

# Monitoring the bird communities in Silent Valley National Park



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2006

# **MONITORING THE BIRD COMMUNITIES IN SILENT VALLEY NATIONAL PARK**

A project executed by |  
SALIM ALI CENTRE FOR ORNITHOLOGY AND NATURAL HISTORY

IN COLLABORATION WITH |  
DEPARTMENT OF FORESTS AND  
WILDLIFE | KERALA.

**FINAL REPORT  
2006**

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<b>TABLE OF CONTENTS</b>		<b>Page #</b>
ACKNOWLEDGEMENTS		6
EXECUTIVE SUMMARY		7
CHAPTER I : GENERAL INTRODUCTION		12
1.1 Background		13
1.2 Rationale for selecting birds		14
1.3 Relevant research to date on this topic		16
1.4 Indian context		17
1.5 History of avian research in Silent Valley National Park		18
1.6 Research objectives		20
1.7 Organization of the Study		20
1.8 Report structure		20
CHAPTER II : STUDY AREA AND METHODOLOGY		22
2.1 The Western Ghats		23
2.1.1 Ecological History		24
2.1.2 Climate		25
2.3 Silent Valley National Park		25
2.3.1 History		25
2.3.2 Physical features		27
2.3.3 Location		28
2.3.4 Altitude		29
2.3.5 Climate		29
2.3.6 Geology		31
2.3.7 Drainage		32
2.3.8 Flora		32
2.3.9 Fauna		33
2.3.10 Human activities		34
2.4 Materials		34
CHAPTER III CHANGES IN HABITAT STRUCTURE ALONG AN ALLTITUDINAL TRANSECT		36
3.1 INTRODUCTION		37
3.2 MATERIALS AND METHODS		38
3.2.1 Plot establishment and sampling		38
3.2.3 Statistical analyses		40
3.3 RESULTS		42
3.3.1. Species richness, abundance and diversity		42
3.3.2. Tree density and basal area		44
3.3.3. Dominance and rarity		45
3.3.4. Importance value index (IVI)		45
3.3.5. Familial diversity		47
3.3.6. Girth class diversity and density		47
3.3.7. Vertical Stratification or height profile of trees		50
3.3.8 Trends in species composition		51
3.4 DISCUSSION		53
3.1 SUMMARY		57

CHAPTER IV BIRD COMMUNITY STRUCTURE AS A FUNCTION OF ALTITUDINAL GRADIENT	58
4.1. Introduction	59
4.1.1 Why altitudinal gradient analysis?	61
4.2. Methodology	63
4.2.1 Fixed-radius point counts	63
4.2.2 Statistical analysis	64
4.2.3 Community parameters	64
4.3. Results	69
4.3.1 Bird community structure.	69
4.3.2 Migrants	76
4.3.3 Trophic groups	77
4.3.4 Endemics	75
4.3.5 Bird community similarity	81
4.3.6 Bird community equitability	82
4.4. Discussion	88
4.4.1 Community structure and composition.	89
4.4.2 Migrants	90
4.4.3 Trophic groups	92
4.4.4 Endemics	93
4.4.5 Conservation implications of birds of the Western Ghats.	99
4.4.6 Conclusions	101
4.5 Summary	101
CHAPTER V SPATIO-TEMPORAL VARIATION IN NESTING OF BIRDS	103
5.1 INTRODUCTION	104
5.1.1. Scenario of nesting bird studies	106
5.2 METHODOLOGY	107
5.2.1 Nest sampling	107
5.2.2 Nest monitoring	108
5.2.3 Statistical analysis	109
5.3 RESULTS	111
5.3.1 Breeding species richness, abundance and diversity.	111
5.3.4 Major nesting birds of SVNP	114
5.3.5 Comparison of nest-site characteristics of 12 major species	115
5.3.5.1 Nest height	115
5.3.5.2 Nest-plant height	118
5.3.2.3 Relative nest height	118
5.3.2.4 Concealment of the nest	119
5.3.2.5 Distance from the lateral foliage edge	120
5.3.2.6 Distance from the trunk	120
5.3.2.8 Canopy cover	121
5.3.2.9 Ground cover	122
5.3.2.10 Leaf litter depth	123
5.3.2.11 Distance to the trek-path	123
5.3.2.12 Distance to the nearest tree	124
5.3.2.13 Nest substrate preferences	125
5.4 DISCUSSION	128

5.4.1 Breeding species richness, abundance and diversity	125
5.4.2 Comparison of nest-site characteristics of 12 major nesting species	130
5.5 SUMMARY	138
CHAPTER VI CONCLUSION AND SYNTHESIS	139
REFERENCES	151
Appendix	179
Photo plates	

Suggested Citation:

Vijayan L and Das K.S.A 2006. Monitoring the bird communities in Silent Valley National Park. Final technical report Submitted to the Sálím Ali center for Ornithology and Natural History, India

## EXECUTIVE SUMMARY

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Birds are regarded widely as powerful monitoring tools in environmental management because of their great abundance, diversity, functional importance, sensitivity to perturbations, and ease with which they can be sampled (Bibby 2006). Very little is known concerning the range and composition of the evergreen forest birds in India. Such studies will render a better understanding of the geographical variation in the fauna and has immense conservation value. Hence, a detailed investigation on the bird communities and their ecological requirements was done during 2002-2005.

This study addressed the altitude and habitat associations of birds and the effects of environmental variables and seasonality on them in the Silent Valley National Park (SVNP). Specific objectives of the study were: (1) How does bird community structure differ among various habitats, altitudes and seasons in terms of species diversity, richness and abundance? (2) What are the major factors affecting the spatial and temporal variation of breeding bird communities? (3) How does the vegetation change along the altitudes and habitats affect the bird community structure?

Silent Valley National Park, one of the largest contiguous pristine wet evergreen forests in the Western Ghats, was selected as the study area. Western Ghats Hill ranges form a unique and discrete biogeographic region of India. It is recognized as a globally important ecoregion and one of the 34 global hotspots of biodiversity. This hotspot harbours 16 restricted range species and occupies a position as one of the 218 endemic bird areas of the world. The Silent Valley National Park ( $11^{\circ} 3'$  to  $11^{\circ} 13'$  N and  $76^{\circ} 22'$  to  $76^{\circ} 30'$  E) is located in Palghat District of Kerala State. This area experiences both the South-west and North-east monsoons with heavy downpour during June to August. The average annual rainfall varies in different regions increasing with the elevation from 3200 mm to 4500 mm; the minimum temperature varies from 8 to 19° C and the maximum from 23 to 29° C. The highest temperature is in May and the lowest in January.

We collected data on birds from 60 plots during 2002-2005 from various forest types at different altitudes using fixed distance point counts of 30 m radius. These stations were laid out systematically at a minimum distance of 100 m. A total of 60 points were marked and numbered, 10 points each in three transects of evergreen forest, 10 plots in Broad Leaved Hill Forest, 10 each in Shola Forest and Shola with Grassland. The surveyed habitat gradients consisted of West coast tropical wet evergreen forests at 1000-1200 m altitude (undisturbed evergreen-EG, partly disturbed evergreen-EGD, and evergreen with grassland-EGGL), broad leaved hill forest at 1500-1600 m, shola forest at 1800-2000 m and shola forest with grasslands at 2000-2200 m, at multiple spatial scales (i.e., the microhabitat and landscape). Abiotic factors such as temperature, relative humidity and rainfall were recorded on daily basis using a mini meteorological station established in the study area.

A total of 5253 individuals belonging to 108 species were recorded which included 14 species endemic to the Western Ghats. Highest species richness (83) was found in the wet evergreen forest sites. Species richness was significantly lower in broad-leaved hill forest (37) and montane wet temperate forest (50) compared to the other habitat types. A strong negative correlation was observed between rainfall and species richness ( $r_s = -0.488$ ,  $P < 0.01$ ). The habitats offered greater structural complexity where bird abundance varied across habitats, and altitudes in the park with a negative correlation with respect to altitude. ( $r_s = -0.845$ ,  $p < 0.01$ ).

From 2314 point counts in the six habitats, 3754 detections comprising 85 species were made in the wet evergreen forest, 315 detections of 37 species in the broad-leaved hill forest, and 566 detections of 50 species in the Shola forest, followed by 618 detections of 39 species in Shola with Grassland. Sorenson's quantitative index indicated 92% similarity in the bird community composition between the Wet evergreen forest at 1000m (EG) and 1200 m (EGD) altitude. Most of the bird species had significantly greater abundance in the Wet evergreen forest than the Shola forest possibly due to the microhabitat variations between the sites.

Both total bird abundance and species richness were the highest within the evergreen habitat of Silent Valley National Park. Bird species diversity

followed the same pattern, evergreen ( $H'=2.42$ ) followed by Grasslands and Shola forest ( $H'=2.12$ ) and then by broad-leaved hill forest ( $H'=1.91$ ). Bird species richness, diversity and evenness differed significantly between the habitats. No significant relationship was found between bird and habitat variables measured in these sites. No correlation was evident between Bird Species Diversity and Foliage Height Diversity also. Shannon - Weaver diversity index differed significantly in different habitats (One-way ANOVA,  $F=13.63$ ,  $df=5$ ,  $p<.001$ ). High altitude areas, although had less diversity, had more endemic species as was reported in earlier studies.

Cluster analysis showed that the species composition in different habitats was different. Disturbed and undisturbed evergreen forests shared 87.66% of their species while evergreen forests with grassland (EGGL) shared 76.63% of their species with the partly disturbed evergreen forests (EGD); Shola with grassland shared 79.05% of birds with Shola forest. Maximum exclusive species were found in Shola forest reflecting its highly specialized nature.

I collected data on breeding bird-species density and reproductive biology during 2002-2005. Each study site was divided into ten 50 x 50 m plots on alternate sides of the transects that were used for intensive nest searching twice from January through the mid of June each year and once during the other months. A total of 517 nests of 32 species were observed in Silent Valley National Park. The study examined nest-site characteristics and degree of partitioning of the resources among 12 major co-existing bird species breeding in this area. Habitat characteristics of nest sites differed significantly among species, indicating strong nest-site partitioning. The 12 variables for 442 nest sites were collectively subjected to Principal Component Analysis (PCA) to determine the relationships of the 12 species in the "habitat space" inside the Park. To summarize the differences in the nest site "gestalts" of the species, and to identify the best contributors of their statistical separation, Stepwise Discriminant Function Analysis was performed on the entire set of variables. Wilk's Lambda and F-tests were used to determine the combination of variables providing the best group separation. PCA of the all nest sites yielded physical characteristics of trees and generated four principal components that explained 67.24 % of the total variance. PC1 explained 23.35% of the total variance and

had strong positive contributions from three variables- shrub cover, ground cover, distance to tree, whereas the concealment and tree height were weakly positive in their contribution to PC1. PC2 explained 17% of the variance and had high positive loadings for nest height and relative nest height and moderate positive loadings for tree height and concealment. PC2 was negatively associated with the distance to tree trunk, ground cover, litter depth, distance to trek path and distance to the next tree.

Vegetation structure and composition are the most important features that are predicted to influence the habitat selection of birds. Relationships between the distributions and abundance of birds in different habitats have long been a focal theme of avian ecological research. Hence, a range of vegetation structure variables were measured in all sites with a view to relating patterns of community composition in both taxa to their immediate environment from subplots at each count station based on the standard sampling protocol called Multiple stage Quadrat. All six transects with 60 plots, each plot with an area of 20 x 20 m totaling a 2.4 ha was sampled in SVNP. Each subplot consisted of nested two, 5 x 5 m for sampling shrubs and four 1 x 1m plots for saplings, litter depth and ground cover characteristics.

A total of 1872 stumps of trees belonging to 152 species in 41 families were identified and tagged. The species diversity was found to be more in the Undisturbed evergreen forest ( $H' = 3.81$ ) followed by Shola forest ( $H = 3.22$ ), Broad leaved hill forest ( $H = 3.18$ ) and Shola with grassland ( $H = 2.96$ ). The contribution of species in to each plot, their frequency, basal area, relative frequency, density, dominance and important values are presented. The gradient of the species area curve suggests that more sampling by increasing the area would have resulted in more species being encountered. Polynomial regression model of vegetation diversity with the bird species diversity showed that the relationship is not stronger  $R^2 = 0.1258$ .

Our analysis showed that altitude appears to be the primary environmental variable responsible for the distribution of species. Geldenhuys (1996) states that species diversity within forest patches is determined by patch size and proximity to other forests. Unfortunately, 50% of the larger forest patches are delimited by political boundaries of the Park. This means

that forest land contiguous with the Silent Valley National Park has to be added to the existing park, permitting the uninterrupted gene flow in order to protect the realm from disturbance and to ensure long-term conservation.