

RAPID BIODIVERSITY ASSESSMENT AT CHIMMONY WILDLIFE SANCTUARY

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STATE FOREST & WILDLIFE DEPARTMENT**

2009

No.	CONTENTS	Page No.
	ACKNOWLEDGEMENTS	5
	SUMMARY & RECOMMENDATIONS	6
1.	INTRODUCTION	10
2.	PREVIOUS STUDIES	16
3.	METHODOLOGY	18
4.	RESULTS AND DISCUSSION	20
5.	REFERENCES	58
6.	APPENDIX 1 (Checklist of mammals of Chimmony)	59
	APPENDIX 2 (Checklist of birds of Chimmony)	61
	APPENDIX 3 (Checklist of reptiles of Chimmony)	67
	APPENDIX 4 (Checklist of amphibians of Chimmony)	68
	APPENDIX 5 (Checklist of fishes of Chimmony)	69

LIST OF TABLES		
Table No.	Title	Page No.
1.	Summary of vertebrate diversity in some of the Protected areas of Kerala	8
2.	Population of the large mammals of Chimmony WLS at different study locations	21
3.	Diversity of the large mammals of Chimmony WLS at different study locations	22
4.	Bats reported from the different locations at Chimmony WLS	24
5.	Rodents and insectivores reported from the different locations at Chimmony Wildlife Sanctuary	27
6.	The abundance of the birds at different study locations in Chimmony	38
7.	Bird species richness and diversity at different locations at Chimmony	41
8.	Herpetofauna observed from different location at Chimmony	44
9.	Shannon diversity index of herpetofauna at different locations of Chimmony	49

LIST OF FIGURES		
Figure No.	Title	Page No.
1.	Map of Peechi Wildlife Division	10
2.	Shannon Diversity index of large mammals of Chimmony	23
3.	Simpson Diversity index of large mammals of Chimmony	23
4.	Similarity between the large mammal fauna between different study locations at Chimmony	24
5.	Bird species diversity (Shannon Index) at the various habitats in Chimmony	41
6.	Bray-Curtis Cluster analysis of birds at the different habitats in Chimmony	42

LIST OF PLATES		
Plate No.	Title	Page No.
1.	View of the Chimmony forests	11
2.	Waterfalls at Mulapara in Chimmony	12
3.	A view of the forests at Chimmony	13
4.	Elephants at Chimmony	20
5.	Gaur at Chimmony	22
6.	Greater Short-nosed Fruit Bat at Chimmony	25
7.	Little Indian Field Mouse at Chimmony	26
8.	Lesser False-vampire Bat at Chimmony	29
9.	Indian Spiny Field Mouse at Chimmony	34
10.	House Shrew at Chimmony	35
11.	Chestnut-headed Bee-eater	37
12.	Broad-billed Roller at Chimmony	42
13.	Forest Calotes at Chimmony	44
14.	Bronzed Frog at Chimmony	47
15.	Common Indian Toad at Chimmony	49

ACKNOWLEDGEMENTS

The authors would like to thank the State Forest department for the financial support for the successful completion of the study. The Principal Conservator of Forests and the Chief Conservator of Forests (Wildlife), are especially thanked for granting permission to undertake the study. Mr. W.S. Suting IFS, Chief Conservator of Forests (Wildlife, northern region) has been particularly keen on the biodiversity documentation; his support has been gratefully acknowledged. The first two authors would like to place on record their gratitude to the Vice-Chancellor, Director of Research of Kerala Agricultural University and the Associate Dean, College of Forestry for the permission to carry out the study. The map used in the report was supplied by Dr. P. Vijayakumaran Nair, scientist of KFRI and is gratefully acknowledged. Special thanks are also due to Praveen P Mohandas and Sandeep Das for providing their photographs and Anoop EV and Femimol T.P. for designing the cover. The support of the office and the field staff of the Peechi Wildlife Division as well as the office staff of the College of Forestry, have also been very encouraging, without whose support this work would not have been possible.

Authors

PHOTO CREDITS

Plates 1, 2, 3, 6, 7, 8, 9, 10, 14 and 15	by P.O. Nameer
Plates 11, 12 and 13	by Sandeep Das
Plate 4, 5 and cover photo	by Praveen P. Mohandas
Cover design	by Anoop EV & Femimol T.P.

SUMMARY & RECOMMENDATIONS

The Western Ghats, one of the 25 mega biodiversity hotspots of the world, covers 5% of India's land area, yet contains more than 4000 or 27% of the country's total plant species. Of these, 1500 species are endemic. Nearly 63% of India's arborescent evergreen taxa are endemic to the Western Ghats. The faunal diversity of Western Ghats is also equally rich, with mammals (130), birds (581), reptiles (197), amphibians (120) and fishes (218).

Chimmony was declared as a Wildlife Sanctuary (WS) only during the eighties. There have been only two studies on the fauna of Chimmony WS until now, one on the mammals and other on the birds. Thus the present study on the biodiversity of Chimmony WS has come at a right time, whereby it adds to the baseline data on the sanctuary.

Chimmony WS is also contiguous to the Anamalais region of the Western Ghats. The present study has proved that Chimmony WS is a valuable repository of biodiversity. This is evident from the fact that Chimmony recorded 265 species of vertebrates (Table 1). In terms of mammalian diversity Chimmony ranks second position in the State after Periyar Tiger Reserve.

Table 1. Summary of vertebrate diversity in some of the protected areas of Kerala

Location	Mammals	Birds	Reptiles	Amphibians	Fishes	Total	Source
India	418	1200	480	215	1047	3360	Various
Western Ghats	114	581	197	120	218	1230	Various
Periyar Tiger Reserve (PTR)	62	320	45	27	38	492	PTR website accessed on 1 March 2009
Parambikulam WS	39	268	61	24	47	439	Parambikulam website accessed on 1 March 2009
Silent Valley NP	40	211	35	19	11	316	Nameer et al. 2009
Chimmony WS	53	181	22	9	31	296	Nameer et al, 2009 (present study)
Peechi-Vazhani WS	48	218	32	15	40	353	Nameer et al, 2009

The rapid biodiversity assessment was done at Chimmony WS from April 2008 to December 2008. The salient findings of the study are listed below,

1. 53 species in 24 families have been recorded from Chimmony Wildlife sanctuary. The largest number of mammals reported from the protected areas of Kerala is Periyar Tiger Reserve, with 62 species (<http://www.periyartigerreserve.org/html/animals.htm>) Chimmony WS has been now found to be the second leading sanctuary in terms of mammalian diversity. Parambikulam has only 39 species of mammals (<http://www.parambikulam.org>) while Silent valley has only 31 species of mammals (<http://www.silentvalleynationalpark.com>).
2. The mammals include the threatened large mammals such as tiger, elephant, leopard etc
3. Chiroptera (bats) reported the maximum number of species (18).

4. The second most abundant mammal group was rodents (rats, mice and squirrels)
5. 181 species in 46 families were reported from the Chimmony Wildlife sanctuary during the present study. The number of birds reported from Periyar Tiger reserve is 320, Parambikulam WS (268) and Silent Valley (211).
6. Seven out of the 16 endemic birds of Western Ghats are found in Chimmony WS. , they are Blue-winged Parakeet, Grey-headed Bulbul, Indian Rufous Babbler, Malabar Grey Hornbill, White-bellied Blue-Flycatcher, White-bellied Treepie and Small Sunbird.
7. Sighting of Lesser Fish-Eagle *Ichthyophaga humilis*, Large Hawk-Cuckoo *Hierococcyx sparveroides*, Broad-billed Roller *Eurystomus orientalis* and Northern House-Martin *Delichon urbica* all of which are new records for Chimmony.
8. 22 species of reptiles in nine families were reported from the Chimmony Wildlife sanctuary during the present study. All these are first records for the sanctuary. The number of reptiles reported from Periyar Tiger reserve was 45, Parambikulam WS (61) and Silent Valley (35).
9. Among the reptiles, skinks contributed to 74.31% followed by lizards (15.97%), geckos (5.56%), 3.47 (5%) and monitor lizard (0.69%)
10. Of the skinks, Snake Skink *Lygosoma punctatus* was the numerically dominant (45.83% of all the reptile sightings), followed by Little Skink, *Mabuya macularia* (12.50% of all the reptile sightings), Brahminy Skink, *Mabuya carinata* (9.03% of all the reptile sightings).
11. Two species of geckos were sighted of which the geckos Kandy Dwarf Gecko *Cnemaspis khandian* (5.56% of all the reptile sightings) was the dominant one, while the second species of gecko could not be identified.
12. Three species of lizards could be sighted on the transects among which Forest Calotes *Calotes rouxi* (8.33% of all the reptile sightings) was the most dominant one, followed by Common Garden Lizard *Calotes versicolor* (4.17% of all the reptile sightings) and Elliott's Forest Lizard *Calotes elliotti* (3.47% of all the reptile sightings).

13. Out of the four species of snakes sighted on the transects Malabar Pit viper *Trimeresurus malabaricus* (1.39% of all the reptile sightings), was the most dominant one. The other three species such as Common Rat snake *Ptyas mucosus*, Dumeril's Black-headed Snake *Sibynophis subpunctatus* and Buffstriped Keelback *Amphiesma stolata* accounted for 0.69% of all the reptile sightings each
14. Nine species of amphibians in five families were reported from the Chimmony Wildlife sanctuary during the present study. The number of amphibians reported from Periyar Tiger reserve was 27, Parambikulam WS (24) and Silent Valley (19).
15. The most abundant among them was Bronzed Frog, *Rana temporalis* (50% of all the amphibian sightings), this was followed by Beddome's frog, *Indirana beddomii* (28.3% of all the amphibian sightings), Leith's Leaping Frog *Indirana leithii* (10.9% of all the amphibian sightings), Water Skipper Frog, *Euphlyctis cyanophlyctis* (4.3% of all the amphibian sightings), Verrucose Frog *Fejervarya keralensis* (2.2% of all the amphibian sightings), Common Indian Toad *Bufo melanostictus* (2.2% of all the amphibian sightings), Rufescent Burrowing Frog, *Fejervarya rufescens* (1.1% of all the amphibian sightings) and Indian Bull Frog *Hoplobatrachus tigerinus* (1.1% of all the amphibian sightings).

RECOMMENDATIONS

The present study has proved the significance of Chimmony WS from biodiversity point of view. Stringent measures must be followed for the biodiversity conservation. This biodiversity value of the sanctuary can be used to highlight the ecotourism potential of the area.

The present one was a general study on the biodiversity elements of Chimmony WS. More specific studies on the ecological aspects must be carried out on the faunal groups such as small carnivores, bats, rodents, insectivores, among mammals. Among the reptiles specific taxonomical and ecological studies must be carried out on snakes, turtles and tortoises, geckos, lizards and skinks. Similarly detailed studies also are warranted on the amphibians such as frogs, toads and caecilians. Needless to say the studies on the fish fauna as well as invertebrates would only make the faunal biodiversity documentation complete.

1. INTRODUCTION

1.1 Location

Chimmony Wildlife Sanctuary lies within 10° 26'N and 10° 27'N latitude and 76° 31'E and 76° 37'E longitude in Thrissur District of Kerala State, Mukundapuram Taluk within the administrative Jurisdiction of Northern Wildlife Circle, Palakkad. The sanctuary consists of parts of Kodassery Reserve with an extent of 85.067 sq. km. (George, 2002).

1.2 Geology, Rock and Soil

1.2.1 Geology & Rock: Metamorphic Gneiss is the principal formation of the hills. On the lower slopes and on the hills the rocks tend to become lateritic. Small extent of rocky blanks, consisting of sheet rocks is seen scattered in the sanctuary (George, 2002).

1.2.2 Soil Profile: The soil is originated from weathering of crystalline rocks like granite, gneisses and charnockites. Surface soil is generally sandy loam in texture while the subsurface soil is loamy. Initial stages of laterization are observed where the soils are devoid of vegetal cover and erosion is active (George, 2002).

1.3 Terrain: The terrain is hilly and the altitudinal range varies from 40 m above MSL at the Chimmony dam site to 1,110 m above MSL in the eastern end. The highest peak is Ponmudi (1,116 m).

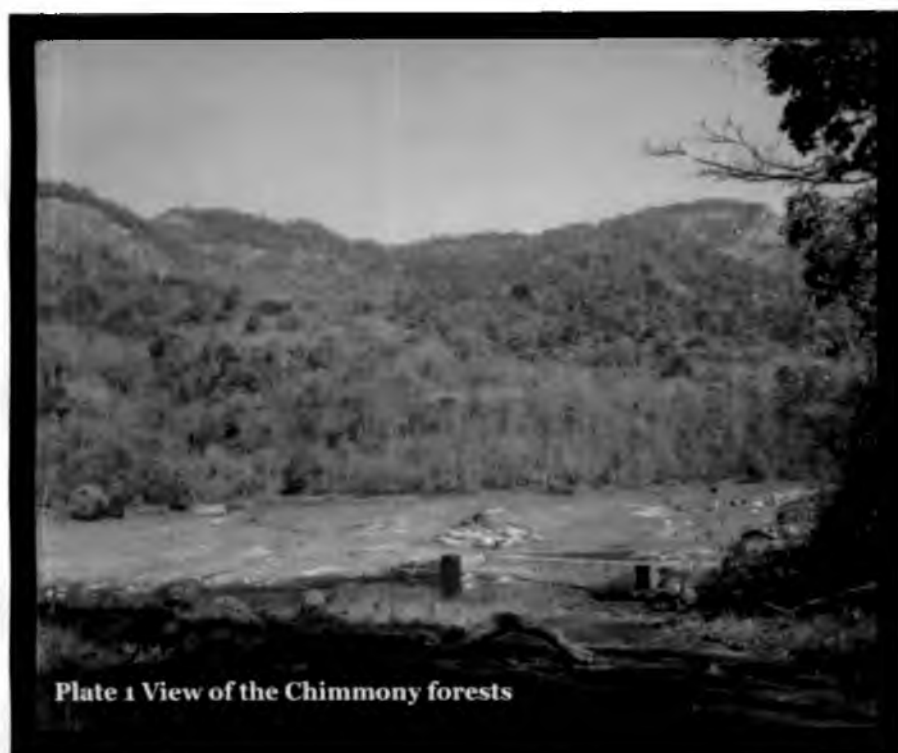
1.4 Climate



Fig. 1 Map of Peechi Wildlife Division

1.4.1 Rainfall Pattern and Distribution: The average annual rainfall is 2,980 mm (George, 2002). Most of the rain is received during the southwest monsoon period from June to September. The sanctuary also receives the northeast monsoons during October-November. Apart from these scattered summer showers are received mostly during April.

1.4.2 Temperature: The dry season is from December to May. The hottest months are March, April and May. The temperature varies between a maximum of 36°C and a minimum of 24°C in the hottest months. During December - January, the minimum temperature falls to 15°C (George, 2002).



1.5 Drainage: The Sanctuary has more than 250 fingertip streams of which Chimmony river, Virakuthodu, Anaporu *thodu* (stream), Payampara *thodu*, Nellipara *thodu*, Thachanakadavu *thodu*, Kodakallu *thodu*, Mulappara *thodu*, Chavarala *thodu*, Kanjiripara *thodu* and Vavala *thodu* are prominent ones. Most of these streams are seasonal and dry up during summer. All streams drain to Chimmony reservoir, having water spread area of 10.1 km². Chimmony dam is constructed across the Chimmony River, which is a tributary of the river Karuvannur.



Plate 2 Waterfalls at Mulapara in Chimmony

There are two man-made water pools in the Sanctuary, one at Virakuthodu and the other at Nellipara.

1.6 Vegetation

The natural forests of the Sanctuary are classified on the basis of Champion & Seth (1969) into the following types:

1. 14/C4 West Coast Tropical Evergreen Forests
2. 24/C2 West Coast Semi-evergreen Forests
3. 33/C Southern Indian moist deciduous forests

1.6.1 Tropical Evergreen Forests: Evergreen forests are found in the higher reaches of the sanctuary and are characterised by tall trees, with buttress. Canes (*Calamus* sp.) and reeds (*Ochlandra* sp.) are abundant among the evergreen forests.

The top canopy is dominated by the species like *Palaquium ellipticum* (Pali), *Mesua ferrea* (Nangue), *Cullenia exarillata* (Vediplavu), *Dipterocarpus indicus* (Kalpine), *Hopea parviflora* (Kambakam) and *Dysoxylum malabaricum* (Vellakil). While the predominant species found lower canopy are *Aporusa lindleyana* (Vetti), *Canarium strictum* (Thelly), *Melicope lunu-ankenda* (Nasakam) and *Mallotus philippensis* (Kurangumanjal). The undergrowth comprises of *Calamus rotang*, *Calamus travancoricus*, *Laportea crenulata* and *Ochlandra wightii*. The ground vegetation is mostly of wild arrowroot, *Curcuma spp.*, *Strobilanthus sp.* and *Elettaria cardamomum*.

1.6.2 Semi-Evergreen Forests: Semi-evergreen forests contain elements of both the evergreen and moist deciduous forests. The dominant species in the top canopy are *Haldina cordifolia* (Manjakadambu), *Bombax ceiba* (Elavu), *Toona ciliata* (Chandana vembu), *Syzygium cumini* (Njaval) and *Lagerstroemia microcarpa* (Venteak). Whereas the lower canopy consists of *Cinnamomum zeylanicum* (Edana), *Melicope lunu-ankenda* (Nasakam), and *Mallotus philippensis* (Karukutty). Species like *Calamus rotang*, *Calamus travancoricus*, *Laportea crenulata*, *Ochlandra wightii*, *Croton malabaricus* and *Clerodendrum viscosum* constitute under growth and ground vegetation.

1.6.3 Moist deciduous forests: These forests occur in the lower elevation of the sanctuary. The



moist deciduous species remain leafless between February to May. *Haldina cordifolia* (Manjakadambu), *Albizia procera* (Vellavaka), *Alstonia scholaris* (Ezhilam pala), *Dalbergia latifolia* (veetti), *Lagerstroemia microcarpa* (Venteak) and *Xylia xylocarpa* (Irul) are the dominant species in the top canopy. The lower

canopy species include *Bridelia retusa* (Kayanni), *Careya arborea* (Pezhu), *Cassia fistula* (Konna) and *Dillenia pentagyna* (Malampunna). The under growth and ground vegetation consists of *Bamboosa arundinacea*, *Clerodendrum viscosum*, *Glycosmis pentaphylla*, *Helicteres isora*, *Holarrhena pubescens*, *Lantana camara*, *Acacia intsia*, *Bahunia vahlii* and *Calicopteris floribunda*.

Area estimates of different vegetation types and land covers as obtained through IRS IB FCC of 1:50,000 scale of March 1995 is presented in Table 1 (Menon, 1995).

Table 1: Vegetation types and land covers at Chimmony WLS

	Area (km ²)	% of the total area
Evergreen and Semi-evergreen forest	45.731	53.91
Moist deciduous	30.312	35.63
Teak Plantation	3.981	4.68
Grass	0.039	0.05
Rock	0.173	0.20
Reservoir	4.831	5.68
	85.067	100.00

1.7 Fauna: 22 species of mammals were reported by Jayson and Easa (1996). This include the Tiger *Panthera tigris*, Leopard *Panthera pardus*, Elephant *Elephas maximus*, Sambar *Rusa unicolor*, Barking Deer, *Muntiacus muntjak*, Mouse Deer *Moschiola meminna*, Wild Boar, *Sus scrofa*, Slender Loris *Loris lydekkerianus*, Bonnet Macaque *Macaca radiata*, Lion-tailed Macaque *Macaca silenus*, Nilgiri Langur *Trachypithecus johnii*, Malabar Giant Squirrel *Ratufa indica*, Indian Porcupine *Hystrix indica*, Black-naped Hare *Lepus nigricollis* etc. Mammals spotted during the present study are listed in the Appendix I.

2. PREVIOUS STUDIES

2a. Mammals: Chimmony was declared as a Wildlife Sanctuary in 1984. The only study on the large mammals of Chimmony was by Jayson and Easa (1996), who reported 22 species of mammals from there. Department of Wildlife Sciences of College of Forestry has done few studies on the rodents and bats of the Chimmony Wildlife Sanctuary since 2006, such as Arun (2006), Ali (2006), John (2007), Joy (2008) and Babu (2008). Apart from this the large mammals of the Chimmony was counted as part of the All Kerala Wildlife census held since 1993.

2b. Birds: The management plan of Chimmony Wildlife sanctuary (Kaler, 1990) listed 150 species of birds from the sanctuary, while the last bird surveys done at Chimmony in 1992 reported 177 species (Nameer, 1992) and the survey did in 2006 (Nameer and Augustine, 2006), reported 181 species.

2c. Reptiles: No earlier studies were done on the reptiles of Chimmony Wildlife sanctuary. The Management Plan of the Chimmony Wildlife sanctuary however, reports 25 species of reptiles, though the source of the information was not given. The Management Plan also states that, "study of reptilian fauna of the Sanctuary is not done so far" (George, 2002).

2d. Amphibians: No earlier studies were done on the amphibians of Chimmony Wildlife sanctuary. The Management Plan of the Chimmony Wildlife sanctuary, however, reports 14 species of amphibians, though the source of the information was not given (George, 2002).

2e. Fishes: No earlier studies were done on the fishes of Chimmony Wildlife sanctuary. The Management Plan of the Chimmony Wildlife sanctuary however, reports 31 species of fishes, though the source of the information was not given (George, 2002).

3. METHODOLOGY

The study was conducted from April 2008 to December 2008. Different methods were used for the biodiversity assessment of different groups of vertebrates. The same is detailed below.

Mammals: a combination of several standard methods such as line transect method, total count and dung count method for the larger mammals, digital pug mark techniques for the large carnivores, camera traps for the lesser carnivores, mist netting for bats and Sherman trapping for the non-volant small mammals was used.

Birds: Prefixed transects radiating from the base camps were followed in the morning (0730h to 1100h) and in the afternoon (1430h to 1800h). While walking on the transects all the birds encountered (sighted/heard as well as call) were recorded species wise. Apart from this the number of individuals per species also was counted. This was continued for first two hours and then only those species that was not seen on that transect, on that day, alone was recorded.

All the birds opportunistically sighted/heard outside the transect were recorded separately. This information was mainly for the preparation of the checklist. The birds were identified using binoculars (10 x 50 or 8 x 40) and field guides of Ali and Ripley (1987), Grimmett *et al.* (1998), Kazmierczak (2000) and Rasmussen and Anderton (2005).

Herpetofauna: Herpeto-faunal richness and abundance in the forest was assessed using Visual Encounter Survey (Heyer *et al.* 1994). In Visual Encounter Survey, the team walks through an area or habitat systematically searching for herpetofauna. The forests floor was searched for

the herpetofauna among the leaf litters, fallen logs, boulders and crevices of rocks. The search for the herpetofauna was also done on the trees, where in the bark, buttress, root, hollows on the trees, were thoroughly searched for. A special effort was also made to search for amphibians in and around the streams and water bodies. In every cases the species identity and the number of individuals was recorded along with ecological notes. Herpetofauna was also studied using quadrats. Several 5m x 5m quadrates were taken and the herpetofauna were studied within those quadrats.

Fishes: Fishes were studied by capturing the fishes using various fishing gears such as, hook and line, dip nets, gill nets, bag nets, gill nets and bag nets. These are used in various situations, for eg., hook and lines are used in areas where the bottom is rocky or uneven and the operation of normal fishing gears is rather difficult. Dip nets operation focus on the surface swimming fishes. The gill nets are allowed to drift across the water, and the fishes that attempt to swim through the nets are trapped. While the bag nets are elongated rectangular trap net, with a broad front part and pointed hint part. The mesh size usually increases from the cod end towards the mouth.

4. RESULTS & DISCUSSION

4.1 MAMMALS

4.1.1 Mammals of Chimmony Wildlife Sanctuary:

53 species in 24 families and 9 orders have been reported from the Chimmony Wildlife

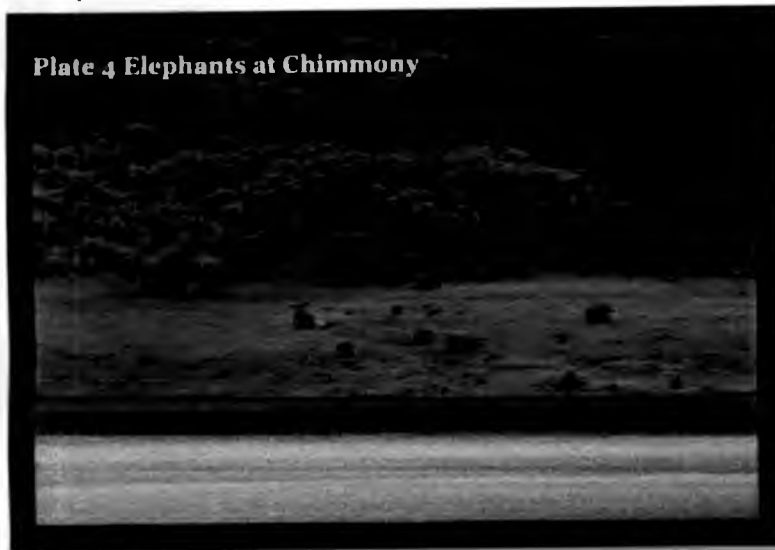


Plate 4 Elephants at Chimmony

Sanctuary during the present study. The checklist of mammals of Chimmony Wildlife Sanctuary is given in Appendix 1. Order Chiroptera reported maximum number of species (18), followed by order Rodentia with 12 species, order Carnivora (10) Artiodactyla (6) and Primates (3). Orders Insectivora, Lagomorpha,

and Proboscidea reported one species each. The families that recorded the maximum number of species were Vespertilionidae with seven species, followed by Muridae (six), Pteropodidae and Sciuridae (four each).

Jayson and Easa (1996) reports 22 species of mammals. The present study thus reports 31 additional species of mammals than the earlier studies from Chimmony Wildlife sanctuary.

4.1.2 Census on Large Mammals of Chimmony Wildlife Sanctuary:

The census data on the large mammals of Chimmony WLS is given in Table 2. Bonnet Macaque (18) was the most abundant animal at Chimmony WLS, followed by Asian Elephant (14), Malabar Giant Squirrel (12), Spotted Deer (12) and Gaur (12). Only three Wild Boar could be counted during the large mammal census. Maximum number of large mammals was reported at the Virakuthode region, followed by Vavala and Echippara regions within the sanctuary.

Table 2. Population of the large mammals of Chimmony WLS at different study locations

Species	Virakuthodu	Vavala	Echippara	Mangalamkava	Total
Bonnet Macaque <i>Macaca radiata</i>	0	12	0	6	18
Asian Elephant <i>Elephas maximus</i>	14	0	0	0	14
Malabar Giant Squirrel <i>Ratufa indica</i>	4	3	3	2	12
Spotted Deer <i>Axis axis</i>	0	0	12	0	12
Indian Gaur <i>Bos gaurus</i>	12	0	0	0	12
Wild Boar <i>Sus scrofa</i>	0	3	0	0	3
	30	18	15	8	71

4.1.3 Diversity of Large Mammals of Chimmony Wildlife Sanctuary:

The Shannon diversity index and the Simpson's index of diversity of the mammals of the Chimmony Wildlife Sanctuary is given in Table 3 and Fig. 2 and Fig. 3.

Table 3. Diversity of the large mammals of Chimmony WLS at different study locations

Index	Virakuthode	Vavala	Mangalam Kava	Echipara
Shannon H' Log Base 10.	0.47	0.45	0.28	0.28
Shannon H max Log Base 10.	0.48	0.48	0.30	0.30
Shannon J'	0.98	0.95	0.92	0.92



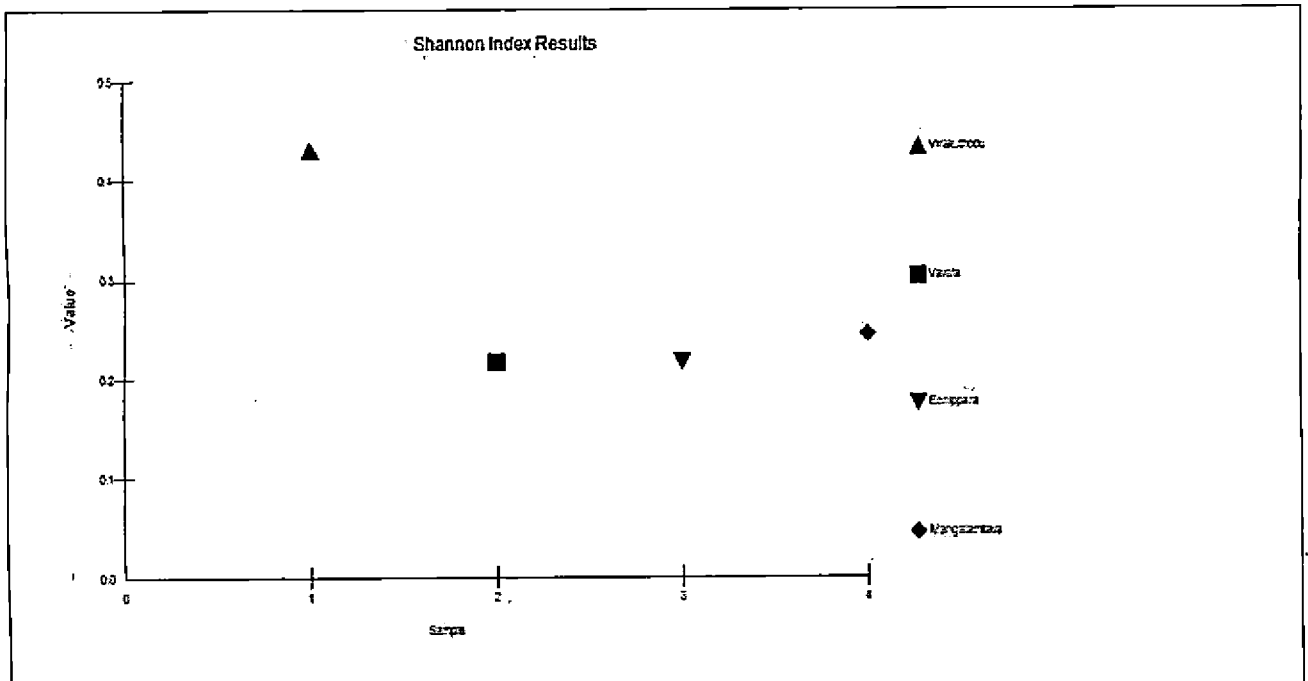


Fig. 2 Shannon Diversity index of large mammals of Chimmony

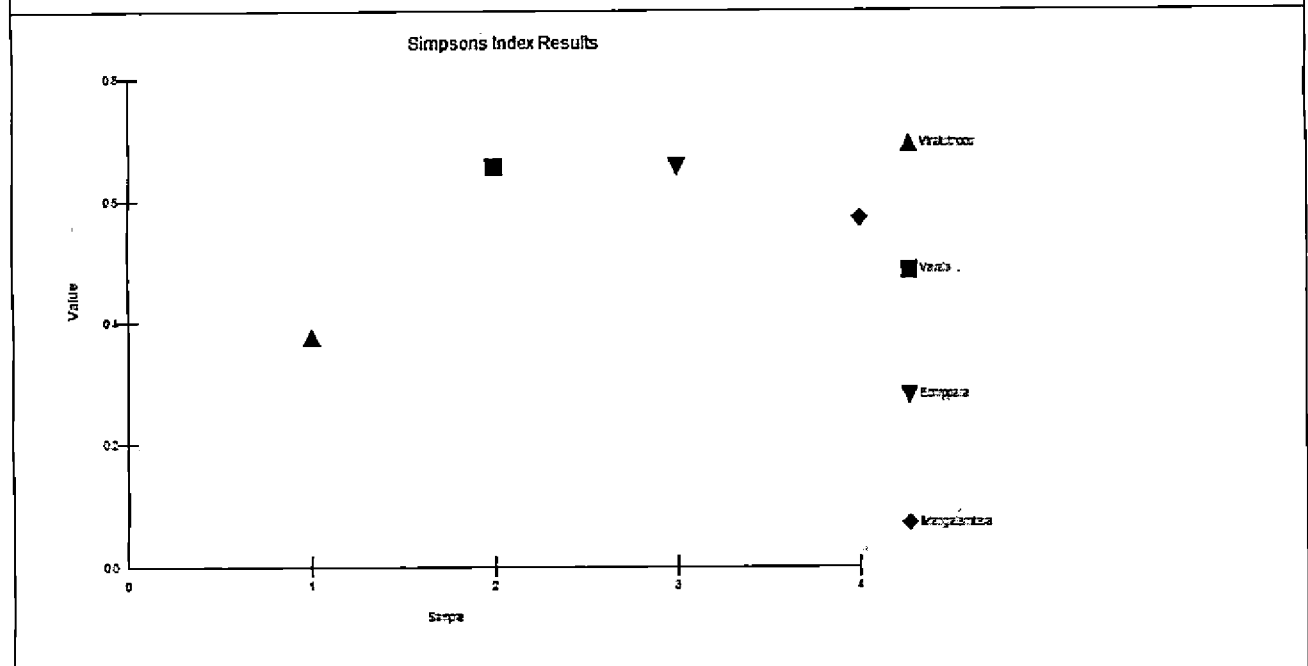


Fig. 3 Simpson Diversity index of large mammals of Chimmony

4.1.4 Similarity of the Large Mammals between the different study locations at Chimmony

Wildlife Sanctuary:

Similarity of the large mammals between the different study locations at Chimmony Wildlife Sanctuary is given in Fig. 4. There exists more similarity between the large mammals of Mangalamkava and Vavala, then with Echipara.

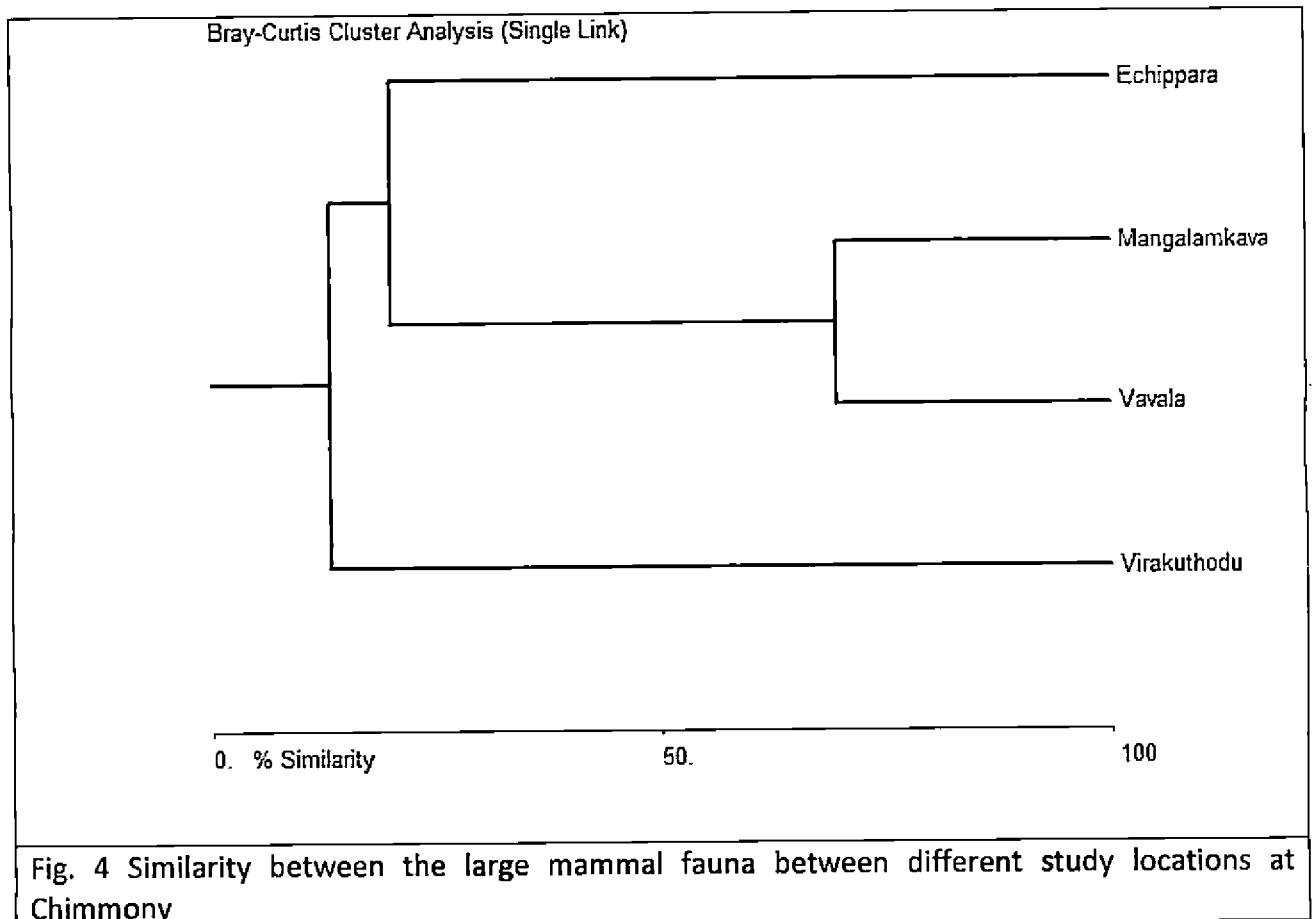


Fig. 4 Similarity between the large mammal fauna between different study locations at Chimmony

4.1.5 Small Mammals (Bats, rodents and insectivores) of the of Chimmony Wildlife Sanctuary

The small mammals sighted from the present study are presented in Table 4 and Table 5. Six species of bats, four species of rodents and one species of insectivore are recorded during the present study from Chimmony WLS.

4.1.5.1 Bats



The most abundant species of bat at Chimmony has been Rufous Horseshoe Bat *Rhinolophus rouxii*, (64.4% of the total bats caught), followed by Greater Short-nosed Fruit Bat *Cynopterus sphinx* (15.6% of the total bats caught), Lesser False Vampire

Bat *Megaderma spasma* (6.7% of the total bats caught), Leschenault's Rousette *Rousettus leschenaultia* (4.4% of the total bats caught), Beddomme's Horseshoe Bat *Rhinolophus beddomei* (4.4% of the total bats caught), and Lesser Short-nosed Fruit Bat *Cynopterus brachyotis* (4.4% of the total bats caught) (Table 4).

Table 4. Bats reported from the different locations at Chimmony Wildlife Sanctuary

Species	Virakuthode	Anaporu	Mulappara	Pazhayavellam	Eettakomban	Ponmudi	Vavala	Total
1. Rufous Horseshoe Bat <i>Rhinolophus rouxii</i>	18	0	5	0	3	2	1	29
2. Greater Short-nosed Fruit Bat <i>Cynopterus sphinx</i>	0	6	1	0	0	0	0	7
3. Lesser False Vampire Bat <i>Megaderma spasma</i>	1	0	0	2	0	0	0	3
4. Leschenault's Rousette <i>Rousettus leschenaulti</i>	1	0	0	0	0	1	0	2
5. Beddomme's Horseshoe Bat <i>Rhinolophus beddomei</i>	1	0	0	0	1	0	0	2
6. Lesser Short-nosed Fruit Bat <i>Cynopterus brachyotis</i>	0	2	0	0	0	0	0	2
	21	8	6	2	4	3	1	45

4.1.5.2 Rodents and insectivores



Plate 7 Little Indian Field Mouse at Chimmony

Four species of rodents and one species of insectivore are recorded during the present study from Chimmony WLS (Table 5). The most abundant species of rodent at Chimmony was Blanford's *Madromys Madromys*

blanfordi (41.67% of the total rodents caught), followed by Roof / House Rat *Rattus rattus* and Flat-haired Mouse, *Mus platythrix* (16.67% each of the total rodents caught) and while the Little Indian Field Mouse, *Mus booduga* (8.33% of the total rodents caught) (Table 5). Asian Musk Shrew, *Suncus murinus* was the only Insectivore located during the present study.

Table 5. Rodents and insectivores reported from the different locations at Chimmony Wildlife Sanctuary

	Verakuthodu	Aanaappor	Pazhayavellam	Ponmudi	Total
1. Blanford's Madromys <i>Madromys blanfordi</i>	2	2	1		5
2. Roof / House Rat <i>Rattus rattus</i>	2				2
3. Flat-haired Mouse <i>Mus platythrix</i>	1			1	2
4. Asian Musk Shrew <i>Suncus murinus</i>	1			1	2
5. Little Indian Field Mouse <i>Mus booduga</i>	1				1
Total	7	2	1	2	12

4.1.6 Small Mammal species description

4.1.6.1 *Pteropus giganteus* (Brunnich, 1782): This is a very large fruit bat with an average forearm length of 168.4mm (152-183mm). It exceeds in size all other species known from Kerala. The snout is long and hairy throughout. The ears are black, virtually hairless, tall and pointed. The wings are massive. The first digit (thumb) has a large claw; the claw of the second digit is small. The feet are large and have very robust claws. The pelage is moderately long and coarse over the head, upper shoulder and ventral aspect. It is a rich chestnut brown on the crown of the head. On the nape of the neck and mantle, it varies from a light yellowish tan to a deep chestnut brown. The pelage is relatively darker around the eyes and mouth. The pelage on the posterior shoulders and mid dorsal region is short, sparse and black with some paler hair tips. There is a clear line of demarcation on the shoulders between the chestnut hairs of the head, neck and mantle and the dark hairs of the dorsum. The interfemoral membrane is little

developed and there is no external tail. *Pteropus giganteus* were not caught in the mist net. However, two dead individuals were obtained from Chimmony dam site area that is a moist deciduous habitat.

4.1.6.2 *Cynopterus sphinx* (Vahl, 1797): This is a medium sized fruit bat with an average forearm length of 70.2mm (64-79mm). The membrane is dark brown throughout, but with pale fingers on the wing. The medial part of interfemoral membrane is hairy, above and below. The muzzle is short, broad and covered with hairs as far as the nostrils, which project well forwards. The ears are simple and essentially naked; mocha brown in colour but with well defined pale anterior and posterior borders. The pelage is soft and silky in texture. A total of 76 individuals captured from the sanctuary, majority of which (92.11%) were from moist deciduous habitat.

4.1.6.3 *Cynopterus brachyotis* (Muller, 1838): This species averages smaller than *Cynopterus sphinx* with a forearm length of 60.3mm (57.3-63.3mm). It can be distinguished by its smaller ears, which do not exceed 18mm in length. In comparison with *Cynopterus sphinx* the pale borders of the ears are narrow or absent. Two individuals were obtained during the study period both from evergreen at an altitude of 543m MSL.

4.1.6.4 *Rousettus leschenaulti* (Desmarest, 1820): This species is having an average forearm length of 80.6mm (75-86mm). The muzzle is relatively short and slender. The pelage is soft, fine and silky. It is fulvous brown on the crown of the head, back, flanks and throat; the belly is more greyish in the median area. Eleven individuals were captured from two sites, both moist-deciduous habitat. A large roost of *Rousettus leschenaulti* comprising of more than fifteen thousand individuals was found in a rocky cave at Mampara.

4.1.6.5 *Megaderma lyra* E. Geoffroy, 1810: This is robust species with an average forearm length of 66.4mm (56.0-71.5mm). The head is characterized by its large, oval ears, which have

a fringe of white hairs on their inner margins. The ears are joined medially for between one third and half their length. Each ear has a bifid tragus, the posterior process of which is taller. The face is hairy on the forehead and upper cheeks. The snout is naked, flesh coloured but with some well defined papillae. The lower jaw projects beyond the upper. The nose leaf is erect, straight-sided and some 10mm in height; it has a longitudinal ridge and a simple rounded horizontal base. The pelage is fine, soft and moderately long. It extends on to the forearms for half their length dorsally. The upper surface of the body is a uniform mouse grey faintly washed with brown. The ventral surface is paler, with the hair tips on the throat and belly white; the hair bases are grey. The membranes and ears are greyish black and semi translucent. The wings are broad. Five individuals were captured from two different locations of moist deciduous habitat.

4.1.6.6 *Megaderma spasma* (Linnaeus, 1758): A smaller species than *Megaderma lyra* with an average forearm length of 56.9mm (54.0-62.0mm). The interfemoral membrane larger than *Megaderma lyra*. The face differs in the shape of the vertical nose-leaf, which is shorter than that of *Megaderma lyra*; it has convex rather than straight sides and its longitudinal ridge has a characteristic heart shaped base. The pelage is deep grey on the upper surface; it is paler grey on the belly. A total of thirteen individuals were captured from five different locations moist deciduous habitat.



4.1.6.7 *Rhinolophus rouxii* Temminck, 1835: The forearm length of this species varies from 44.4-52.3mm. The pelage is soft and silky. There is a considerable variation in pelage colour ranging from orange, to russet brown to buffy brown to grey. This is the second most abundant bat species in the sanctuary. Out of the 41 individuals collected from the sanctuary, 34 (82.93%) were from moist deciduous habitat.

4.1.6.8 *Rhinolophus lepidus* Blyth, 1844: This is a small Rhinolophid with an average forearm length of 39.8mm (37.0-41.8mm). The pelage colour is typically grey-brown dorsally and slightly paler ventrally. Two individuals were captured both from moist deciduous habitat.

4.1.6.9 *Hipposideros fulvus* Gray, 1838: This is a medium-small species of *Hipposideros* with characteristically very large ears, the tips of which are broadly rounded off. The forearm length averages 40.4mm (38.4-44.0mm). The structure of the wings is essentially similar to *Hipposideros ater* with the third metacarpal significantly shorter than the fourth. The feet are small. The nose leaf has a greatest width of about 5mm. The pelage is variable in colour including dull yellow, pale grey, dull brown and golden orange. Two individuals were captured from the same site of a moist deciduous habitat.

4.1.6.10 *Hipposideros speoris* (Schneider, 1800): Although the forearm length averages 50.7mm (45.6-54.0mm), which significantly exceeds that of *Hipposideros fulvus*, the ears are markedly smaller. The nose leaf has three supplementary leaflets, of which the outer is distinctly smaller than the other two. The narial lappets are well developed. The intermediate leaf has a slightly concave upper edge. The posterior leaf is divided into four cells by three vertical septa, its upper edge is slightly thickened and without processes. A frontal sac is present in males where as in females it is represented by a tuft of hairs. The pelage colour is variable. Some individuals are grey, palest on the ventral surface, and between the shoulders on the upper back; they are

darker on the flanks. Others are yellowish brown or bright orange colour. Twelve individuals were captured from a single site known as Poovanchira. A cave roost of more than five hundred individuals was also found in Poovanchira which comes under moist deciduous habitat.

4.1.6.11 *Hipposideros ater* Templeton, 1848: This is a small species of *Hipposideros* superficially similar to *Hipposideros fulvus* with a significantly shorter forearm (average 36.3mm; 34.9-38mm) and smaller ears. The breadth of the ears is sub equal to their height and the tips are broadly rounded off; each ear has a well-defined antitragus. The nose-leaf has a greatest width of about 4.0-4.5mm. Its anterior leaf is without supplementary lateral leaflets or a median emargination. The feet are small. In the wing, the fourth metacarpal exceeds the fifth in length whilst the third is the shortest. The tail is long and is enclosed, all except the extreme tip, with in the well-developed interfemoral membrane. The wings and the interfemoral membrane are naked, above and below, and are a uniform dark brown or black. The pelage is variable in colour ranging from dull yellow, golden orange or pale grey to dark brown on the dorsal aspect. The hair bases are paler than the tips. The ventral aspect is also variable in colour but is usually paler than the back. Two individuals were captured from moist deciduous habitat.

4.1.6.12 *Scotophilus heathii* Horsfield, 1831: This is a robust bat with an average forearm length of 60.7 mm (55.4-65.8mm). The tail is long, with only the terminal 2 to 3 mm. projecting free from the interfemoral membrane. The muzzle is broad and blunt; it is swollen on the sides, dark in colour and mostly naked. The nostrils are simple in form, round and slightly outward facing. The ears are small in relation to the size of the head; they are naked and have a number of transverse ridges. The antitragus of each ear is well formed and separated from the posterior margin of the pinna by a distinct notch. The tragus is half the height of the pinna and crescent shaped. The pelage is fine and short; it is longer on the nape of the neck and throat. The head and back have pale buffy brown hair roots and darker olive-grey-brown tips; the nape of the neck is paler. The throat, chest and belly are pale yellow-buff throughout. The inter-femoral

membrane and wings are uniformly dark brown and essentially naked, except for some hairs adjacent to the body and forearm on the ventral surface of each wing. In the wing, the third metacarpal slightly exceeds the fourth and fifth in length. The feet are about half the length of the tibiae. Five individuals were collected from moist deciduous habitat of the sanctuary.

4.1.6.13 *Scotophilus kuhlii* Leach, 1821: This species with an average forearm length of 49.0mm. (44.0-56.4mm), can only be distinguished with certainty from *Scotophilus heathii* by its smaller size. In all other structures it is essentially similar. The pelage is chestnut brown above; paler below usually without the characteristic yellowish tinge of *Scotophilus heathii*. Five individuals were collected from moist deciduous habitat of the sanctuary.

4.1.6.14 *Pipistrellus coromandra* (Gray, 1838): This is a small pipistrelle with an average forearm length of 30.0mm. (25.5-34.3mm). It is uniform brown on the dorsal surface, ranging from chestnut to dark clove brown. The ventral surface is conspicuously paler, with beige brown or cinnamon brown tips to the hairs, depending on the individual; the hair roots are dark. The ears and membrane are mid to dark brown and essentially naked, although there are some hairs on the inter-femoral membrane adjacent to the body and the tail, above and below. Only one individual was collected from a moist deciduous habitat.

4.1.6.15 *Pipistrellus tenuis* (Temminck, 1840): This is the smallest pipistrelle found within the Indian subcontinent with an average forearm length of 27.7mm (25.0-30.2mm). Since it is not possible to discriminate between this species and smaller individuals of *Pipistrellus coromandra* using external characters, cranial characters were used for the identification of this species. The skull is significantly smaller than that of *Pipistrellus coromandra*. One individual each were obtained from both evergreen and moist deciduous habitats.

4.1.6.16 *Pipistrellus ceylonicus* (Kelaart, 1852): This is a relatively large *Pipistrellus* with an average forearm length of 37.2mm (33.0-42.0mm). The ears, naked areas of the face, wings and interfemoral membrane are uniform dark brown. There are some hairs on the interfemoral membrane, above and below, adjacent to the body, tail and femora. The dorsal pelage is variable in color ranging from grey- brown to chestnut, reddish or golden brown. The ventral surface has dark hair bases and pale grey tips. Only one individual was collected from evergreen habitat.

4.1.6.17 *Pipistrellus affinis* (Dobson, 1871): This is a large species of pipistrelle with an average forearm length of 40.2mm (38.4-41.4mm). The pelage is soft, dense and relatively long. It is essentially dark brown above, although the extreme tips of some of the hairs are pale grey, giving a slightly grizzled effect. The ventral surface is also dark, only slightly paler than the back. The membranes, ears and naked parts of the face are uniform blackish brown. Only one individual was collected from evergreen habitat.

4.1.6.18 *Kerivoula picta* (Pallas, 1767): This is a relatively small bat with an average forearm length of 34.7mm (31.5-37.9mm). The muzzle is very hairy but the nostrils are naked, which are slightly protuberant and face outwards and slightly downwards. The upper and lower lips are also hairy. The ears are relatively large; the anterior border of each is smoothly concave; the tip rounded off; there is a distinct concavity just below the tip on the posterior border. The tragus is tall and narrow. The pelage is long, dense and woolly. On the dorsal surface, it is bright orange, to tawny-red from the tips to the roots. On the ventral surface, it is buff coloured, with a distinct orange hue on the flanks. The wings are bright orange adjacent to the body and on either side of the metacarpals, above and below; the remainder is black. The interfemoral membrane is orange to scarlet. The feet are hairy. The wings are attached to the bases of the outer toes. Only one individual was collected from the sanctuary boundary region near the dam site, which is a moist deciduous habitat.

4.1.6.19 Common House Rat (*Rattus rattus*): This is a common species which has wide distribution throughout the world. The wild species have it's under parts completely white and upper deep grey to black. The tail is usually longer than the head and body (Prater, 1971 and Menon, 2003). In the present study the species was captured in both the habitats of the sanctuary, namely moist deciduous and semi-dry patches and is found to be abundant.

4.1.6.20 Blanford's Madromys (*Madromys blanfordi*): It is a rare species of rodent and is a typical forest species. The rat is about 150-180 mm long, its tail is little longer. Very distinctive in this species is the colour of the tail. It is brown for three quarters of its length, but the terminal portion is clothed with longer white hairs. Its soft long fur is grey brown above, and white on the underside. This wood rat inhabits dry or moist deciduous and evergreen forest zones in southern, central, and eastern India as far north as Bengal. In southern India this is found only in the forest. (Prater, 1971 and Menon, 2003). In Chimmony, they dominate most of vegetations and were the highest in number from the total species collected.

4.1.6.21 Indian Spiny Field Mouse (*Mus platythrix*): The fur in this mouse, both above and below is composed almost entirely of flattened spines, those on the back stiffer and coarser than those on the lower parts.



The colour above is sandy or dark brown and white below. The separation of two colours is sharp and well defined. (Prater, 1971 and Menon, 2003). Rocky habitats were found to be

preferred by this species, from where these were captured.

4.1.6.22 Indian Field Mouse (*Mus booduga*): It is about 5-8 cm. in body length, with a tail slightly over 5 cm. The dorsal fur is brown or dark greyish and underside is white. It is a very common species in our fields and gardens. (Prater, 1971 and Menon, 2003). During the present study this species was trapped only once in the forest indicating low abundance of this species in the forest area when compared to other species.

4.1.6.23 House Shrew (*Suncus murinus*): The common shrew of India, also called the Grey



Musk Shrew because of the characteristic odour that it leaves about the house. It is greyish-brown, has a short, thick tail with a few bristles and large, pink ears. It varies in size and colour throughout India. The species was trapped only once in the forest during the study and was found in a strange habitat in the high hills of Ponmudi, which is a contradiction to its habitats near human inhabitations.

4.1.6.24 Jungle Striped Squirrel (*Funambulus tristriatus*): This is the largest species of the genus. There are clear light stripes on the back, three in number, and the under parts are light or whitish. The tail is most often shorter than the head and body. Hands and feet are without any special peculiarity. Fourth finger is usually dominant in the hand. The species is endemic to Western Ghats. (Prater, 1971 and Menon, 2003). The species is common throughout the study area and was observed twice during the study period.

4.1.6.25 Indian Giant Squirrel (*Ratufa indica*): Also called the Malabar Giant Squirrel, this is an endemic squirrel to India. It consists of varying bright pelages. The back is a mixture of maroon and black and the under parts are cream or buff. In the northern Western Ghats, this squirrel is brownish maroon in appearance with an all brown or brown and white tail (Prater, 1971 and Menon, 2003). In the south it is black and dark maroon with a black and brown tail. Its presence is marked well in the periphery regions of the sanctuary and is less distributed as one goes into the forest. It was observed several times in the moist deciduous forests of Chimmony.

4.1.6.26 Indian Porcupine (*Hystrix indica*): The common and largest porcupine of India, this thickset rodent is covered with long black and white quills with a long crest of spines flowing from the forehead to the middle of the back. Its tail ends in a bunch of thick white quills. In southern India sub-species is often referred to as the “Red Porcupine” which has quills with a rusty tinge on its back.

During the study period seven species of rodents and one species of insectivore were recorded. Out of this, four species of rodents and one species of insectivores were trapped. The presence of other species was based on ocular estimation. This study at the Chimmony Wildlife Sanctuary is for the first time and is relevant in diversity and abundance studies.

4.2 BIRDS

4.2.1 Checklist of Birds of Chimmony WLS:

181 species of birds (Appendix 2) have been reported from Chimmony Wildlife Sanctuary. This includes seven Western Ghats endemic species such as Blue-winged Parakeet, Grey-headed Bulbul, Indian Rufous Babbler, Malabar Grey Hornbill, White-bellied Blue-Flycatcher, White-bellied Treepie and Small Sunbird. Other significant observations include, the sighting of Lesser Fish-Eagle *Ichthyophaga humilis*, Large Hawk-Cuckoo *Hierococcyx sparveroides*, Broad-billed Roller *Eurystomus orientalis* and Northern House-Martin *Delichon urbica* all of which are new records for Chimmony.



53 species that were sighted during the last bird survey (Nameer, 1992) could not be sighted during the present survey. This includes birds of prey such as Black Baza, Greater Grey-headed Fish-Eagle, Changeable Hawk-Eagle, Eurasian Sparrow-hawk, Bonelli's Eagle etc. Of this Greater Grey-headed Fish-Eagle could have been a misidentification of the Lesser Fish-Eagle.

4.2.2 Abundance of birds of Chimmony WLS

The abundance of the birds at different habitat in Chimmony is given in Table 6. The ten most abundant birds of Chimmony WLS during the present study were, Greenish Leaf-Warbler, White-cheeked Barbet, Greater Racket-tailed Drongo, Yellow-browed Bulbul, Malabar Whistling-Thrush, Large-billed Leaf-Warbler, Small Sunbird, Indian Hanging-Parrot, Blue-winged Parakeet and Ashy Drongo.

Table 6. The abundance of the birds at different habitats in Chimmony

Common Name	Scientific name	evergreen	moist deciduous	plantation & reservoir	Total
1. Greenish Leaf-Warbler	<i>Phylloscopus trochiloides</i>	34	28	8	70
2. White-cheeked Barbet	<i>Megalaima viridis</i>	21	16	3	40
3. Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>	25	12	3	40
4. Yellow-browed Bulbul	<i>Iole indica</i>	27	6		33
5. Malabar Whistling-Thrush	<i>Myiophonus horsfieldii</i>	26	7		33
6. Large-billed Leaf-Warbler	<i>Phylloscopus magnirostris</i>	20	9		29
7. Small Sunbird	<i>Nectarinia minima</i>	5	18	4	27
8. Indian Hanging-Parrot	<i>Loriculus vernalis</i>	7	13	4	24
9. Blue-winged Parakeet	<i>Psittacula columboides</i>	16	6	1	23
10. Ashy Drongo	<i>Dicrurus leucophaeus</i>	18	5		23
11. Scarlet Minivet	<i>Pericrocotus flammeus</i>	21			21
12. *Southern Hill-Myna	<i>Gracula indica</i>	11	8	2	21
13. Little Cormorant	<i>Phalacrocorax niger</i>			18	18
14. *Malabar Grey Hornbill	<i>Ocyrceros griseus</i>	14	3		17
15. Quaker Tit-Babbler)	<i>Alcippe poioicephala</i>	15	2		17
16. Brahminy Kite	<i>Haliastur indus</i>			16	16
17. Bronzed Drongo	<i>Dicrurus aeneus</i>	4	9	1	14
18. *Greater Coucal	<i>Centropus sinensis</i>	3	4	6	13
19. Crimson-throated Barbet	<i>Megalaima rubricapilla</i>	8	5		13
20. Eurasian Golden Oriole	<i>Oriolus oriolus</i>	4	9		13
21. Darter	<i>Anhinga melanogaster</i>			12	12
22. Malabar Trogon	<i>Harpactes fasciatus</i>	8	2	1	11
23. Common Iora	<i>Aegithina tiphia</i>	3	4	4	11
24. White-bellied Treepie	<i>Dendrocitta leucogastra</i>	11			11
25. Jungle Crow	<i>Corvus macrorhynchos</i>	1	7	3	11
26. White-breasted Kingfisher	<i>Halcyon smyrnensis</i>	4	2	4	10
27. Small Bee-eater	<i>Merops orientalis</i>		8	2	10
28. Lesser Golden-backed Woodpecker	<i>Dinopium benghalense</i>	3	6	1	10
29. Asian Paradise-Flycatcher	<i>Terpsiphone paradisi</i>	6	4		10
30. *Crested Serpent-Eagle	<i>Spilornis cheela</i>	8	1		9
31. Grey Junglefowl	<i>Gallus sonneratii</i>	6	2	1	9
32. Chestnut-headed Bee-eater	<i>Merops leschenaulti</i>	2	6	1	9
33. Large Pied Wagtail	<i>Motacilla maderaspatensis</i>	4	5		9
34. Asian Fairy-Bluebird	<i>Irena puella</i>	8	1		9
35. Brown-breasted Flycatcher	<i>Muscicapa muttui</i>	6	3		9
36. Emerald Dove	<i>Chalcophaps indica</i>	2	6		8
37. Jungle Babbler	<i>Turdoides striatus</i>		5	3	8

38. Brown-capped Pygmy Woodpecker	<i>Dendrocopos nanus</i>	5	2		7
39. Asian Brown Flycatcher	<i>Muscicapa dauurica</i>	7			7
40. Tickell's Blue-Flycatcher	<i>Cyornis tickelliae</i>	2	4	1	7
41. Black Eagle	<i>Ictinaetus malayensis</i>	5	1		6
42. Common Golden-backed Woodpecker	<i>Dinopium javanense</i>	6			6
43. Red-rumped Swallow	<i>Hirundo daurica</i>		6		6
44. Black-crested Bulbul	<i>Pycnonotus melanicterus</i>	5	1		6
45. Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	1	4	1	6
46. Gold-fronted Chloropsis	<i>Chloropsis aurifrons</i>	6			6
47. Spotted Babbler	<i>Pellorneum ruficeps</i>	6			6
48. Black-naped Monarch-Flycatcher	<i>Hypothymis azurea</i>	3	3		6
49. Velvet-fronted Nuthatch	<i>Sitta frontalis</i>	5	1		6
50. Purple Sunbird	<i>Nectarinia asiatica</i>	5	1		6
51. Indian Treepie	<i>Dendrocitta vagabunda</i>		2	4	6
52. Indian Pond-Heron	<i>Ardeola grayii</i>			5	5
53. Red-wattled Lapwing	<i>Vanellus indicus</i>			5	5
54. Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	1	1	3	5
55. *Jungle Owlet	<i>Glauclidium radiatum</i>	2	3		5
56. *Asian Palm-Swift (707-708)	<i>Cypsiurus balasiensis</i>		5		5
57. Large Woodshrike	<i>Tephrodornis gularis</i>	3	1	1	5
58. Orange-headed Thrush	<i>Zoothera citrina</i>	4	1		5
59. Blyth's Reed-Warbler	<i>Acrocephalus dumetorum</i>		4	1	5
60. Great Cormorant	<i>Phalacrocorax carbo</i>			4	4
61. *Crested Tree-Swift	<i>Hemiprocne coronata</i>	4			4
62. Black-headed Babbler	<i>Rhopocichla atriceps</i>	2	2		4
63. *Black-naped Oriole	<i>Oriolus chinensis</i>	3	1		4
64. River Tern	<i>Sterna aurantia</i>			3	3
65. Indian Edible-nest Swiftlet	<i>Collocalia unicolor</i>	3			3
66. Great Pied Hornbill	<i>Buceros bicornis</i>	3			3
67. Ashy Woodswallow	<i>Artamus fuscus</i>		2	1	3
68. Oriental Magpie-Robin	<i>Copsychus saularis</i>		1	2	3
69. *Western Crowned Warbler	<i>Phylloscopus occipitalis</i>	3			3
70. White-bellied Blue-Flycatcher	<i>Cyornis pallipes</i>	3			3
71. Plain Flowerpecker	<i>Dicaeum concolor</i>	2		1	3
72. Little Spiderhunter	<i>Arachnothera longirostra</i>	3			3
73. Grey-headed Starling	<i>Sturnus malabaricus</i>		2	1	3
74. Little Egret	<i>Egretta garzetta</i>	2			2
75. Cattle Egret	<i>Bubulcus ibis</i>			2	2
76. *Shikra	<i>Accipiter badius</i>	2			2
77. Red Spurfowl	<i>Galloperdix spadicea</i>		2		2
78. Spotted Dove	<i>Streptopelia chinensis</i>		1	1	2
79. Pompadour Green-Pigeon	<i>Treron pompadora</i>	2			2
80. Brainfever Bird	<i>Hierococcyx varius</i>		2		2
81. *Oriental Scops-Owl	<i>Otus sunia</i>		2		2
82. Collared Scops-Owl	<i>Otus bakkamoena</i>	2			2

83. Brown Hawk-Owl	<i>Ninox scutulata</i>	1	1		2
84. Small Blue Kingfisher	<i>Alcedo atthis</i>		2		2
85. Greater Golden-backed Woodpecker	<i>Chrysocolaptes lucidus</i>		1	1	2
86. Heart-spotted Woodpecker	<i>Hemicircus canente</i>		1	1	2
87. Indian Pitta	<i>Pitta brachyura</i>		2		2
88. Grey Wagtail	<i>Motacilla cinerea</i>	1	1		2
89. Common Tailorbird	<i>Orthotomus sutorius</i>		2		2
90. Purple-rumped Sunbird	<i>Nectarinia zeylonica</i>	1	1		2
91. Indian Shag	<i>Phalacrocorax fuscicollis</i>			1	1
92. Oriental Honey-Buzzard	<i>Pernis ptilorhynchus</i>	1			1
93. Lesser Grey-headed Fish-Eagle	<i>Ichthyophaga humilis</i>	1			1
94. Crested Goshawk	<i>Accipiter trivirgatus</i>		1		1
95. * Besra Sparrowhawk	<i>Accipiter virgatus</i>	1			1
96. Osprey	<i>Pandion haliaetus</i>			1	1
97. Blue Rock Pigeon	<i>Columba livia</i>			1	1
98. Green Imperial-Pigeon	<i>Ducula aenea</i>		1		1
99. Large Hawk-Cuckoo	<i>Hierococcyx sparverioides</i>	1			1
100. Asian Koel	<i>Eudynamys scolopacea</i>		1		1
101. Small Green-billed Malkoha	<i>Phaenicophaeus viridirostris</i>		1		1
102. Ceylon Frogmouth	<i>Batrachostomus moniliger</i>	1			1
103. House Swift	<i>Apus affinis</i>			1	1
104. Stork-billed Kingfisher	<i>Halcyon capensis</i>			1	1
105. Lesser Pied Kingfisher	<i>Ceryle rudis</i>			1	1
106. Oriental Broad-billed Roller	<i>Eurystomus orientalis</i>	1			1
107. Rufous Woodpecker	<i>Celeus brachyurus</i>		1		1
108. *Great Black Woodpecker	<i>Dryocopus javensis</i>		1		1
109. * Northern House-Martin	<i>Delichon urbica</i>	1			1
110. Pied Flycatcher-Shrike	<i>Hemipus picatus</i>	1			1
111. *Large Cuckoo-Shrike	<i>Coracina macei</i>		1		1
112. Small Minivet	<i>Pericrocotus cinnamomeus</i>		1		1
113. Red-vented Bulbul	<i>Pycnonotus cafer</i>			1	1
114. *Black Bulbul	<i>Hypsipetes leucocephalus</i>		1		1
115. Jerdon's Chloropsis	<i>Chloropsis cochinchinensis</i>	1			1
116. White-rumped Shama	<i>Copsychus malabaricus</i>		1		1
117. *Indian Scimitar-Babbler	<i>Pomatorhinus horsfieldii</i>	1			1
118. Rufous-bellied Babbler	<i>Dumetia hyperythra</i>		1		1
119. White-headed Babbler	<i>Turdoides affinis</i>			1	1
120. Rusty-tailed Flycatcher	<i>Muscicapa ruficauda</i>		1		1
121. Great Tit	<i>Parus major</i>		1		1
122. Black-lored Yellow Tit	<i>Parus xanthogenys</i>	1			1
123. Thick-billed Flowerpecker	<i>Dicaeum agile</i>	1			1
124. Tickell's Flowerpecker	<i>Dicaeum erythrorhynchos</i>		1		1
125. Loten's Sunbird	<i>Nectarinia lotenia</i>		1		1
126. Common Myna	<i>Acridotheres tristis</i>)		1		1

4.2.3 Diversity of Birds of Chimmony WLS

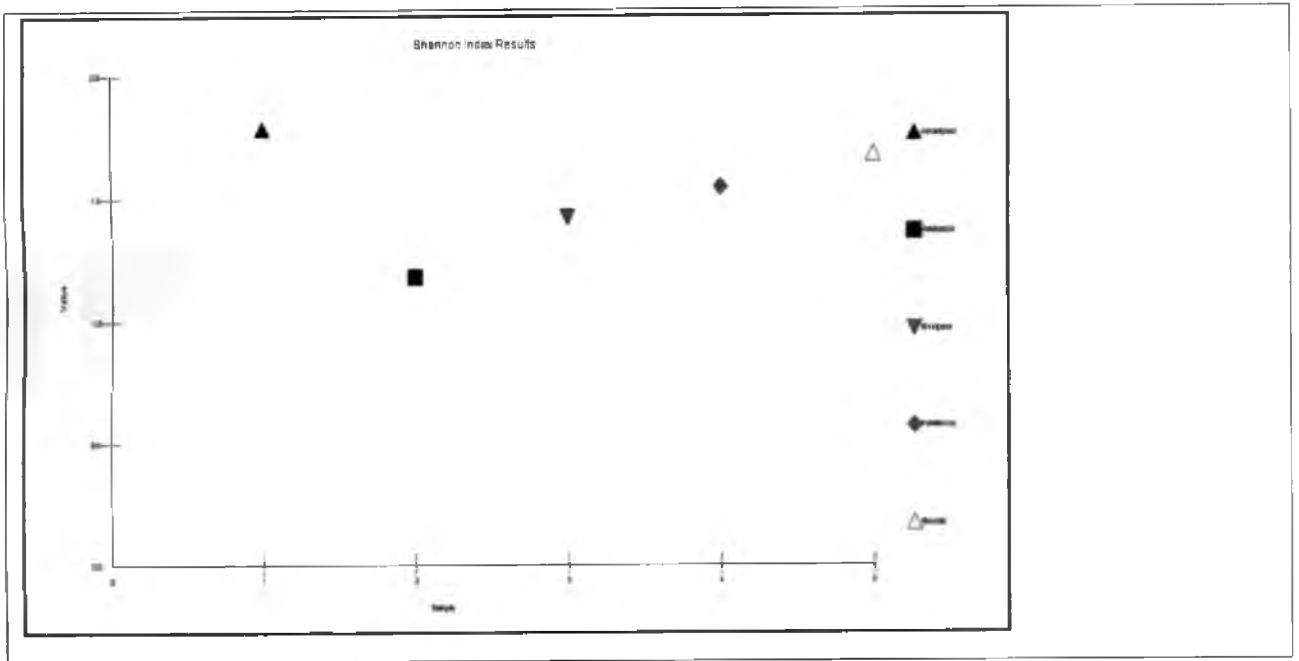
4.2.3.1 Bird species richness and diversity at Chimmony

The bird species richness and diversity of the various habitats at Chimmony are given in Table 7, Fig. 5. Evergreen and moist deciduous habitats were on par, in terms of maximum number of species (78 and 79 respectively) as well as number of individuals (751 and 622 respectively).

Table 7. Bird species richness and diversity at different habitats at Chimmony Wildlife Sanctuary

Index	Evergreen	Moist deciduous	Plantation and reservoir
# of species	78	79	47
# of individuals	751	622	331
Shannon H' Log Base 10	1.67	1.71	1.47
Shannon Hmax Log Base 10	1.89	1.91	1.67
Shannon J' (evenness)	0.88	0.89	0.88
Simpson's Diversity (1-D)	0.97	0.97	0.96

Fig. 5 Bird species diversity (Shannon Index) at the various study sites in Chimmony



4.2.3.2 Similarity of birds among the different study locations at Chimmony

Bray-Curtis cluster analysis of similarity of birds within the three study sites in Chimmony is given in Fig. 6. It can be seen that the bird communities of Karadipara and Palakuzhy were showing more similarity, which in turn was similar to the birds of Moodal, followed by Munipara. Bird communities of Kombazha stood different from the other regions studied in Chimmony -Vazhani.



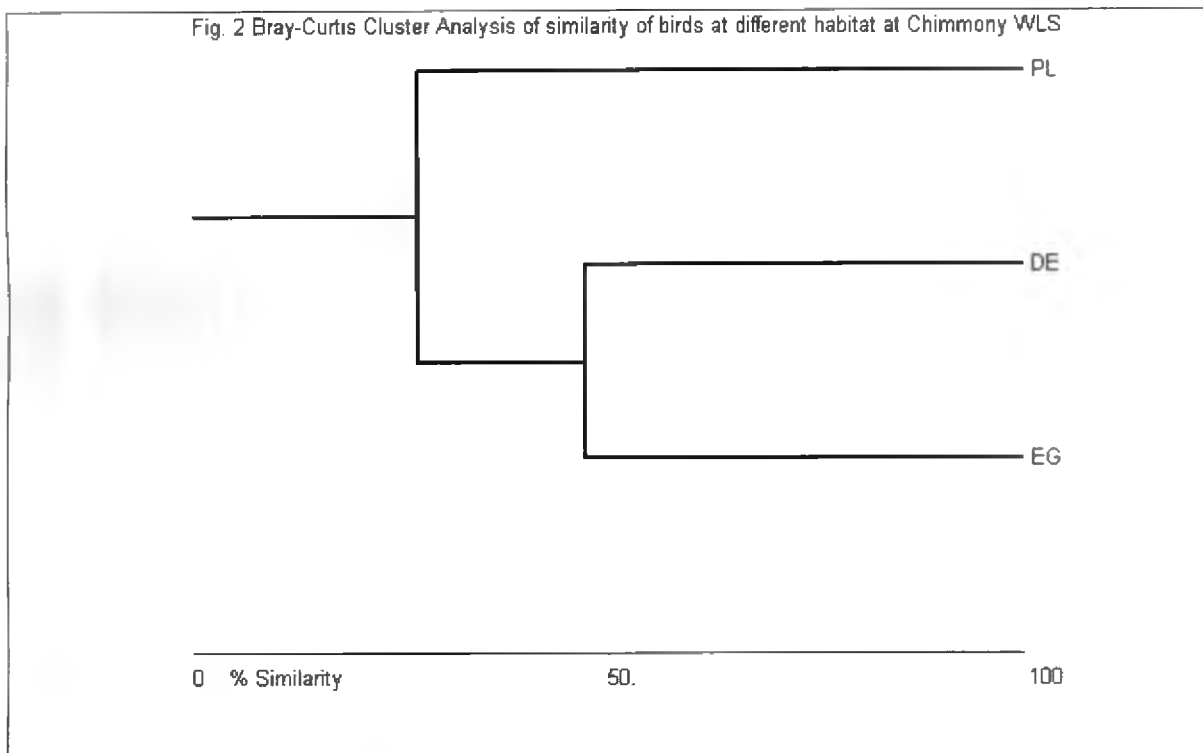


Fig. 6 Bray-Curtis Cluster analysis of birds at the different study sites in Chimmony

Legend: PI- Plantations & reservoir, De- deciduous forests, EG – evergreen forests

4.3 HERPETOFAUNA (REPTILES AND AMPHIBIANS)

A total of 236 individual herpetofauna composing of 15 genera and 22 species were detected on the line transects (Table 8). This includes 144 individuals of reptiles (14 species, nine genera) and 92 individuals of amphibians (eight species, six genera).

Plate 13 Forest Calotes at Chimmony



Table 8. Herpetofauna observed from different location at Chimmony Wildlife sanctuary during the present study.

Species	Echipara	Mangalam Kava	Virakuthode	Vavala	Total
Skink					
Snake Skink, <i>Lygosoma punctatus</i>	4	16	46		66
Little Skink, <i>Mabuya macularia</i>	8	4	6		18
Brahminy Skink, <i>Mabuya carinata</i>	1	1	11		13
Skink sp.	2	4	1		7
Lizards					0
Elliott's Forest Lizard, <i>Calotes ellioti</i>	1			4	5
Forest Calotes, <i>Calotes rouxi</i>		4	8		12
Common Garden Lizard, <i>Calotes versicolor</i>		3	3		6
Gecko					0
Kandy Dwarf Gecko, <i>Cnemaspis khandiana</i>	3		1	4	8
<i>Cnemaspis</i> sp.		1	1	1	3
Varanus					0
Common Indian Monitor, <i>Varanus bengalensis</i>			1		1
Snakes					0
Common Rat snake, <i>Ptyas mucosus</i>			1		1
Dumeril's Black-headed Snake, <i>Sibynophis subpunctatus</i>			1		1
Buffstriped Keelback, <i>Amphiesma stolata</i>		1			1
Malabar Pit Viper, <i>Trimeresurus malabaricus</i>		2			2
Total	19	36	80	9	144
Frogs					
Bronzed Frog, <i>Rana temporalis</i>		39	7		46
Beddome's frog, <i>Indirana beddomii</i>		16	10		26
Leith's Frog,		6	4		10

<i>Indirana leithii</i>					
Verrucose Frog, <i>Fejervarya keralensis</i>		2			2
Rufescent Burrowing Frog, <i>Fejervarya rufescens</i>		1			1
Common Indian Toad, <i>Bufo melanostictus</i>		2			2
Water Skipper Frog, <i>Euphlyctis cyanophlyctis</i>			4		4
Indian Bull Frog, <i>Hoplobatrachus tigerinus</i>				1	1
		66	25	1	92

4.3.1 Reptiles of Chimmony WLS

Among the reptiles skinks contributed to 74.31% followed by lizards (15.97%), geckos (5.56%), 3.47 (5%) and monitor lizard (0.69%) (Table 7).

Of the skinks, Snake Skink *Lygosoma punctatus* was the numerically dominant (45.83% of all the reptile sightings), followed by Little Skink, *Mabuya macularia* (12.50% of all the reptile sightings), Brahminy Skink, *Mabuya carinata* (9.03% of all the reptile sightings). One species skink could not be identified (Table 7).

Two species of geckos were sighted of which the geckos Kandy Dwarf Gecko *Cnemaspis khandian* (5.56% of all the reptile sightings) was the dominant one, while the second species of gecko could not be identified.

Three species of lizards could be sighted on the transects among which Forest Calotes *Calotes rouxi* (8.33% of all the reptile sightings) was the most dominant one, followed by Common Garden Lizard *Calotes versicolor* (4.17% of all the reptile sightings) and Elliott's Forest Lizard *Calotes ellioti* (3.47% of all the reptile sightings) (Table 7).

Out of the four species of snakes sighted on the transects Malabar Pit viper *Trimeresurus malabaricus* (1.39% of all the reptile sightings), was the most dominant one. The other three species such as Common Rat snake *Ptyas mucosus*, Dumeril's Black-headed Snake *Sibynophis subpunctatus* and Buffstriped Keelback *Amphiesma stolata* accounted for 0.69% of all the reptile sightings each (Table 7).

Bengal monitor *Varanus bengalensis* has been sighted only from Virakuthode within Chimmony wildlife sanctuary (Table 7).

4.3.2 Amphibians of Chimmony WLS

A total of eight species, six genera and 92 individuals (Table 7) of amphibians were sighted on the transects at Chimmony wildlife sanctuary.

The most abundant among them was Bronzed Frog, *Rana temporalis* (50% of all the amphibian sightings), this was followed by Beddome's frog, *Indirana beddomii* (28.3% of all the amphibian sightings), Leith's Leaping Frog *Indirana leithii* (10.9%



of all the amphibian sightings), Water Skipper Frog, *Euphlyctis cyanophlyctis* (4.3% of all the amphibian sightings), Verrucose Frog *Fejervarya keralensis* (2.2% of all the amphibian sightings), Common Indian Toad *Bufo melanostictus* (2.2% of all the amphibian sightings), Rufescent

Burrowing Frog, *Fejervarya rufescens* (1.1% of all the amphibian sightings) and Indian Bull Frog *Hoplobatrachus tigerinus* (1.1% of all the amphibian sightings).

4.3.2 Diversity of herpetofauna of Chimmony WLS

The diversity of herpetofauna of Chimmony WLS is given in Table 9. Mangalamkava recorded the maximum diversity of the herpetofauna, followed by Virakuthode, Echippara and Vavala.

Table 9. Shannon diversity index of herpetofauna at different locations of Chimmony Wildlife sanctuary during the present study.

Index	Mangalamkava	Virakuthode	Echippara	Vavala
Shannon H' Log Base 10	0.87	0.86	0.67	0.52
Shannon Hmax Log Base 10	1.18	1.18	0.78	0.60
Shannon J'	0.74	0.73	0.85	0.86

4.3.4 Species on the herpetofauna of Chimmony WLS

4.3.4.1 Leith's Leaping Frog, *Indirana leithii*

It is a small sized frog with obtuse snout. Skin at the back is with small – scattered tubercles. A strong fold is present from the eye to the shoulder. It is brown above with small dark spots. Limbs have dark transverse bands.

This has so far been reported only from Malabar region, Eravikulam National Park (NP), Munnar reserved forest (RF) and Periyar Tiger Reserve (TR) in Kerala (Easa, 2003). This is the first report of this species from Chimmony WLS. This species is endemic to Western Ghats.

4.3.4.2 Bronzed Frog, *Rana temporalis*

This is a medium sized frog with very distinct tympanum. Toes are entirely webbed. Skin is smooth. A prominent glandular fold runs along the dorso-lateral region. The species is yellowish brown with dark cross bars on limbs.

This species is known from Malabar region, Parambikulam WLS, Trivandrum RF, Ponmudi RF, Silent Valley NP, Pooyamkutty RF, Chinnar WLS, Wayanad WLS, Nilambur RF and Muthikulam-Siruvani RF in Kerala (Easa, 2003). This is the first report of this species from Chimmony WLS. This species is endemic to Western Ghats.

4.3.4.3 Common Indian Toad, *Bufo melanostictus*

This is largest among the Indian toads. First finger is equal to or longer than the second Toes are at least half webbed. The tarso metatarsal articulation reaches the tympanum or eye .The skin is tuberculated with many black tipped warts .Two series of large warts are present along the middle of the back. The species is uniform grey on the dorsal and uniform white on the ventral. This is a common species and is seen near human habitations also.



This species has been reported from the following places in Kerala including Thiruvananthapuram district, Ponmudi RF, Aralam WLS, Parambikulam WLS, Nilgiri Biosphere Reserve (Kerala Portion), Peechi-Vazhani WLS, Chinnar (WLS), Pooyamkutty (RF) and Kuttanad paddy fields (Easa, 2003).

4.3.4.4 Beddome's Frog, *Indirana beddomii*

It is small to medium sized frog closely related to *R leithii*. It can be distinguished from *R leithii* by inter orbital space as broad as the upper eyelid. Skin at the back is with short longitudinal glandular folds. A strong supra- tympanic fold is present. It is brown above with indistinct spots. A pale mid dorsal stripe is frequently present. Limbs are cross barred.

This species has been reported from Ponmudi RF, Aralam WLS, Parambikulam WLS, Peechi WLS, Chinnar WLS, Silent Valley NP, Wayanad WLS, Nilambur RF and Pooyamkutty RF (Easa, 2003). The present study has reported this species from Chimmony WLS.

4.3.4.5 Indian Bull Frog, *Hoplobatrachus tigerinus*

This is the largest Indian frog. Snout is obtusely pointed projecting beyond the mouth. Tympanum is distinct. First finger is longer than the second. Toes are fully webbed but the web does not reach the tip of the third toe. The species is yellow to olive green with black spots and stripes. Skin on the dorsal side is smooth or granular with longitudinal folds. A light colored vertebral streak is often present from snout to event. Limbs are spotted.

This species has been reported from throughout Kerala (Easa, 2003). The present study has reported this species from Chimmony WLS.

4.3.4.6 Rufous Leaf-hopper Frog, *Indirana leptodactylus*

A small to medium sized frog with tympanum two –third diameter of eye. Toes are one fourth webbed. Olive brown above mottled with darker brown. A more or less distinct subtriangular spot is present between the eyes.

This species has been reported from Parambikulam WLS, Thrissur dt., Malabar region, Thenmala RF and Ernakulam dt (Easa, 2003). The present study has reported this species from Chimmony WLS.



4.3.4.7 Verrucose Frog, *Limnonectes keralensis*

A medium sized frog with obtuse snout and distinct tympanum. A broad pale mid- dorsal stripe is frequently present. There is a diamond shaped spot on mid back. Toes are fully webbed except the fourth, which has two free phalanges .The skin at the back is extremely Wriggled hence known as Verrucose Frog.

This species was reported from Parambikulam WLS, Travancore region, Nilambur RF, Cochin dt, Wayanad WLS, Chinnar WLS and Pooyamkutty RF (Easa, 2003). The present study has reported this species from Chimmony WLS.

4.3.4.8 Large Wrinkled Frog, *Nyctibatrachus major*

This is a medium sized frog with an indistinct tympanum. Femoral glands are well developed in mature males. Dorsum is dark or brownish black with closely set uniform wrinkled folds. Limbs are cross barred.

This species was reported from Dhoni RF, Wayanad WLS, Cochin dt., Ponmudi RF, Silent Valley NP, Aralam WLS, Nilambur RF, Neyyar WLS, and Siruvani RF (Easa, 2003). The present study has reported this species from Chimmony WLS.

4.3.4.9 Paddy Field Frog, *Limnonectes limnocharis*

Small sized frog with 35mm snout-vent length. Toes are half webbed with three phalanges of fourth toe free. Tibio-tarsal articulation reaches the nostril. First finger is longer than the second. Skin is warty above often glandular folds. A strong fold is present from eye to shoulder. It is grey or brown with darker markings. Legs are barred. A vertebral band is often present.

This species has been reported from Pooyamkutty RF, Kuttanadu paddy fields, Parambikulam WLS, Silent Valley NP and Aralam WLS (Easa, 2003). The present study has reported this species from Chimmony WLS.

4.3.4.10 Termite Hill Gecko, *Hemidactylus triedrus*

This large colourful gecko is somewhat yellowish with a brownish, pinkish or greenish tinge on dorsum and with numerous scattered white tubercles all over. The back is with four large olive-green white edged saddle shaped cross- bars or bands between the head and hind limbs and supra-ocular region is greenish .m Head is with one or two yellow stripes behind the eye and a yellow streak across the nape The ventral surface is light pink in the young which in the adult becomes white or yellow with a reddish tinge. Upper labials are 8-10 and lower labials are 7-8.

This species has been reported from the following places in Kerala, such as Thiruvananthapuram district, Chinnar WLS, Kollam district, Peechi-Vazhani WLS (Easa, 2003). The present study also reported this species from Chimmony WLS.

4.3.4.11 Southern House Gecko, *Hemidactylus frenatus*

The type locality of this species is Java. It is with pinkish or tobacco –brown, pale grey or absolutely brown dorsal side. Faint brown longitudinal stripes are seen on the dorsum. A dark streak generally emerges from near the eyes and extend up to groin Tail is reddish .Belly is whitish or light yellow. Head is quite large and covered above with small granular scales which become larger on the snout .Ear opening is subcircular. Upper labials are 10-12 and lower labials 8-10.

This species has been reported from the following places in Kerala, such as Meemuttu RF, Neyyar WLS, Chinnar WLS, Periyar TR, Wayanad WLS, Silent Valley NP and Muthikulam-Siruvani RF (Easa, 2003). The present study has reported this species from Chimmony WLS.

4.3.4.12 Brook's Gecko, *Hemidactylus brooki*

This moderately large gecko described from Borneo is with a light to dark – brown spotted dorsum, dirty white belly and with a dark streak along the side of head. Head is large, ovate and prominent. Eye is moderately large with a vertical pupil. Ear opening is oval and head is covered

with small granular and larger scales. Snout is covered with small convex scales. Upper labials are 8-12 and lower labials 7-9.

This species has been reported from the following places in Kerala, such as Peechi-Vazhani WLS, Periyar TR, Wayanad WLS, Nilambur RF, Silent Valley NP, Chinnar WLS, Neyyar WLS, Aralam WLS (Easa, 2003).

4.3.4.13 Rock Gecko, *Hemidactylus maculatus*

This giant gecko is brown with dark- brown spots on the dorsum and with undulating transverse bars and streaks; belly is dirty- white. Head is large and prominent, with a bulging on the tip of snout ;eye is moderately large with an vertical pupil ; ear opening is small ;head is covered with small granular scales intermixed with larger conical tubercles, snout is convex scales. Upper labials 10-12 and lower labials are 9-10.

This species was reported only from Nilambur RF (Easa, 2003). The present study has reported this species from Chimmony WLS.

4.3.4.14 Dwarf Gecko, *Cnemaspis khandiana*

This is a small brown gecko with transversely arrange variegation and a faint vertebral stripe or spot. Throat is dark – brown and ventrum light –brown. Tubercles on the flanks are white. Head is covered above with minute keeled scales which are largest on the snout .Upper labials are 6-9 and lower labials 6-8.

This species has been reported from Silent Valley NP, Nilambur RF, Chinnar WLS, Periyar TR, Muthikulam - Siruvani RF and Peechi-Vazhani WLS (Easa, 2003). The present study has also reported this species from Chimmony WLS.

4.3.4.15 Peninsular Rock Agama, *Psammophilus dorsalis*

The body is feebly depressed and cheeks swollen in the adult male. Dorsal is olive – brown in young and females, pale- brownish in adult male. There is a series of white elongated spots on sides and back. The lips are yellowish brown, yellowish on the ventral aspect and throat

generally speckled with grey .Head is very large, elongated and flat. Upper labials are 10-13 and as many lower labials.

This species was reported only from Malabar (Easa, 2003). The present study has reported this species from Chimmony WLS.

4.3.4.16 Forest Calotes, *Calotes rouxi*

It is a small calotes with olive-brown head, nape and red gular pouch the side of the head and neck are banded with brown .Ante –humeral fold is black. Dark brown lines radiate from the eye belly are brownish. Upper labials 9-10 and as many lower labials.

This species has been reported from Wayanad WLS, Nilambur RF, Silent Valley NP, Muthikulam-Siruvani RF, Peechi-Vazhani WLS and Chinnar WLS (Easa, 2003). The present study has reported this species from Chimmony WLS.

4.3.4.17 Elliotti's Forest Lizard, *Calotes elliotti*

This small sized species was first described from Malabar .It is olive on the dorsal with distinct dark- brown cross-bars on the body. Neck is with angular black mark on each side .A white spot is been below the eye and dark –brown lines radiate from the eye. Anti –humeral fold is black and belly is white. Head is moderately large. Upper labials 9-10 and as many lower labials.

This species has been reported from Wayanad WLS, Silent Valley NP, Muthikulam-Siruvani RF and Peechi-Vazhani WLS (Easa, 2003). The present study has reported this species from Chimmony WLS.

4.3.4.18 Common Garden Lizard, *Calotes versicolor*

The species was first described from India and the exact locality was not known. The body is compressed and the dorsal color light –brown grayish. Transverse spots are present on back and sides and a dark streak from eyes. Head scales are irregular and juxtaposed. Upper labials 10-13 and lower labials are 11-14.

This species has been reported from all the forested areas of Kerala (Easa, 2003). The present study has reported this species from Chimmony WLS.

4.3.4.19 Little Skink, *Mabuya macularia*

The skink is brown olive or bronzy, with or without longitudinally arranged black spots. Light dorso-lateral stripe is always present. The side of neck and flanks are dark-brown generally spotted with white. There are 28-34 scales round the middle of the body.

This species has been reported from Neyyar WLS, Periyar TR, Wayanad WLS, Nilambur RF, Silent Valley NP, Muthikulam-Siruvani RF, Parambikulam WLS, Peechi-Vazhani WLS and Chinnar WLS (Easa, 2003). The present study has reported this species from Chimmony WLS.

4.3.4.20 Brahminy Skink, *Mabuya carinata*

The skink is with olivaceous – brown or shining bronze coloured dorsalside. The back and anterodorsal portion of the tail is with dark- brown to black spots or longitudinal lines along the lateral margin of the scales. The lateral aspects are dark brown or slightly lighter in color, generally with brown spots. Two somewhat lighter dorsolateral stripes are present. Belly is yellowish- white. There are 30-34 scales round the middle of the body.

This species has been reported from throughout Kerala (Easa, 2003). The present study has reported this species from Chimmony WLS.

4.3.4.21 Common Rat snake, *Ptyas mucosus*

This species is olive brown above with irregular but strongly marked black cross bars on the posterior half of the body. Maxillary teeth are 20-25. Scales are in 18 or 19 rows at mid body. Ventrals are 190-213, caudals 100-146 and anals 2.

This species has been reported from throughout Kerala (Easa, 2003). The present study has reported this species from Chimmony WLS.

4.3.4.22 Common Green Whip Snake, *Ahaetulla nasuta*

This species was described from Sri Lanka. It is greenish with a yellow stripe on the lateral sides. Snout ends in a pointed dermal appendage with a median groove above, usually formed by the rostral alone and rarely by the rostral. There is no loreal. Supralabials are in contact with the internasals and the prefrontals. Ventrals are 166-207, subcaudals 127-180 and anals 2.

This species has been reported from Wayanad WLS, Nilambur RF, Silent Valley NP, Muthikulam-Siruvani RF, Peechi-Vazhani WLS, Chinnar WLS, Ponmudi RF, Periyar TR and Neyyar WLS (Easa, 2003). The present study has reported this species from Chimmony WLS.

4.3.4.23 Common Wolf Snake, *Lycodon aulicus*

The species is brown or grayish above, with white or yellow cross bars. Snout is more or less spatulate and projecting beyond the lower jaw. Supralabials are 9. Scales are in 17 rows at mid body. Ventrals are 172-224, subcaudals 56-80 and anals 2.

This species has been reported from Wayanad WLS, Parambikulam WLS, New Amarambalam RF and Chinnar WLS (Easa, 2003). The present study has reported this species from Chimmony WLS.

4.3.4.24 Malabar Pit Viper, *Trimeresurus malabaricus*

This species was described from the Western Ghats. The dorsum is greenish or olive brown with a series of brown spots with yellow stripes. Upper head scales are slightly enlarged. Scales are in 19-21 rows, feebly keeled. Ventrals are 143-158 in females. Caudals are 50-63 in males and 44-54 in females.

This species has been reported from Meenmutty RF, Aralam WLS, Parambikulam WLS, Chinnar WLS, Peechi-Vazhani WLS, Wayanad WLS, Nilambur RF, Silent Valley NP, Ponmudi RF and

Muthikulam- Siruvani RF (Easa, 2003). The present study has reported this species from Chimmony WLS.

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APPENDIX

Appendix 1. Checklist of Mammals of Chimmony Wildlife sanctuary

Species	Scientific name
I. Elephantidae	
1. Elephant	<i>Elephas maximus</i>
II. Cercopithecidae	
2. Nilgiri Langur	<i>Trachypithecus johnii</i>
3. Bonnet macaque	<i>Macaca radiate</i>
4. Lion-tailed Macaque	<i>Macaca silenus</i>
III. Sciuridae	
5. Flying Squirrel sp	
6. Dusky Palm Squirrel	<i>Funambulus sublineatus</i>
7. Jungle Palm Squirrel	<i>Funambulus tristriatus</i>
8. Malabar Giant Squirrel	<i>Ratufa indica</i>
IV. Muridae	
9. Blanford's Madromys	<i>Madromys blanfordi</i>
10. Little Indian Field Mouse	<i>Mus booduga</i>
11. Flat-haired Mouse	<i>Mus platythrix</i>
12. Roof Rat	<i>Rattus rattus</i>
13. Sahyadris Forest Rat	<i>Rattus satarae</i>
14. Indian Gerbil	<i>Tatera indica</i>
V. Platacanthomyidae	
15. <i>Platacanthomys lasiurus</i>	Spiny Tree Mouse
VI. Hystricidae	
16. Indian Crested Porcupine	<i>Hystrix indica</i>
VII. Leporidae	
17. Black-naped Hare	<i>Lepus nigricollis</i>
VIII. Soricidae	
18. Asian Musk Shrew	<i>Suncus murinus</i>
IX. Pteropodidae	
19. Lesser Dog- faced Fruit bat	<i>Cynopterus brachyotis</i>
20. Short-nosed Fruit bat	<i>Cynopterus sphinx</i>
21. Indian Flying Fox	<i>Pteropus giganteus</i>
22. Fulvous Fruit bat	<i>Rousettus leschenaultii</i>
X. Megadermatidae	
23. Greater False Vampire	<i>Megaderma lyra</i>
24. Lesser False Vampire	<i>Megaderma spasma</i>
XI. Hipposideridae	
25. Dusky Leaf-nosed bat	<i>Hipposideros ater</i>
26. Fulvous Leaf-nosed bat	<i>Hipposideros fulvus</i>
27. Schneider's Leaf-nosed bat	<i>Hipposideros speoris</i>

XII. Rhinolophidae	
28. Blyth's Horseshoe bat	<i>Rhinolophus lepidus</i>
29. Rufous Horseshoe bat	<i>Rhinolophus rouxii</i>
XIII. Vespertilionidae	
30. Painted bat	<i>Kerivoula picta</i>
31. Chocolate Pipistrelle	<i>Pipistrellus affinis</i>
32. Kelaart's Pipistrelle	<i>Pipistrellus ceylonicus</i>
33. Indian Pipistrelle	<i>Pipistrellus coromandra</i>
34. Indian Pygmy bat	<i>Pipistrellus tenuis</i>
35. Asiatic Greater Yellow House bat	<i>Scotophilus heathii</i>
36. Asiatic Lesser Yellow House bat	<i>Scotophilus kuhlii</i>
XIV. Manidae	
37. Indian Pangolin	<i>Manis crassicaudata</i>
XV. Canidae	
38. Golden Jackal	<i>Canis aureus</i>
39. Wild Dog/ Dhole	<i>Cuon alpinus</i>
XVI. Felidae	
40. Jungle Cat	<i>Felis chaus</i>
41. Leopard	<i>Panthera pardus</i>
42. Tiger	<i>Panthera tigris</i>
XVII. Herpestidae	
43. Grey Mongoose	<i>Herpestes edwardsi</i>
XVIII. Mustelidae	
44. Smooth-coated Otter	<i>Lutrogale perspicillata</i>
XIX. Ursidae	
45. Sloth Bear	<i>Melursus ursinus</i>
XX. Viverridae	
46. Asian Palm Civet	<i>Paradoxurus hermaphroditus</i>
47. Small Indian Civet	<i>Viverricula indica</i>
XXI. Suidae	
48. Wild Boar	<i>Sus scrofa</i>
XXII. Tragulidae	
49. Mouse Deer	<i>Moschiola meminna</i>
XXIII. Cervidae	
50. Spotted Deer	<i>Axis axis</i>
51. Sambar Deer	<i>Rusa unicolor</i>
52. Barking Deer	<i>Muntiacus muntjac</i>
XXIV. Bovidae	
53. Gaur	<i>Bos gaurus</i>

Appendix 2. Checklist of Birds of Chimmony Wildlife sanctuary

Common Name	Scientific name
I. Phalacrocoracidae	
1. Little Cormorant	<i>Phalacrocorax niger</i>
2. Great Cormorant	<i>Phalacrocorax carbo</i>
3. Indian Shag	<i>Phalacrocorax fuscicollis</i>
II. Anhigidae	
4. Darter	<i>Anhinga melanogaster</i>
III. Ardeidae	
5. Little Egret	<i>Egretta garzetta</i>
6. Cattle Egret	<i>Bubulcus ibis</i>
7. Indian Pond-Heron	<i>Ardeola grayii</i>
8. Little Green Heron	<i>Butorides striatus</i>
9. Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>
10. Black Bittern	<i>Dupetor flavicollis</i>
IV. Accipitridae	
11. Oriental Honey-Buzzard	<i>Pernis ptilorhynchus</i>
12. Black-shouldered Kite	<i>Elanus caeruleus</i>
13. Black Baza	<i>Aviceda leuphotes</i>
14. Brahminy Kite	<i>Haliastur indus</i>
15. Greater Grey-headed Fish-Eagle	<i>Ichthyophaga ichhyaetus</i>
16. Lesser Grey-headed Fish-Eagle	<i>Ichthyophaga humilis</i>
17. *Crested Serpent-Eagle	<i>Spilornis cheela</i>
18. Crested Goshawk	<i>Accipiter trivirgatus</i>
19. *Shikra	<i>Accipiter badius</i>
20. Eurasian Sparrowhawk	<i>Accipiter nisus</i>
21. * Besra Sparrowhawk	<i>Accipiter virgatus</i>
22. Bonelli's Eagle	<i>Hieraetus fasciatus</i>
23. Black Eagle	<i>Ictinaetus malayensis</i>
24. Changeable Hawk-Eagle	<i>Spizaetus cirrhatus</i>
V. Pandionidae	
25. Osprey (203)	<i>Pandion haliaetus</i>
VI. Phasianidae	
26. Red Spurfowl	<i>Galloperdix spadicea</i>
27. Grey Junglefowl	<i>Gallus sonneratii</i>
VII. Rallidae	
28. White-breasted Waterhen	<i>Amaurornis phoenicurus</i>
VIII. Charadriidae	
29. Kentish Plover	<i>Charadrius alexandrinus</i>
30. Red-wattled Lapwing	<i>Vanellus indicus</i>
IX. Charadriidae	
31. Common Sandpiper	<i>Actitis hypoleucos</i>
X. Laridae	
32. River Tern	<i>Sterna aurantia</i>
XI. Columbidae	

33. Blue Rock Pigeon	<i>Columba livia</i>
34. Oriental Turtle-Dove	<i>Streptopelia orientalis</i>
35. Spotted Dove	<i>Streptopelia chinensis</i>
36. Emerald Dove	<i>Chalcophaps indica</i>
37. Pompadour Green-Pigeon	<i>Treron pompadora</i>
38. Yellow-legged Green-Pigeon	<i>Treron phoenicoptera</i>
39. Green Imperial-Pigeon	<i>Ducula aenea</i>
40. Mountain Imperial-Pigeon	<i>Ducula badia</i>
XII. Psittacidae	
41. Indian Hanging-Parrot	<i>Loriculus vernalis</i>
42. Rose-ringed Parakeet	<i>Psittacula krameri</i>
43. Plum-headed Parakeet	<i>Psittacula cyanocephala</i>
44. Blue-winged Parakeet	<i>Psittacula columboides</i>
XIII. Cuculidae	
45. Pied Crested Cuckoo	<i>Clamator jacobinus</i>
46. Large Hawk-Cuckoo	<i>Hierococcyx sparverioides</i>
47. Brainfever Bird	<i>Hierococcyx varius</i>
48. Indian Cuckoo	<i>Cuculus micropterus</i>
49. Banded Bay Cuckoo	<i>Cacomantis sonneratii</i>
50. Indian Plaintive Cuckoo	<i>Cacomantis passerinus</i>
51. Asian Koel	<i>Eudynamis scolopacea</i>
52. Small Green-billed Malkoha	<i>Phaenicophaeus viridirostris</i>
53. *Greater Coucal	<i>Centropus sinensis</i>
XIV. Strigidae	
54. *Oriental Scops-Owl	<i>Otus sunia</i>
55. Collared Scops-Owl	<i>Otus bakkamoena</i>
56. Brown Fish-Owl	<i>Ketupa zeylonensis</i>
57. *Jungle Owlet	<i>Glaucidium radiatum</i>
58. Brown Hawk-Owl	<i>Ninox scutulata</i>
XV. Podargidae	
59. Ceylon Frogmouth	<i>Batrachostomus moniliger</i>
XVI. Caprimulgidae	
60. Great Eared-Nightjar	<i>Eurostopodus macrotis</i>
61. Indian Jungle Nightjar	<i>Caprimulgus indicus</i>
62. *Jerdon's Nightjar	<i>Caprimulgus atripennis</i>
63. Common Indian Nightjar	<i>Caprimulgus asiaticus</i>
64. Franklin's Nightjar	<i>Caprimulgus affinis</i>
XVII. Apodidae	
65. Indian Edible-nest Swiftlet	<i>Collocalia unicolor</i>
66. Brown-backed Needletail-Swift	<i>Hirundapus giganteus</i>
67. White-rumped Needletail-Swift	<i>Zoonavena sylvatica</i>
68. *Asian Palm-Swift	<i>Cypsiurus balasiensis</i>

69. Alpine Swift	<i>Tachymarptis melba</i>
70. House Swift	<i>Apus affinis</i>
71. *Crested Tree-Swift	<i>Hemiprocne coronata</i>
XVIII. Trogonidae	
72. Malabar Trogon	<i>Harpactes fasciatus</i>
XIX. Alcedinidae	
73. Small Blue Kingfisher	<i>Alcedo atthis</i>
74. Stork-billed Kingfisher	<i>Halcyon capensis</i>
75. White-breasted Kingfisher	<i>Halcyon smyrnensis</i>
76. Lesser Pied Kingfisher	<i>Ceryle rudis</i>
XX. Meropidae	
77. Blue-bearded Bee-eater	<i>Nyctornis athertoni</i>
78. Small Bee-eater	<i>Merops orientalis</i>
79. Chestnut-headed Bee-eater	<i>Merops leschenaulti</i>
XXI. Coraciidae	
80. Indian Roller	<i>Coracias benghalensis</i>
81. Oriental Broad-billed Roller	<i>Eurystomus orientalis</i>
XXII. Upupidae	
82. Common Hoopoe	<i>Upupa epops</i>
XXIII. Bucerotidae	
83. *Malabar Grey Hornbill	<i>Ocyroceros griseus</i>
84. Great Pied Hornbill	<i>Buceros bicornis</i>
XXIV. Capitonidae	
85. White-cheeked Barbet	<i>Megalaima viridis</i>
86. Crimson-throated Barbet	<i>Megalaima rubricapilla</i>
87. Coppermith Barbet	<i>Megalaima haemacephala</i>
XXV. Picidae	
88. Brown-capped Pygmy Woodpecker	<i>Dendrocopos nanus</i>
89. Rufous Woodpecker	<i>Celeus brachyurus</i>
90. *Great Black Woodpecker	<i>Dryocopus javensis</i>
91. Small Yellow-naped Woodpecker	<i>Picus chlorolophus</i>
92. Common Golden-backed Woodpecker	<i>Dinopium javanense</i>
93. Lesser Golden-backed Woodpecker	<i>Dinopium benghalense</i>
94. Yellow-fronted Pied Woodpecker	<i>Dendrocopos mahrattensi</i>
95. Greater Golden-backed Woodpecker	<i>Chrysocolaptes lucidus</i>
96. Heart-spotted Woodpecker	<i>Hemicircus canente</i>
97. Indian Pitta	<i>Pitta brachyura</i>
XXVI. Hirundinidae	
98. Dusky Crag-Martin	<i>Hirundo concolor</i>
99. Common Swallow	<i>Hirundo rustica</i>
100. Red-rumped Swallow	<i>Hirundo daurica</i>
101. * Northern House-Martin	<i>Delichon urbica</i>
102. Ashy Woodswallow	<i>Artamus fuscus</i>
XXVII. Motacillidae	

103.	Forest Wagtail	<i>Dendronanthus indicus</i>
104.	Large Pied Wagtail	<i>Motacilla maderaspatensis</i>
105.	Yellow Wagtail	<i>Motacilla flava</i>
106.	Grey Wagtail	<i>Motacilla cinerea</i>
XXVIII. Campephagidae		
107.	Pied Flycatcher-Shrike	<i>Hemipus picatus</i>
108.	*Large Cuckoo-Shrike	<i>Coracina macei</i>
109.	Black-headed Cuckoo-Shrike	<i>Coracina melanoptera</i>
110.	Small Minivet	<i>Pericrocotus cinnamomeus</i>
111.	Scarlet Minivet	<i>Pericrocotus flammeus</i>
112.	Large Woodshrike	<i>Tephrodornis gularis</i>
113.	Common Woodshrike	<i>Tephrodornis pondicerianus</i>
XXIX. Pycnonotidae		
114.	Grey-headed Bulbul	<i>Pycnonotus priocephalus</i>
115.	Black-crested Bulbul	<i>Pycnonotus melanicterus</i>
116.	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>
117.	Red-vented Bulbul	<i>Pycnonotus cafer</i>
118.	Yellow-browed Bulbul	<i>Iole indica</i>
119.	*Black Bulbul	<i>Hypsipetes leucocephalus</i>
XXX. Irenidae		
120.	Common Iora	<i>Aegithina tiphia</i>
121.	Jerdon's Chloropsis	<i>Chloropsis cochinchinensis</i>
122.	Gold-fronted Chloropsis	<i>Chloropsis aurifrons</i>
123.	Asian Fairy-Bluebird	<i>Irena puella</i>
XXXI. Laniidae		
124.	Brown Shrike	<i>Lanius cristatus</i>
XXXII. Turdidae		
125.	Blue-headed Rock-Thrush	<i>Monticola cinclorhynchus</i>
126.	Malabar Whistling-Thrush	<i>Myiophonus horsfieldii</i>
127.	Orange-headed Thrush	<i>Zoothera citrina</i>
128.	Eurasian Blackbird	<i>Turdus merula</i>
129.	Oriental Magpie-Robin	<i>Copsychus saularis</i>
130.	White-rumped Shama	<i>Copsychus malabaricus</i>
XXXIII. Timalidae		
131.	Spotted Babbler	<i>Pellorneum ruficeps</i>
132.	*Indian Scimitar-Babbler	<i>Pomatorhinus horsfieldii</i>
133.	Rufous-bellied Babbler	<i>Dumetia hyperythra</i>
134.	Black-headed Babbler	<i>Rhopocichla atriceps</i>
135.	Indian Rufous Babbler	<i>Turdoides subrufus</i>
136.	Jungle Babbler	<i>Turdoides striatus</i>
137.	White-headed Babbler	<i>Turdoides affinis</i>
138.	Quaker Tit-Babbler	<i>Alcippe poiocephala</i>

XXXIV. Sylviidae	
139. Franklin's Prinia	<i>Prinia hodgsonii</i>
140. Blyth's Reed-Warbler	<i>Acrocephalus dumetorum</i>
141. Common Tailorbird	<i>Orthotomus sutorius</i>
142. Greenish Leaf-Warbler	<i>Phylloscopus trochiloides</i>
143. Large-billed Leaf-Warbler	<i>Phylloscopus magnirostris</i>
144. *Western Crowned Warbler	<i>Phylloscopus occipitalis</i>
XXXV. Muscicapidae	
145. Asian Brown Flycatcher	<i>Muscicapa dauurica</i>
146. Rusty-tailed Flycatcher	<i>Muscicapa ruficauda</i>
147. Brown-breasted Flycatcher	<i>Muscicapa muttui</i>
148. White-bellied Blue-Flycatcher	<i>Cyornis pallipes</i>
149. Blue-throated Flycatcher	<i>Cyornis rubeculoides</i>
150. Red-throated Flycatcher	<i>Ficedula parva</i>
151. Tickell's Blue-Flycatcher	<i>Cyornis tickelliae</i>
XXXVI. Monarchidae	
152. Asian Paradise-Flycatcher	<i>Terpsiphone paradisi</i>
153. Black-naped Monarch-Flycatcher	<i>Hypothymis azurea</i>
XXXVII. Paridae	
154. Great Tit	<i>Parus major</i>
155. Black-lored Yellow Tit	<i>Parus xanthogenys</i>
XXXVIII. Sittidae	
156. Velvet-fronted Nuthatch	<i>Sitta frontalis</i>
XXXIX. Dicaeidae	
157. Thick-billed Flowerpecker	<i>Dicaeum agile</i>
158. Tickell's Flowerpecker	<i>Dicaeum erythrorhynchus</i>
159. Plain Flowerpecker	<i>Dicaeum concolor</i>
XL. Nectariniidae	
160. Purple-rumped Sunbird	<i>Nectarinia zeylonica</i>
161. Small Sunbird	<i>Nectarinia minima</i>
162. Purple Sunbird	<i>Nectarinia asiatica</i>
163. Loten's Sunbird	<i>Nectarinia lotenia</i>
164. Little Spiderhunter	<i>Arachnothera longirostra</i>
XLI. Estrilididae	
165. White-rumped Munia	<i>Lonchura striata</i>
XLII. Sturnidae	
166. Grey-headed Starling	<i>Sturnus malabaricus</i>
167. Common Myna	<i>Acridotheres tristis</i>
168. Jungle Myna	<i>Acridotheres fuscus</i>
169. *Southern Hill-Myna	<i>Gracula indica</i>
XLIII. Oriolidae	
170. Eurasian Golden Oriole	<i>Oriolus oriolus</i>
171. *Black-naped Oriole	<i>Oriolus chinensis</i>
172. Black-headed Oriole	<i>Oriolus xanthornus</i>

XLIV. Dicuridae	
173. *Black Drongo	<i>Dicrurus macrocercus</i>
174. Ashy Drongo	<i>Dicrurus leucophaeus</i>
175. Bronzed Drongo	<i>Dicrurus aeneus</i>
176. Spangled Drongo	<i>Dicrurus hottentottus</i>
177. Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>
XLV. Artamidae	
178. Ashy Woodswallow	<i>Artamus fuscus</i>
XLVI. Corvidae	
179. Indian Treepie	<i>Dendrocitta vagabunda</i>
180. White-bellied Treepie	<i>Dendrocitta leucogastra</i>
181. House Crow	<i>Corvus splendens</i>
182. Jungle Crow	<i>Corvus macrorhynchos</i>

Appendix 3. Checklist of Reptiles of Chimmony Wildlife sanctuary

Common name	Scientific name
I. Emydidae	
1. Cochin black turtle	<i>Melanochelys trijuga</i>
Testudinidae	
2. Travancore tortoise	<i>Indotestudo fosteni</i>
II. Gekkonidae	
3. Kandy Dwarf Gecko	<i>Cnemaspis khandiana</i>
4. Brook's House Gecko	<i>Hemidactylus brookii</i>
III. Agamidae	
5. Elliot's Forest Lizard	<i>Calotes ellioti</i>
6. Roux's Forest Lizard	<i>Calotes rouxi</i>
7. Indian garden lizard	<i>Calotes versicolor</i>
8. Western Ghats Flying Lizard	<i>Draco dussumieri</i>
IV. Scincidae	
9. Common Skink	<i>Mabuya carinata</i>
10. Bronze Mabuya	<i>Mabuya macularia</i>
11. Snake Skink	<i>Lygosoma punctatus</i>
V. Varanidae	
12. Common Indian Monitor	<i>Varanus bengalensis</i>
VI. Boidae	
13. Indian Sand Boa	<i>Eryx johnii</i>
14. Indian Python	<i>Python molurus</i>
VII. Colubridae	
15. Rat Snake	<i>Ptyas mucosus</i>
16. Dumeril's Black-headed Snake	<i>Sibynophis subpunctatus</i>
17. Green Vine Snake	<i>Ahaetulla nasuta</i>
18. Buffstriped Keelback	<i>Amphiesma stolata</i>
VIII. Elaphidae	
19. King Cobra	<i>Ophiophagus hannah</i>
20. Cobra	<i>Naja naja</i>
IX. Viperidae	
21. Hump-nosed Pit Viper	<i>Hypnale hypnale</i>
22. Malabar Pit Viper	<i>Trimeresurus malabaricus</i>

Appendix 4. Checklist of Amphibians of Chimmony Wildlife sanctuary

Common name	Scientific name
I. Bufonidae	
1. Common Indian Toad	<i>Bufo melanostictus</i>
II. Ranidae	
2. Verrucose Frog	<i>Fejervarya keralensis</i>
3. Rufescent Burrowing Frog	<i>Fejervarya rufescens</i>
4. Indian Bull Frog	<i>Hoplobatrachus tigerinus</i>
5. Water Skipper Frog	<i>Euphlyctis cyanophlyctis</i>
6. Bronzed Frog	<i>Rana temporalis</i>
III. <u>Petropedetidae</u>	
7. Beddome's Frog	<i>Indirana beddomii</i>
8. Leith's Leaping Frog	<i>Indirana leithii</i>
IV. <u>Rhacophoridae</u>	
9. Malabar Flying Frog	<i>Rhacophorus malabaricus</i>

Appendix 5. Checklist of Fishes of Chimmony Wildlife sanctuary

Common name	Scientific name
I. Anguillidae	
1. Indian long fin eel	<i>Anguilla bengalensis</i>
II. Cyprinida	
2. Boopis razor belly minnow	<i>Salmostoma boopis</i>
3. Flying barb	<i>Esomus danricus</i>
4. Giant danio	<i>Danio aequipinnatus</i>
5. Common rasbora	<i>Rasbora daniconius</i>
6. Attentive carplet	<i>Amplyphargngdon</i>
7. River carp baril	<i>Barilius gatensis</i>
8. Common carp	<i>Cuprinus caprio</i>
9. Scarlet banded barb	<i>Puntius amphibious</i>
10. Black spot barb	<i>Puntius filamentosus</i>
11. Melon barb	<i>Puntius melanampyx</i>
12. Ticto barb	<i>Puntius ticto</i>
13. Mullya garra	<i>Garra mullya</i>
III. Homalopteridae	
14. Western Ghat loach	<i>Bhavanaia australis</i>
15. Denson's loach	<i>Noemacheilus denisoni</i>
16. Guenther's loach	<i>Noemacheilus guentheri</i>
17. Triangular banded loach	<i>Noemacheilus triangularis</i>
IV. Cobitidae	
18. Malabar loach	<i>Lepidocephalus thermalis</i>
V. Bagridae	
19. Keletius mystus	<i>Mystus keletius</i>
20. Wayanad mystus	<i>Mystus montanus</i>
21. Striped dwarf catfish	<i>Mystus vittatus</i>
VI. Siluridae	
22. Indian butter catfish	<i>Ompok bimaculatus</i>
23. Boal	<i>Wallago attu</i>
VII. Clariidae	
24. Valencienn's calrid	<i>Clarias dussumieri</i>
VIII. Heteropnuestidae	
25. Stinging catfish	<i>Heteropnuestes fossilitus</i>
IX. Belonidae	
26. Fresh water garfish	<i>Xenentodon cancila</i>
X. Cyprinodontidae	
27. Malabar killie	<i>Aplocheilus lineatus</i>
XI. Chinnadae	

28. Asiatic snake head	<i>Channa orientalis</i>
XII. Cichlidae	
29. Orange chromid	<i>Etiloplus maculates</i>
30. Mazambique cichlet	<i>Tilapia mossambica</i>
XIII. Mastacembalidae	
31. Tire track spiny eel	<i>Mastacembelas armatus</i>

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