

Conservation Book

An Assessment of the Population and Habitat Use of the Grey - breasted Laughingthrush

S. Somasundaram
&
Lalitha Vijayan



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Sálim Ali Centre for Ornithology
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An Assessment of the Population and Habitat Use of the Grey - breasted Laughingthrush

Funded by



OBC Oriental Bird Club

Principal Investigator

S. Somasundaram

Consultant

Lalitha Vijayan



Salim Ali Centre for Ornithology and Natural History

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S. Somasundaram is a doctoral student of SACON, and his area of specialization is endemic and endangered species conservation.

Lalitha Vijayan is the Senior Principal Scientist in the Division of Conservation Ecology. She received her Ph.D. degree from Bombay University for a study on the comparative biology of drongos in South India under the guidance of late Dr. Salim Ali. She worked in a multidisciplinary project on the 'Ecosystem of Keoladeo National Park' for a decade. At SACON, she has been working on the avian communities and endangered species in the Western Ghats and Andaman Islands and, on the wetlands.

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S. Somasundaram

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Moongilpallam, Anaikatty P.O.
Coimbatore 641 108, INDIA
Ph: 0422-2657103 to 105
Fax: 0422-2657088
Email: salimali@vsnl.com

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INTRODUCTION

The pressures for land use change have led to a steady loss of habitat and to an increasing isolation of habitat remnants throughout the world (Henle et al. 2004). Habitat destruction and fragmentation are the most likely major causes of the increase in the rate of species extinction in recent decades (Henle and Streit 1990; Groombridge 1992; Burgman and Lindenmayer 1998). As fragmentation proceeds, stochastic forces are added to the deterministic declines caused by a dwindling supply of habitat (Zuidema et al. 1996). Even when the loss and fragmentation of habitats is halted, there may be a legacy of further species loss due to stochastic extinction (Shaffer 1981; Belovsky 1987) and the relaxation of communities within the remnants (Diamond 1984; Wilcove et al. 1986; Terborgh et al. 1997).

In the wake of this process some species may disappear, first locally, then regionally, and finally globally. There are about 12% of the approximately 10,000 bird species are threatened with extinction in the next 10 to 100 years, and another 8% are near-threatened [Stattersfield and Capper 2000]. This loss of species is likely to result in the collapse of significant ecosystem processes and free ecosystem services to people [Daily 1997], such as pest control by insectivorous birds.

Relationship between the habitat and populations of species and its importance in ecology and conservation are documented in several species of birds (Cody 1985). Environmental changes particularly those associated with habitat alteration are of concern to biologists because they are expected to lead to changes in number and types of species present in communities (Vitousek *et al.* 1997). Variation over time in habitat characteristics in response to disturbance regime can influence communities in a number of ways. Short-term stochastic events (such as extreme weather or fire) may temporarily reduce populations of a certain species while providing favorable conditions for others. On the other hand, long-term impacts could cause permanent

changes in the types of species a particular location can support. The aggregated effect of many localized changes, however, may lead to substantial and perhaps permanent shifts in the composition of the regional biota. Slow and directional environmental change over broad spatial extents have been particularly difficult to study, due to both a lack of long-term, large-scale data and the difficulty of conducting large-scale experiments. Some researchers have used patterns observed over spatial gradients to simulate and predict community responses to temporal change (Sodhi 2006).

Tropical forest are well known their biological diversity (Myers 1988) and the most important habitat for threatened birds (BirdLife International 2001); but much of it is lost over the years in many parts of the world mainly due to human interferences (Castelletta *et al* 2000). The remaining such forests is not only being lost but also degraded affecting the flora and fauna. The patterns and processes in natural communities are affected largely by habitat alteration or degradation through human interference such as urbanization, conversion of forest into plantation, croplands, reservoirs and so on (Vijayan & Gokula 2006). The impact of such changes is much more in the tropical forests that are richer in biological diversity. Although these forests cover only 14% of the land surface, they hold at least half the world's species (Myers 1988) and thus the loss of even a few hectares of forest could bring with it the disappearance of probably a large number of species. In India, the Western Ghats, one of the Global hottest Hotspots of Biodiversity (Mittermeier *et al* 1998, Myers *et al* 2000) and Endemic Bird Areas (Stattersfield *et al* 1998) has been facing habitat loss. Many habitat specialists and endemics have been becoming rare and threatened because of extensive habitat alterations (Prabhakar & Gadgil 1994, Vijayan & Gokula 1999, 2006, Vijayan *et al.* 1999, 2005, Somasundaram & Vijayan 2005, Vijayan & Vijayan 2006, Somasundaram 2006, Somasundaram & Vijayan 2006). One of the globally threatened species the Nilgiri Laughing Thrush has been found to disappear from a few localities (Vijayan & Prasad 2004). The Grey breasted Laughingthrush *Gerulax jerdoni* is a globally near

threatened species endemic to the Western Ghats (BirdLife International 2001). Laughing thrushes, of the genus *Garrulax* lesson, are birds of the avian family Musicapidae, comprising 46 species (Zuoxin, 1982) of which 26 occur in the Indian subcontinent. Grey breasted Laughing thrush *Garrulax jerdoni* one of the 16 species of birds endemic to the Western Ghats (Stattersfield *et al* 1998). It is found on the hills of Kerala and Western Tamil Nadu from 1200m to the summit. This species, once common and resident in the southern Western Ghats (Islam 1985, Ali & Ripley 1987) inhabiting in the shola forests, has been becoming locally rare and hence listed under near threatened. Since many species were affected by a variety of human disturbances, the need was felt to examine the status and the population of this species and compare with the data of Islam during 1980-81 in the Palni Hills (Islam 1985) and hence, this study was taken up in the Palni Hills during the breeding season of this species from February 2006 to June 2006.

Although there are 16 endemic birds in the Western Ghats, detailed ecology of only seven species, namely the Black-and-Orange Flycatcher (Khan 1977, 1978), Grey-breasted Laughing Thrush and Nilgiri Laughing Thrush (Islam 1985), Malabar Grey Hornbill (Maheswaran 2001), Grey-headed Bulbul (Vijayan & Balakrishnan 2006), Nilgiri Wood Pigeon and Nilgiri Pipit (Vijayan *et al.* 2005) have been documented. Apart from these, Vijayan *et al.* (2000) have estimated the population of the Nilgiri Laughing Thrush in the Upper Nilgiris. Breeding biology of the Blue-winged (Malabar) Parakeet was recorded by Gokula and Venkatraman (2003). Status and habitat preference of the White-bellied Shortwing in the Western Ghats were studied by Robin and Sukumar (2002) and Robin *et al.* (2006). Non-breeding ecology of the Nilgiri Flycatcher was documented by Ranjini (2003) and it's breeding by Somasundaram and Vijayan (*comm.*).

Information on the biology and ecological requirements is available only for a few species (Somasundaram 2006). Status surveys for assessing the population form the top priority for all the species. Basic studies on ecology are essential

for conservation and management. Based on the uses of the habitat, an evaluation of the habitat suitability and requirement can be done including habitat modeling using remote sensing and GIS techniques (Prasad *et al* 1998, Vijayan *et al* 2005). Such models can be utilized for habitat management and conservation (Prasad *et al.* 1996, Vijayan *et al.* 2000).

The Grey-breasted Laughing Thrush *Garrulax jerdonii* is a globally near threatened endemic bird of the Western Ghats with a very narrow range of distribution in the upper reaches of the southern Western Ghats inhabiting the montane wet temperate (shola) forest. Islam (1985) studied the ecology of this species for one year. He documented the breeding population at Poombarai and Paricombai in Kodaikkanal forest division. Continuous habitat loss by alteration of forests for various purposes has brought about extensive damage and fragmentation of forests in the Western Ghats with losses of 25% forest cover in Palni hills during the 1972 - 80. Under-storey birds are known to be the most sensitive to disturbance in the forest structure as they are most adapted to specific microhabitat conditions. Hence, the project was undertaken with the following objectives:

- Assess the status of the globally near threatened Grey-breasted Laughing Thrush with respect to its population, habitat use and availability and, compare it with the earlier data.
- Identify threats to the habitat and species and suggest conservation measures.

STUDY AREA

The study was conducted in the Palni Hills in the Western Ghats. The Palni Hills (10°1' N to 10°26' N; 77°14' E to 77°52' E) got their English name from the

town Palani, which lies just north of them, the native appellation of which is Varahagiri or Boar Hills (Anon 1908). Palni Hills come under Dindigul District with the revenue taluks of Palani, Kodaikanal and Bathalakundu. The north and east of Palni Hills are bounded by Dindigul district, west by Periyakualm taluk of Theni District, and the north-east by Udumalpet taluk of Coimbatore District. While all these are all in Tamil Nadu, the south-west of Palni Hills is bounded by Iddukki District of Kerala. Kodaikanal is a sanitarium in the Upper Palni Hills. There are about 2.25 lakhs people living in the Upper Palni Hills (www.tamilnadu/dindigul/maps.com).

The Palni Hills are the south-eastern offshoot of the Western Ghats in Tamil Nadu, with altitude ranging from 300 m to nearly 2600 m above msl. (Sustainable Development Programme 1992). It is one of the highly fragmented and populated areas in the Western Ghats. It covers 12600.48 km², out of which 2130.04 km² is forest with different types of vegetation, namely evergreen, semi-evergreen, moist deciduous, dry-deciduous, dry evergreen, shola forests and grasslands. Dry deciduous forest (816.92 km²) covers the maximum and, shola (6.58 km²) the minimum (Amarnath *et al.* 2003). The Palni Hills is in the catchments of the rivers, namely Kodaganaru, Palar, Kuthiraiyar, Porandalar, Varadhamanathi, Manjalar and Aruthanathi, which drain into two major rivers; Vaigai and Cauveri. Nine dams were constructed in these rivers mainly for irrigation and drinking water for Dindigul, Madurai and Theni districts (Table 1). The Palni Hills consists of two well-marked topographic divisions, namely Upper Palnis and Lower Palnis with the elevation ranging between 1500-2450 m and 300 -1500 m respectively. The Lower Palnis consists of slopes with (c.1683 sq. km) more tropical moist vegetation.

Plate I - Habitat types



Undisturbed Shola

Disturbed Shola with *Acacia*
plantation



Cultivation land

Table 1 Vegetative cover in the Palni Hills

Vegetation type	Area in Km ²
Evergreen	285.86
Semi-evergreen	110.48
Moist deciduous	626.89
Dry deciduous	816.92
Shola	6.58
Grassland	283.30
Total Area	2130.04

Source: Amarnath *et al.* 2003.

The Upper Palnis is an undulating plateau known as Kodaikanal plateau, which stretches from the outskirts of Kodaikanal town to the Kerala state on the west. It includes the eastern slopes of the Western Ghats running southwards. The highest peak, Vandaravu in the Upper Palnis occurs near the Tamil Nadu - Kerala border (2554 m msl). The Upper Palni plateau, extending to 385 sq km with an average altitude of 2200 m, consists of undulating slopes of grasslands (16627 ha) interspersed with forests, locally called Sholas (2337 ha), with subtropical or temperate vegetation. It comprises three valleys, namely Parrappar- Devanakarai Valley with the Perumal peak 2205 m, Gundar Valley with Observatory 2343 m, Karumankadu 2439 m in the east and, Vembadi with Vembadi peak 2506 m and Upper Amaravathi Valley with Vandaravu peak 2506 m in the west. On the north of the Kodaikanal plateau, two great valleys pierce the hills and penetrate southwards as far as the Vilpatti and Poomparai. Of these, the Poomparai valley is the most striking with its parallel sides almost cut up with cultivation.

Status survey of the Grey breasted Laughingthrush was carried out in the Kodaikkandal forest division are Kodaikanal Botanical garden, Golf course, Berijam, Mannavanur, Kukkal, Poombarai and Paricombai. At Poombarai and Paricombai most of the natural shola vegetation was replaced with wattle and

pine. Surveys were conducted at the study sites from February to April 2006. Elevation of the places is above 1850 m. Of these areas Kukkal and Poombarai, is considered as Important Bird Areas in India (Islam & Rahmani 2004) and Asia (Chan *et al* 2004).

Conservation issues in the Palni Hills

The Palni Hills had a large area of evergreen forests but currently most of them are fragmented to smaller patches which might be due to the large number of orchards and commercial plantations and lack of protected areas (Amarnath *et al.* 2003).

Coupled with the destruction of forests and large scale introduction of commercial species, came the invasion of weeds such as *Ageratina adenophora* and *Lantana camara*. These have, irretrievably altered the floristic face of the Palni Hills. The primary vegetation now is confined to isolated pockets such as Kukkal (330 ha) and Mathikettan (100 ha) sholas both of which are listed as Nature Reserves. Wattle, Eucalyptus and Pine are the major plantations which alone accounted for 23,037 ha in 1986-87. Expansion of agriculture, requirements of local people for timber and fuel wood, and cattle grazing also made a telling effect on the natural vegetation.

It may be noted that the National Remote Sensing Agency, Hyderabad has reported a loss of 25 % of the forest cover in the Palni Hills between 1972 and 1980. The impact of such a loss of forests on the watershed and biodiversity has already been reported by Mathew (1990).

Major problems specific to Kukkal are collection of fire wood and lichen, cattle grazing, and wood cutting while the major problem for Pambar is disposal of a large quantity of plastics as a result of the increased tourism.

Physical features

Climate

The Kodaikanal taluk falls in the tropical zone, but it enjoys a sub-tropical to temperate climate.

Temperature

The minimum temperature of Kodaikkanal town varies between 8 °C and 13° C and the maximum between 17° C and 22° C. The average annual mean maximum and minimum temperature for the last 10 years was 19°C and 8°C respectively. Monthly average of the maximum was (22.6°C) in March –April and the minimum (8.3°C) in December during the intensive study (Fig. 0).

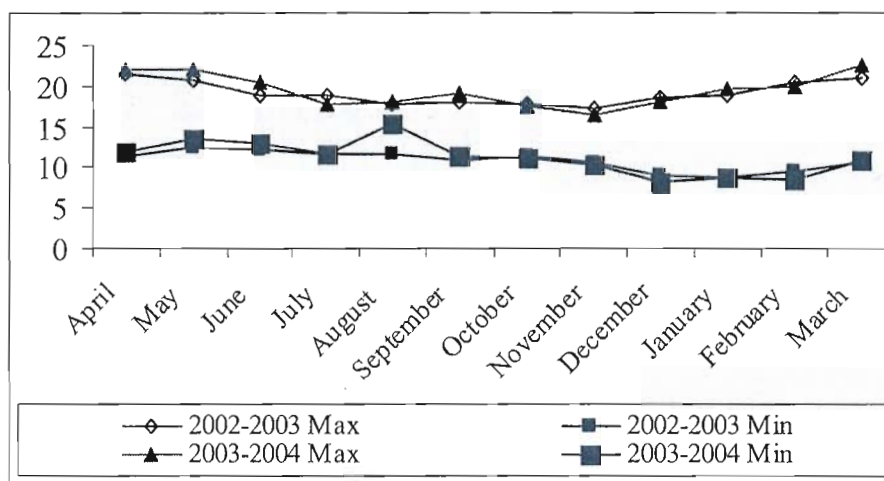


Figure 00 Monthly mean maximum-minimum temperature in the Palni Hills during April 2002 to March 2004.

Relative humidity

The mean humidity of the area was 77.5 % during 2002 – 2003 while it was slightly less (74 %) during 2003 – 2004. Annual average varied from 51 % to 89 % during 2002 -2003 while it was 49% to 89 % during 2003 -2004 (Fig. 2.4).

Rainfall

The Palni Hills receives both the south-west and north-east monsoons but the maximum rainfall was from the latter. The total rainfall was the highest in October (Fig. 2.5), while the number of rainy days was the highest in September and October (Fig. 2.6). A minimum of 2.5mm rain in a day is considered as rainy day. Winter (December – February) had comparatively less rain.

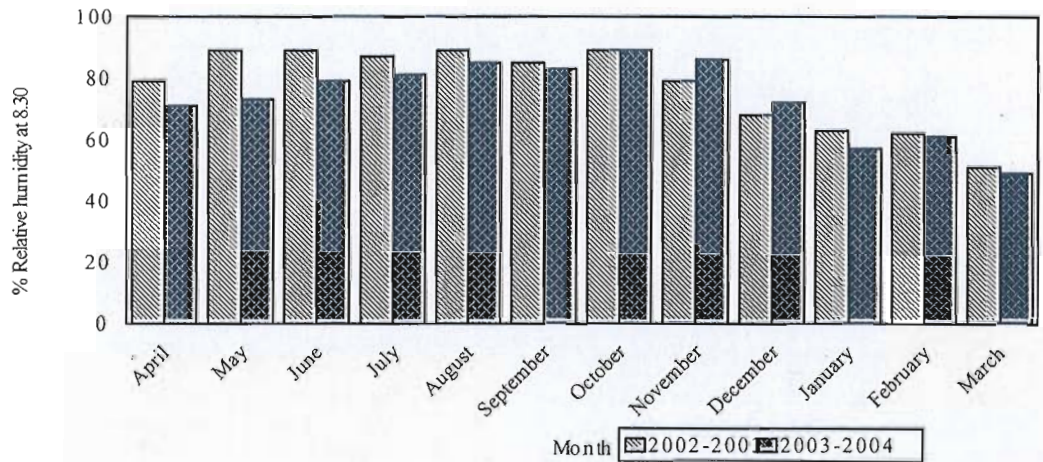


Figure 00 Mean monthly relative humidity at Kukkal from April 2002 to March 2004.

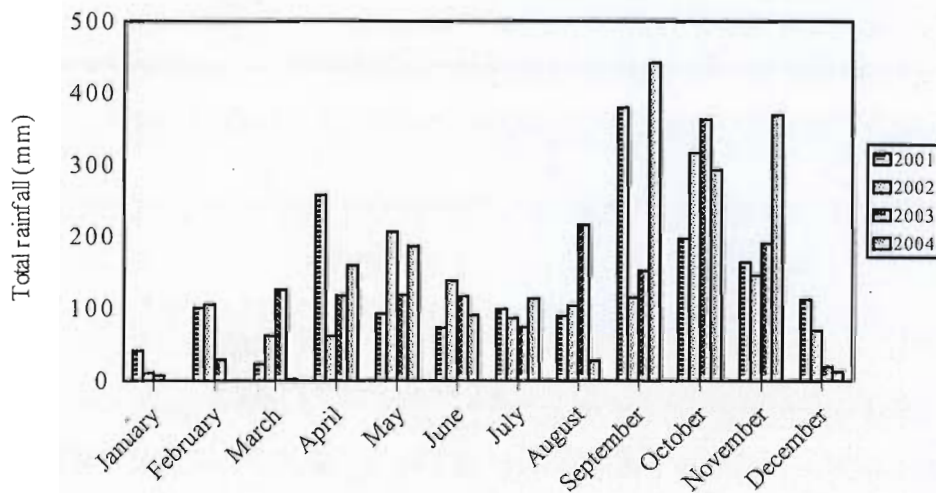


Figure 00 Variation in the monthly rainfall in the intensive study area

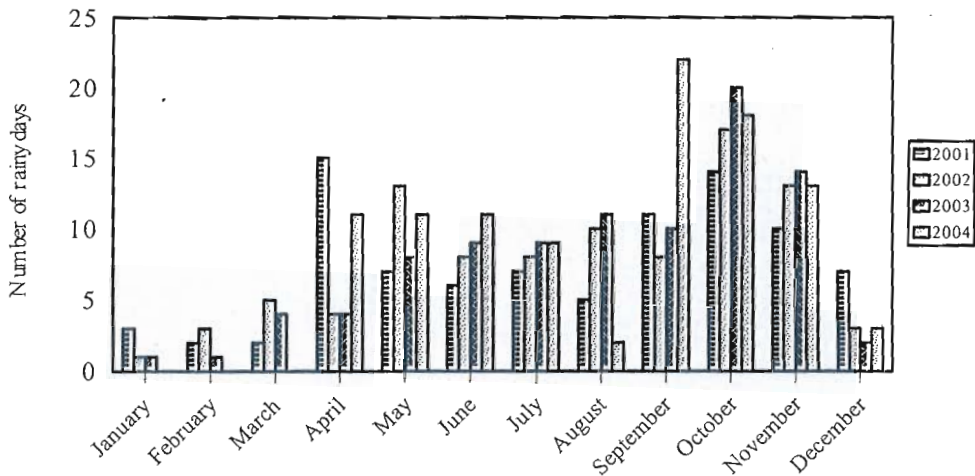


Figure 00 Number of rainy days in various months the intensive study area
Geomorphology and soil

The Western Ghats was formed in Archean age, represented by gneiss and granites. The Palni Hills consists of plutonic rocks. The rocks are entirely charnockites, bluish granite, through broad bands of feldspars and quartz cross the gneissic foliations. The out slopes of the hills were washed mainly by rain because of rarity of vegetation. The soil found in slopes is brown and loamy, and is rich in organic matter while it is clayey in the valley. The thickness of the topsoil varied from a few millimeters to 90 cm. The soil is rich in iron and aluminum oxides and the porous thickness was measured up to 1m (Amarnath *et al.* 2003).

Vegetation

The natural vegetation in the Kodaikannal area is the southern montane wet temperate forest, commonly known as "Shola". This specialized forest is distributed all over the rolling hills, especially in sheltered folds in the hills either at the head of the streams or on the converging slopes. These are usually confined to sites where there is good atmospheric moisture (Khan 1977, Nair *et al.* 2001). The Shola forests exhibit high bio-diversity. 75 species of Threatened plants (34 families) were recorded in the Palni Hills (Matthew 1996). A recent study shows 60 new species of plants and 82 species of orchids (Amarnath *et al.* 2003).

There are vast stretches of grasslands in the Palni Hills. However in many places exotics such as *Acacia*, *Eucalyptus* and *Pine* have been planted. Other exotic species such as *Cytisus*, *Ulex*, *Eupatorium*, and *Rubus* became naturalized in the areas especially along the roadside.

Plant community was studied in 1.08 ha of montane wet temperate (shola) forest. 97 species of plants were identified, out of which 63 were trees, 19 shrubs, and 15 stragglers (Appendix I). 18 tree species were endemic, of which *Beilschmiedia wightii* (74 trees / ha) was the most dominant followed by *Rhododendron nilagiricum* (67 / ha). Among shrubs, *Psychotria nilgiriensis* (208 / ha), followed by *Ardisia rhomboidea* (35 / ha) were the dominant endemics.

Vegetation profile of montane wet temperate forest was dominated by trees with 2.5 to 7.5 m height (Fig. 2.7). The dominant trees were *Phoebe paniculata*, *Symplocos foliosa*, *Neolitsea zeylanica*, and *Maesa indica*. The dominant shrub species were *Psychotria nilgiriensis* var. *astephana*, and *Lasianthus acuminatus*. The dominant stragglers (lianas) were *Ventilago bomaniensis*, *Piper mullesua*, and *Ampelocissus araneosa*.

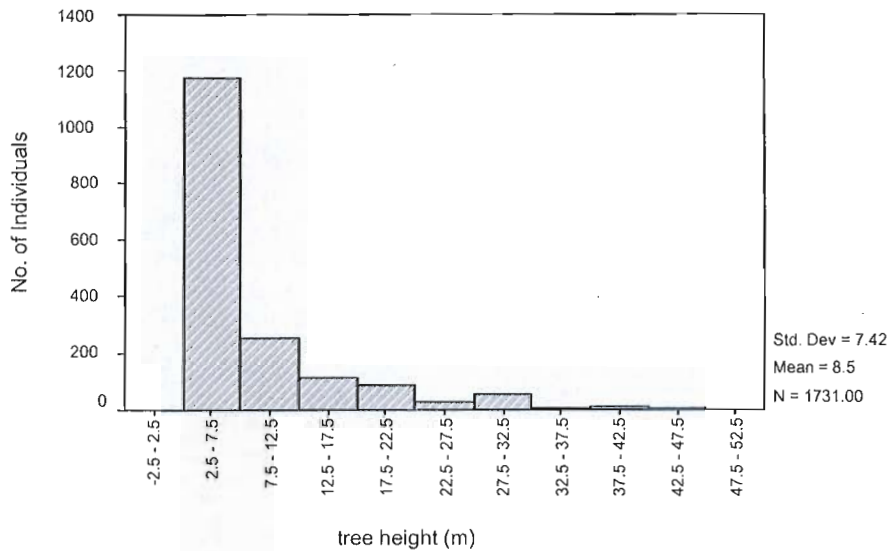


Figure 00 Distribution of trees with varying height classes at Kukkal

Species richness and diversity (H') were more in trees than in shrubs and lianas. In all, 1734 trees of 63 species, 402 shrubs of 19 species and 143 lianas of 15 species were recorded in the sampled area (Table 2.2.). Edges of the shola and openings inside were covered mainly by *Maesa indica*.

Table. 1. Species richness, diversity and equitability of plants at Kukkal

Growth forms	Species richness	Diversity	Equitability
TREE	63	3.15	0.76
Shrub	19	1.31	0.44
Liana	15	2.14	0.79

Fauna

Insects

Insects are the predominant diet of most tropical birds and their importance in the ecology of some of the birds was reported earlier (Vijayan 1975, 1984, Khan

1978, Islam 1985, Nirmala 2002). Islam (1985) and Thomas *et al.* (1995) studied the insect community of the Palni Hills, the former as a part of the Laughing Thrush ecology and the latter focusing on the altitudinal gradient of insect diversity.

Herpetofauna

No especial effort was taken to record the herpetofauna of the study area. However *Buffo malanostictus* and tree frogs were sighted. Among the reptiles, Uropeltids and *Salea anamallayana* were frequently seen. Bamboo Pit Viper, Rat Snake and a few other species were also sighted (but could not be identified).

Birds

The montane wet temperate forests have high endemism and many habitat specialists (Vijayan & Gokula 2000). Species richness and abundance were more in these forests than in the grasslands and plantations in the Nilgiris (Vijayan & Gokula. 2006). The Black-and-Orange Flycatcher *Ficedula nigrorufa*, Nilgiri Flycatcher *Eumyias albicaudata*, Grey-breasted Laughing thrush *Garrulax jerdoni*, White-bellied Shortwing *Brachypteryx major* and Nilgiri Wood Pigeon *Columba elphinstonii* are endemics in the high altitude montane wet temperate forests in the southern Western Ghats, while Crimson-backed Sunbird *Nectarinia minima* another endemic occur in both high and mid elevation forests (Somasundaram & Vijayan. 2004). Important studies on the birds of Palni Hills are by Islam (1985), Shahabuddin (1997), Balachandaran (1999), Somasundaram and Vijayan (2004), and Balachandaran and Rahmani (2005).

Methods

Bird population was estimated by using Variable width circular – plot method (Ralph & Scott 1981, Bibby *et al.* 1992). Stations were not closer than 100 m to the next station. Census began half an hour after sunrise when the bird activity was at the peak (Buckland *et al.* 1993). The duration of census in each plot was

ten minutes. Careful scanning for birds was carried out while approaching and leaving the point to spot any undetected birds and these birds were separately noted. All the birds seen, heard, or flying under the canopy were recorded (Buckland *et al.* 1993, Raman 2001a).

Species diversity (H') was calculated by using Shannon - Weiner index (1949) as given earlier in the chapter.

Mammals

No systematic study was done on the mammalian fauna of Kukkal. However, the rare species recorded in the course of study were Nilgiri Tahr, Nilgiri Langur, Nilgiri Marten and Leopard.

Survey locations in the Palni Hills

Poombarai

Paricombai

Kodaikanal Botanical garden

Golf course

Berijam

Mannavanur

Kukkal

The study was conducted on the Black -and -orange (Black-and-rufous) Flycatcher *Ficedula (Muscicapa) nigrorufa*. It is one of the 16 endemic birds of the Western Ghats and one of the globally near threatened species (Ali & Ripley 1987, Grimmett *et al.* 1998, Stattersfield *et al.* 1998, BirdLife International 2001). In the Indian subcontinent, of the 1295 species of birds recorded, 81 % are land birds (Inskipp *et al.* 1996). In India, 75 species are Globally Threatened, two Data Deficient, one Conservation Dependant and 52 Near Threatened (BirdLife International 2001). Western Ghats have 507 species of birds, of which 144 are aquatic including those found in the coastal habitats (Daniels *et al.* 1992, Daniels 1997). Of the 16 endemic birds of this region, four are threatened, namely Nilgiri Laughing Thrush, Nilgiri Wood Pigeon, White-bellied Shortwing and Broad-tailed Grassbird and, four near threatened, namely Nilgiri Pipit, Grey-breasted Laughing Thrush, Black-and-Orange Flycatcher, and Nilgiri Flycatcher. Besides these, six threatened (Spot-billed Pelican, White-backed Vulture, Lesser Adjutant, Kashmir Flycatcher, Wood Snipe and Greater Spotted Eagle) and ten near threatened species (Grey-headed Fish-Eagle, Malabar Pied Hornbill, Great Hornbill, Red-headed Vulture, Pallid Harrier, Darter, Black-headed Ibis, Ferruginous Duck, Painted Stork and Lesser Flamingo) occur in this region (BirdLife International 2001). Nilgiri Pipit and Nilgiri Flycatcher, considered as Near Threatened by BirdLife International (2001) have been included under Vulnerable by Islam and Rahmani (2004) and Vijayan & Vijayan (2006) and, Grey-headed Bulbul also as Vulnerable (Vijayan & Balakrishnan 2005, Vijayan & Vijayan 2006).

A general bird survey was carried out and species recorded (Grimmett *et al.* 1998) in habitats present in area such as shola – grassland landscape and plantations (wattle, pine and tea) to detect the presence of birds . The study

period was September 2006 to January 2007. An average of ten days was spent in the field each month for observation.

In the present survey trek paths were mainly used, so also main roads, foot and bridle paths, all cutting across or skirting the sholas and other types of habitats. Where there was definite path I walked through or along the edges of sholas and evergreen forests and noted the number and sexes, whenever possible of the target species sighted and or heard. Approximate area surveyed of each habitat was recorded to get the comparative abundance of the target species. Analysis of the data was done separately for different locations and habitats and compared these data with those of Khan during 1974-77 (Khan 1977).

Abundance

Field work was conducted inside the shola forests, Eucalyptus and wattle plantations, Tea estates of Nilgiris between September 2006 and January 2007 spending 128 contact hours. Bird was recorded in all the surveyed places. Mean density of the birds was 5 / 10 ha. Maximum number of birds was in Naduvattam, 8 /10 ha. Minimum number of birds was in Ooty Botanical garden 1/10 ha. (Fig. 1)

Distribution

The over all distribution of the Black-and-orange Flycatcher in the areas surveyed in Nilgiris with number of birds and the ratio of sexes recorded shows their presence in most of the localities. The field data presented in appendix 2 shows that the Black-and-orange Flycatcher is common in Nilgiris. I visited the shola forest, tea plantation, gardens, and eucalyptus plantation. Botanical garden and the Sim's park were absolutely open gardens with exotic plants and a few bushes around the place where garden refuse were dumped. It was rather easy to find almost all pairs in both gardens during each visit.

Grey breasted Laughingthrush density in different places

Grey breasted Laughingthrush recorded was the maximum in Naduvattam followed by Bengalmattam and Pykara. The minimum number of birds was recorded in Ooty Botanical Garden. Naduvattam has shola forest, which is the main habitat for Black-and-Orange Flycatcher, and the Garden has more open place with artificial habitat and disturbances. The sholas of Kolacumbie and Melur also provided microhabitat similar to those in Pykara , but were smaller and disturbed.

Habitat -wise distribution

The abundance of the Black-and-orange Flycatcher was compared among the habitats (Fig. 2). Maximum bird was recorded in rather undisturbed and protected Shola forest in Naduvattam, -Mukruti and Bengalmattam, followed by Tea plantation in Kolocumbie and Woodlands tea estate. Minimum number of this bird was recorded in Ooty Botanical Garden.

The sholas are the major components of the macrohabitat of the Black-and-orange Flycatcher. Mostly the sholas, few evergreen forest and some Eucalyptus plantation have been considered as the macrohabitat of the Black-and- orange Flycatcher.

Comparison between results of the previous and present surveys.

This graph in Figure 2 reveals the difference between the earlier data taken by Khan during 1977 (Khan 1978) and the present study. Population size

decreased in all the places except Naduvattam (50 % +), which has shola and probably because of protection. The decline was maximum in the Botanical garden (95.45 %) at Ooty, where minimum density was recorded during this study, whereas it was high in 1977. Over a period of 30 years, the population has declined drastically as a result of the disturbances to the area probably by the changes in the habitat and disturbance from people. Bengalmattam and Kundha dam area (25 %) had less decline probably because of the protection by the Electricity Board and the Forest Department (Table 3).

Environmental factors such as rainfall, temperature, humidity, soil condition, wind did not directly affect flycatcher, but indirectly all these factors affected the habitat with the growth of the plants of the sholas which were essentially the habitats of the Black-and -range flycatcher.

Black-and-Orange Flycatcher was one of the commonest flycatchers in upper plateau of Nilgiris (Khan 1978). Although it prefers dense evergreen and shola forests, they are found also in the plantations. The population decline in the Nilgiris could be attributed mainly to loss of natural habitats and disturbance to the existing patches. Major threat to all endemic species is the destruction of primary forest; larger species are also threatened by hunting (BirdLife International 2001). Species with wide global ranges have tolerance for disturbed habitat unlike endemic and habitat specialist species and hence the impact is severe on the endemics, leading to even local extinction (Vijayan *et al.* 2000). Such consequences of wide spread deforestation have been documented for many bird communities and species (Robbins *et al.* 1989, Askins *et al.* 1990, Brooks *et al.* 1997, Bender *et al.* 1998, Castellatta *et al.* 2000, Riley 2002). Loss of forest habitats comes with profound modifications of both the composition and configuration of landscapes that can exacerbate the decline of forest birds (Prasad *et al.* 1998). Forest habitats are often shredded or fragmented into patches embedded in a matrix of open areas created by changes in the land use.

Deforestation and urbanization had definite effect on the flycatcher. The foremost was the loss of habitat, which ultimately forced the birds to move towards unsuitable, or less suitable habitat thereby made them vulnerable to predators and diminished the chances of successful breeding and feeding (Khan 1978).

During the past two centuries the Nilgiris had lost over 50% of the shoals (Table 1) to practically uninhabitable areas for the endemic species. The people again denuded the sholas around their settlement either for fire-wood or crop cultivation and by grazing cattle inside the sholas. High rate of fragmentation in protected areas that often interact synergistically with other pressures to reduce biodiversity (Pattanavibool & Dearden 2002). The progressive reduction of total forest area and mean patch size may elicit a suite of ecological responses involving microclimate (Ranney *et al.* 1981), disturbance (Franklin and Forman 1987), decomposition (Klein 1989), nutrient cycling (Ryszkowski 1992), pollination (Jennersten 1988), vegetation structure and composition (Ranney *et al.* 1981), and predation (Gates and Gysel 1978; Small and Hunter 1988).

The Black-and-orange Flycatcher was observed in many localities in upper Nilgiris during September 2006 to January 2007. The species inhabits shola forests and plantations in the upper part of the Nilgiris hills mostly above 1500 m. The mean density was 5 bird /10 ha. Maximum birds were recorded in Naduvattam (8/10 ha) and minimum in Ooty Botanical Garden (1 / 10 ha). Most used habitat was shola forest followed by Tea plantation. During the survey, the Black-and-orange Flycatcher was in very low numbers mainly because of disturbances. A comparison was made with the earlier data (Khan 1978) which shows that the population has declined drastically in all the places except Naduvattam. The presence of streams and mosses inside the shola with dense undergrowth canopy cover and minimum human disturbance are the

most important factors for their existence. The present study shows that the Black-and-orange Flycatcher may face local extinction in a few places in the immediate future as found on comparing the earlier reports and sightings.

There are only two protected areas within the upper Nilgiris, namely Mukurti National Park in Tamil Nadu and Silent Valley in Kerala. Only small part of its range is covered in the upper reaches of the Silent Valley National Park in Kerala. Already recommendations are given for additional areas to be added to the Mukurthi National Park, stopping of alteration of forests and grasslands remaining in the Nilgiris, and restoration of these natural habitats with peoples participation (Vijayan *et al.* 1998,1999; Vijayan and Gokula 1999, 2006, Vijayan *et al.* 2000, Bird Life International 2001). Prohibition of all toxic chemicals, felling of trees and grazing have also been recommended along with creating awareness on conservation and wildlife protection (Verghese *et al.* 1995).

The distribution and abundance of birds is one of the central themes of research in avian biology (MacArthur 1972, Cody 1985). For any bird species, habitat varies in quality from place to place; that is in the benefits in terms of survival and reproduction that it confers on its occupants (Newton 1988). Habitat use, in particular, has drawn the attention of researchers because of its relevance to conservation management (Martin & Finch 1995, Sherry & Holmes 1996, Kilgo *et al.* 2002, Kwit *et al.* 2004). Habitat loss has been identified as one of the main factors affecting the survival of the 1025 Globally Threatened bird species (Collar & Andrew 1988, Collar *et al.* 1994), especially those dwelling forest and island (Robinet *et al.* 2003).

Data analysis

The data were analysed in the following ways:

1. Encounter rate of the Nilgiri Wood Pigeon in different habitats.
Encounter rate = Number of birds sighted / Area surveyed
2. Relationship between elevation and encounter rate by using Correlation.
3. Spearman Rank Correlation test for food availability and number of the Nilgiri Wood Pigeon observed.
4. Mann-Whitney U test for comparing nests site characters between the Nilgiri Wood Pigeon and Mountain Imperial Pigeon.
5. Relationship between environmental factors and number of the Nilgiri Wood Pigeon by Stepwise Regression and Correlation.
6. Impact of habitat alteration was determined by using Hills equation.

Results

The study sites in the Kodaikkanal forest division are Kodaikkanal Botanical garden, Golf course, Berijam, Mannavanur, Kukkal, Poombarai and Paricombai. At Poombarai and Paricombai most of the natural shola vegetation was replaced with wattle and pine. Surveys were conducted at the study sites from February to April 2006. In all the places Grey-breasted Laughingthrush was recorded except at Mannavanur. The bird density was high in Kukkal (1.4 bird / ha) followed by Poombarai (0.5 bird / ha), Kodaikkanal Botanical garden (0.33 bird / ha), Golf course (0.16/ ha), and Paricombai (0.22/ha). Breeding activities were observed; 18 nests were found, mostly in shola shrubs except two in wattle plantation nearer to the shola in Kukkal area. The common nesting plants are *Ardisia rhomboidea*, *Litsea floribunda*, *Phoebe paniculata* and *Neolitsea scrobiculata*. Territory mapping was done in Paricombai area and it was compared with the earlier study by Islam (1985) and found that the territory size has increased. Vegetation sampling at Poombari and Paricombai showed *Euria nitida* as the dominant species at Paricombai while at Poombarai *Litsea floribunda*, *Neolitsea scrobiculata* and *Phoebe paniculata* were the dominant shrub species.

Recommendations

No further expansion of plantations and restoration of grasslands and shola forests in the Palni hills.

A GIS database may be created with a variety of thematic details including information on flora and fauna. This would help monitor this globally near threatened species.

In Palni Hills, none of the areas are fully protected; the larger shola forests of Kukkal and Mathikettan (Berijam) may be declared as bird sanctuaries. Better protection needs to be ensured for the proposed Palni Hill Conservation Area.

A strong nature education programme is required regarding the importance of natural vegetation in biodiversity conservation and watershed management of Palni Hills.

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Appendix -1

Birds sighted in the Palni Hills

S. No	Common Name	Scientific Name
1	Nilgiri Flycatcher	<i>Eumyias albicaudata</i>
2	Oriental White-eye	<i>Zosterops palpebrosus</i>
3	White-browed Wagtail	<i>Motacilla maderaspatensis</i>
4	Nilgiri Pipit	<i>Anthus nilghiriensis</i>
5	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>
6	Yellow-browed Bulbul	<i>Iole indica</i>
7	Great Tit	<i>Parus major</i>
8	Brahminy Kite	<i>Haliastur indus</i>
9	Blue-eared Kingfisher	<i>Alcedo meninting</i>
10	Black Drongo	<i>Dicrurus macrocerus</i>
11	Oriental Magpie Robin	<i>Copsychus saularis</i>
12	Variable Wheatear	<i>Oenantha picata</i>
13	Snowy-browed Flycatcher	<i>Ficedula hyperythra</i>
14	Sapphire Flycatcher	<i>Ficedula sapphira</i>
15	Rufous-bellied Niltava	<i>Niltava sundara</i>
16	Vivid Niltava	<i>Niltava vivida</i>
17	Large-billed Crow	<i>Corvus macrorhynchos</i>
18	Tickell's Leaf Warbler	<i>Phylloscopus affinis</i>
19	Nilgiri Laughingthrush	<i>Garrulax cachinnans</i>
20	Nilgiri Wood Pigeon	<i>Columba elphinstonii</i>