs were observed over 118. Troops were not evenly dispersed across the landscape, with the Periyar Range accounting for the majority of the population. Lower numbers were observed in the Azhutha Range (Figure 2), while higher numbers were recorded in the Periyar Range. This geographical heterogeneity indicates a significant ecological preference or habitat appropriateness gradient across the research area.

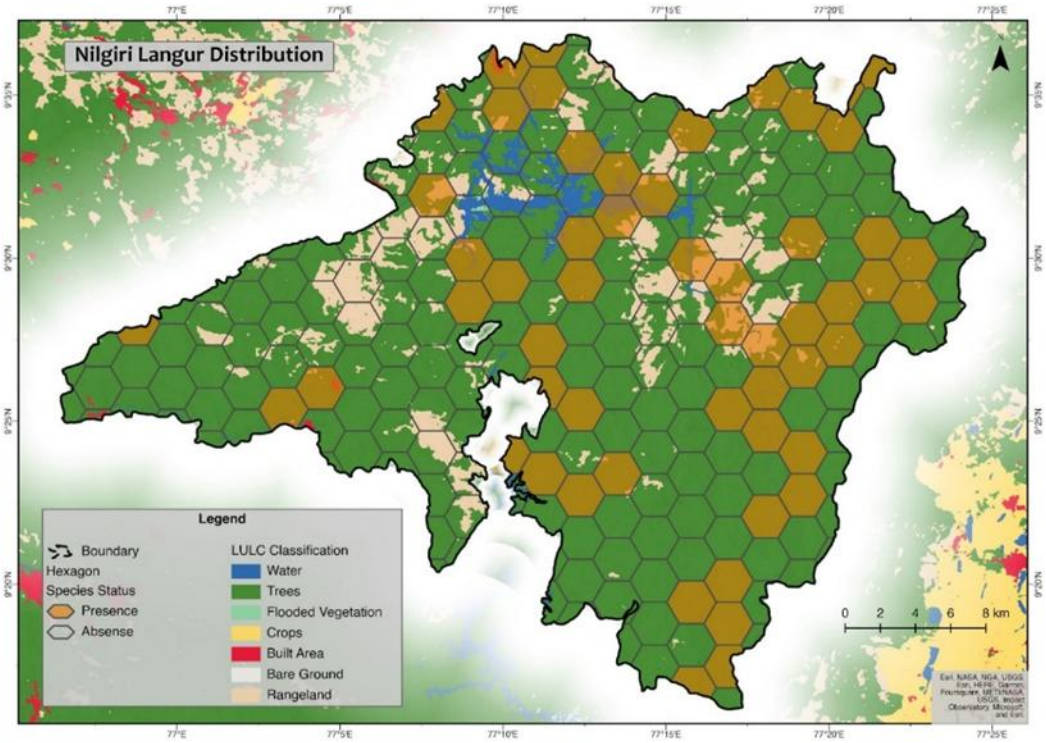

Fig 2. The detection of Nilgiri langurs in Classified vegetation of Periyar Tiger Reserve with overlaid grids for sampling

Habitat Preference Based on Vegetation Type

Vegetation-wise distribution showed marked preferences among the recorded individuals. A comparative percentage-based analysis of the total troop observations yielded the following proportions (Figure 3).

Table 1. Vegetation wide distribution

Sl No	Vegetation Type	Percentage of Individuals
1	Tropical Wet Evergreen Forest	54%
2	Tropical Semi-Evergreen Forest	30%
3	Tropical Moist Deciduous Forest	14%
4	Mountain Wet Temperate Forest	2%

This distribution indicates a clear ecological preference for tropical wet evergreen forests, supporting more than half (54%) of the observed population. Conversely, mountain wet temperate forests were least utilized (2%).

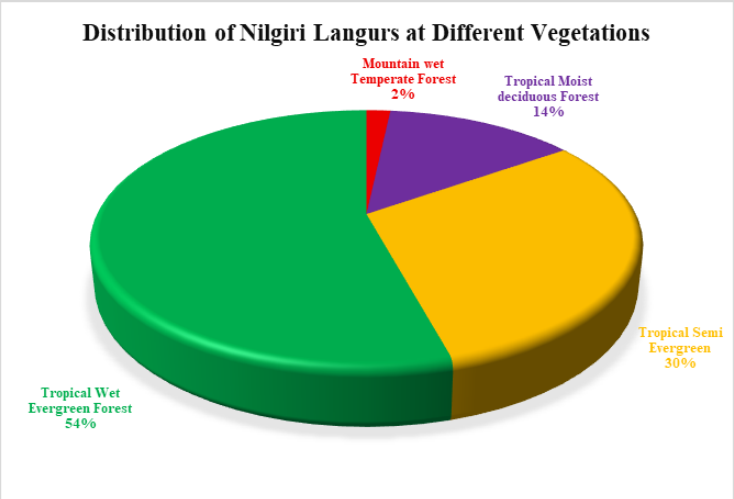

Fig. 3. Distribution of Nilgiri langurs at different vegetations

Statistical Analysis

A Chi-square goodness-of-fit test was used to determine whether the observed distribution of Nilgiri langurs among different plant types was substantially different from a uniform distribution. The null hypothesis suggested that langur populations were evenly distributed across the four vegetation categories, resulting in an expected frequency of 347.25 individuals per category (1389 individuals divided by four types). The observed frequencies are as follows: 750 individuals live in tropical wet evergreen woods, 417 in tropical semi-evergreen forests, 195 in tropical moist deciduous forests, and 28 in mountain wet temperate forests. The estimated Chi-square value was statistically significant, with a degree of freedom (df) of three and a p-value less than 0.0001. This finding strongly rejects the null hypothesis and indicates that the distribution of Nilgiri langurs among plant types is not random. The species' strong affinity for tropical wet evergreen forests, in particular, emphasizes the species' ecological reliance on dense, evergreen habitats and the conservation value of such forest ecosystems within its range

IV. Conclusion

The current study examines the distribution, demographics, and habitat preferences of the Nilgiri Langur (Semnopithecus johnii) in the Periyar Tiger Reserve (PTR), Kerala, India. A total of 1389 individuals were observed across 118 troops, indicating that this endemic primate is widely distributed across the reserve. The Periyar Range had the most troops, followed by the Azhutha, Pamba, Vallakkadavu, and Thekkady ranges, which had fewer troops.

Vegetation and Habitat Preference

The vegetation-based distribution analysis (see Figure: Pie Chart) revealed that Nilgiri langurs predominantly occupy Tropical Wet Evergreen Forests (54%), followed by Tropical Semi-Evergreen (30%), Tropical Moist Deciduous Forests (14%), and to a minimal extent, Mountain Wet Temperate Forests (2%). This supports earlier findings (Malviya et al., 2011; Sunderraj, 2001) that S. johnii shows a strong affinity for dense, evergreen, and semi-evergreen forests, which provide adequate canopy cover and fruit-bearing vegetation for arboreal species.

Altitudinal Range

Nilgiri langurs were observed from lower altitudes of 750 m up to 2019 m at Kottamala, one of the highest peaks in the reserve. However, the majority of sightings occurred between 750–1500 m, indicating a preference for mid-elevation habitats. This range likely offers optimal microclimatic conditions, abundant food resources, and reduced anthropogenic pressure.

Group Size and Demography

Troop numbers ranged from 3 to 23, with an average group size of around 12 people per troop. The composition varied greatly depending on habitat type; as previous studies have shown, bigger groups (18-20 members) were identified in evergreen habitats, whereas smaller groups (6-8 members) were recorded in deciduous woods. This pattern is related to differences in food supply, habitat structure, and canopy connectivity.

Conservation Implications

The IUCN lists Nilgiri langurs as Vulnerable (C2a(i)) and includes them in Schedule I of the Indian Wildlife Protection Act of 1972. Their concentration in ecologically intact areas of the PTR emphasizes the significance of preserving core evergreen forest habitat. Furthermore, anthropogenic pressure, plantation expansion, and climate change all pose continuous hazards to the species' habitat survival. The presence of soldiers near eucalyptus and teak plantations suggests some degree of behavioral plasticity, although such adaptability may not be long-term sustainable.

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