An Ecological Study on Mammals, Birds, Herpetofauna and Butterflies in Teesta Basin, Sikkim

REPORT OF PHASE II







SACON

Salim Ali Centre for Ornithology and Natural History
Coimbatore

An Ecological Study on Mammals, Birds, Herpetofauna and Butterflies in Teesta Basin, Sikkim

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2003-2004

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INTRODUCTION

Among all the Indian states, Sikkim is undoubtedly the richest in biodiversity relative to its geographical area. Although Sikkim is only one twentieth of the Western Ghats in geographical area, the species richness of mammals, birds and butterflies are very high. The other faunal groups have been far less documented to make a comparison meaningful. The flora is also equally diverse at species and higher taxonomic levels, in habit and the associations that they form, orchids being a well-known example. This breathtaking diversity results from the geographical location of the state (where several biogeographic realms overlap), and an altitudinal and climatic regime that is unique in the world. That much of the biodiversity remain today is undoubtedly due to the low human population densities as well as to the biodiversity dependent and diverse human life style.

The above diversity is best experienced if one traverses the course of River Teesta, from an altitude of about 200 m to about 6000 m. From remnant patches of tropical wet forest at the lowest altitudes, the vegetation changes rapidly along the course of the river reflecting altitude, precipitation, topography and aspect. The faunal assemblages also change rapidly from tropical to subtropical, temperate, alpine and finally to cold desert forms. It follows from this rapid transition that all the floral and faunal taxa in Sikkim have very small distribution ranges within the State. Another notable feature of biodiversity in Sikkim is the strong influence of seasonality especially at higher altitudes. While some taxa (such as herpetofauna and smaller mammals) hibernate in winter, others migrate locally (mountain ungulates) or over long distances (birds).

There are several threats to the biodiversity of Sikkim; among the most important are the increasing human population, ongoing and proposed hydel projects in River Teesta and resultant immigration of several thousand construction workers, seasonal influx of tourists, presence of a huge army due to international borders, and increasingly unsustainable extraction of natural resources such as medicinal plants. Although Sikkim has the highest protected area coverage in India (34%), this is primarily due to one large protected area, the Kanchenzonga Biosphere Reserve. There are only six other protected areas, most of them <100 sq.km in area. However,

with increasing human population and conflicting demands on land, it is becoming increasingly difficult to set aside large areas as national parks or sanctuaries (T.R.Sharma pers. comm). Therefore, the promotion of conservation outside protected areas (in reserved forests and private lands) is also critical. The designation and management of protected areas as well as conservation outside protected areas have been severely handicapped by a lack of information on the distribution and ecology of flora and fauna at a scale that is useful to the Forest Department and other agencies.

Objectives

The goal of this project is to fill the major information gap referred to above. More specifically, the project would provide information on the following aspects:

- Distribution, abundance and ecology of mammals, birds, reptiles, amphibians and butterflies in major vegetation types along Teesta River Basin,
- Impacts of various human activities on the above taxa, and major threats;
- Areas of high or unique biodiversity values; and
- Measures for management of biodiversity inside and outside protected areas.

The project would also develop local expertise in biodiversity research and monitoring. Apart from annual reports on major findings, a complete set of data (such as species inventory and abundance and photographs) would be deposited with the Forest Department and other agencies for their use.

STUDY AREA

Location:

Sikkim, 27 10' to 28 5'N and 88 30' to 89 E, the rugged mountain state of Indian Union situated in the Eastern Himalayas and is surrounded by Nepal in the West, Bhutan in the South-East, Tibetan plateau in the North and North-East and Darjeeling district of Indian State West Bengal in the South.

The study was carried out in forests along the Teesta River Basin in Sikkim. Teesta River is the principal physical featutes of Sikkim, which originates at Chollamu at about 4800m and runs north south dividing Sikkim into two halves and descends down to about 300m at Rangpo within a distance of 150 km.

Yathang valley in Summer

View of sub-alpine region in Sikkim

View of pine forest near Yumthang

Broadleaved forest near Chungthang

Plate 1a. Major vegetation types of Teesta valley in Sikkim

Teesta river at Chungthang

Inner view of broadleaved forest.

View of low altitude forest

Agricultural practice at higher altitude

Plate1b. Vegetation types and agricultural practices along Teesta basin in Sikkim

Distinct transition of vegetation occurs at about 900m altitudes. The study area covered an altitudinal range between 300 m- 4700 m. Major vegetation types/zones found in Sikkim (Plate 1a and 1b) given below:

Zone I (< 900 m): Tropical semidecicuous forests, represented chiefly by deciduous plants such as *Ceiba malabarica, Ailanthes grandis, Terminalia myriocarpa, Shorea robusta, Duabanga sonnerotoides, Schima wallichi, Gynocardia odorata, Amora rohituka, Pandanus furcatus* and various species of shrubs such as *Strobilanthus, Polygonum* and *Ttridax.*

Zone II (900-1800 m): Tropical moist and broad leaved forests, most of this zone is partially disturbed due to Cardamom plantation. The major tree species are *Engelhardtia spicata, Alnus nepaulensis, Schima* sp, *Litsaea citrata, Acer campbelli* and *Castanopsis* sp. The shrub species representing the area are *Girardinia* sp, *Maesa* sp, *Melostoma* sp and *Edgeworthia* sp.

Zone III (1800-2800 m): Temperate broad-leaved forests, the dominant trees are *Quercus* spp, *Rhododendron* spp, *Juglans regia, Ilex* sp, *Acer* sp, *Betula* sp with dense cover of *Arundinaria* spp.

Zone IV (2800-3800 m): Temperate coniferous and broad-leaved forests, dominated by *Abies* spp, *Betula* sp, *Acer* sp and various species of *Rhododendron.*

Zone V (>3800m): Sub-alpine vegetation: Tree line ceases beyond 3800m.Plants such as *Junipers,* dwarf species of *Rhododendron, Azaleas* and many species of flowering herbs such as *Potentilla, Anemones, Primula, Ligularia* and *Pedicularis* are common.

Forests of lower altitudes <900 m) of Sikkim are largely altered for agriculture, but still have patches of original tropical moist forest. Some of the common tree species are *Schima wallichi, Ficus* spp., *Bischofia javanica, Artocarpus lakoocha, Ailanthus* sp., bamboo, *Albizzia* spp., *Ceiba* spp. *Toona ciliata.* Patches of original, but degraded, vegetation still remains in steep slopes and along streams. The main crops grown are mustard, potato and cardamom, etc. The landscape is thus a mosaic of

degraded forest patches, agricultural fields with several species of lopped native trees and a variety of seasonal crops, and fallow lands. This mosaic presents an interesting and common landscape in which we can examine the conservation of wild fauna outside protected areas. The forest between 900m-1800m is partially disturbed by cardamom plantation. Although the natural vegetation is maintained and the trees are intact, undergrowths are removed for plantation purposes. The vegetation in broadleaved forest between 1800-2800m is luxuriant with many trees covered by climbers and the ground with dense undergrowth mainly bamboo, *Arundinaria* sp.

METHODS

COMPILATION OF SECONDARY INFORMATION

Considerable information, although outdated, is available on species occurrence in Sikkim, but these have not been compiled systematically. Compilation and analysis of existing information were done to identify major gaps in information and to identify important areas. A checklist of 169 species of mammals has been compiled for the state of Sikkim from various sources, especially Molur *et. al.* (1998a), Avasthe & Jha (1999), Nameer (2000), Agrawal (2000) and Mandal (2003) (**Table 1**, Appendix I). The data were used primarily for assessing altitudinal distribution.

The literature available on birds of Sikkim was collected from various sources to the extent possible. The Book on "Birds of Sikkim" by Ali (1989) is the only exhaustive literature available till date except the recent ecological study in west Sikkim (Chettri, 2000; Chettri *et al.* 2001). Considerable information is available on bird species inventories, taxonomy, distribution and general habits, but these have not been compiled systematically. Therefore, the available information spread in different publications was compiled. The database of recorded species was made along with their altitudinal range based mainly on Ali (1989) and Ali & Ripley (2001). Five altitudinal zones were identified. The zone of each species was noted and the number of species, including the exclusive species, in each zone was compiled and analysed to identify important areas that should be considered while selecting sites for field studies. An analysis of this data was completed, giving a preliminary assessment of species distribution in Sikkim.

Table 1. Major source of secondary information on Mammals, birds, herpetofauna and butterflies of Sikkim

Taxa.	Sl no	Authors
Mammals	1	Molur *et al.* (1998a)
	2	Avasthe and Jha (1999)
	3	Nameer (2000)
	4	Agrawal (2000)
	5	Mandal (2003)
Birds	1	Ali (1989)
	2	Ganguli-Lachungpa (1990a)
	3	Ganguli-Lachungpa (1990b)
	4	Ganguli-Lachungpa (1990c)
	5	Ganguli-Lachungpa (1992)
	6	Ganguli-Lachungpa (1998a)
	7	Ganguli-Lachungpa (1998b)
	8	Ganguli-Lachungpa (1998c)
	9	Ganguli-Lachungpa and Lucksom (1998d)
	10	Chettri (2000)
	11	Grimmet *et al.* (2001)
	12	Chettri *et al.* (2001)
	13	Ali and Ripley (2001)
	14	Birdlife International (2001)
Herpetofauna	1	Boulenger (1890)
	2	Das (1994)
	3	Das (1997)
	4	Molur and Walker (1998b)
	5	Shaw and Barker (1999)
	6	Daniel (2002)
	7	Jha and Thapa (2002)
Butterflies	1	Haribal (1992)
	2	Chettri (2000)

Since there was no authentic literature available on herpetofauna of Sikkim, the information on presence of species was based largely on the distribution of northeast India (Molur *et.al.*1998). The only available literature mentioned was reviewed and crosschecked with Smith (1935) for confirmation. A checklist consisting of 167 species of reptiles and 70 species of amphibians were made. Recently a book on "Amphibians and Reptiles of Sikkim" (Jha and Thapa 2002) helped in shortlisting the already prepared checklist. A total of 61 species of reptiles and 20 species of amphibians have been reported by Jha and Thapa (2002).

Checklist of the butterflies of Sikkim was prepared from the book, 'The butterflies of Sikkim Himalaya' (Haribal, 1992). A total of 689 species of butterflies have been recorded from Sikkim, and the book provides information on their distribution and natural history. Therefore, the available information was compiled into database. Each species was categorized on the basis of altitudinal distribution. Five altitudinal zones identified for birds were chosen for butterflies to look at the distribution pattern with respect to altitude before the commencement of the field studies.

FIELD SAMPLING PROTOCOL

A. Mammals

The following methods were used to estimate species richness and abundance of mammals.

Open width transects: From May 2003 to August 2004, a total of 19 transects ranging from 180 m to 1000 m were laid and sampled in four vegetation types with different altitude zones i.e. the tropical semi-deciduous (below 900 m) or the zone I, tropical broadleaf (900- 1800) or the zone II, temperate broadleaf (1800- 2800 m) or the zone III and the coniferous forest (2800- 3800 m) or the zone IV. Random observations were done in Zone V which is >3800 m. Transects were laid in existing forest trails and newly cut trails. Their length depended on the terrain and undergrowth varying from 180 m to 1000 m. It was not possible to maintain same length for all transects due to the slope of the forests and to avoid overlap of vegetation types. Each transect laid did not cover more than 200 m of altitude range. Transects were laid for sightings of diurnal, arboreal and terrestrial mammals. Parameters such as altitude, time, and

perpendicular distance to transect were recorded during sightings of any species. Transects were replicated three to five times.

Belt transects: The same transects were sampled to estimate the encounter rate of droppings with 2 m on either side. Droppings of mammals were collected along transects and photographed. Site of droppings, content, vegetation type and altitude were recorded at the same time along with the length and breadth of the droppings.

Opportunistic transects: Animal sightings and droppings were also recorded from trails, often through disturbed forests, leading to regular transects. The undisturbed patches nearby transects were also sampled. These were not replicated.

Night Surveys: These were carried out along the roads and transects to the extent possible for sightings of nocturnal mammals such as the flying squirrels and carnivores. It was done both on foot and by a jeep.

Live trapping: Murid rodents and shrews, often referred to as the small mammals were sampled using Sherman traps baited with peanut butter. The open width transects were used for small mammal trappings. Along the length of the transect 40 – 60 traps were laid at 5 metres interval. The trapping duration in each transect lasted for three to five nights. Trapping sessions were repeated in transect when there was no capture in the first session. The traps were checked every morning and the captured rodents were measured, weighed, photographed and released away from transects. Abundance of small mammals was estimated as (n/N x 100), where n is the number of the animals trapped and N is the total number of trap nights in a trapping session.

Camera trapping: Two camera traps were set up in transects where animal signs were seen to obtain photographic records of nocturnal mammals. Banana, dry fish, chicken and rock salt were used as baits for the camera traps.

Opportunistic records: All sightings of wild mammals outside of the above sampling occasions were also recorded.

B. Birds

Circular Plot: Open width circular plot method was used along the predetermined transects considering the steepness and poor visibility in the study area. The counting of birds was conducted at every point distributed along transects in each zones following Javed and Kaul (2000) with necessary modifications. In all, there were 22 transects distributed over five zones of which 19 were regularly sampled. The number of points placed not less than 100m away varied from six to 11 at each transect depending upon the accessibility and steepness of the terrain. In zone I there were 37 points placed over 5 transects. Similarly, 34 points (4 transects) in zone II, 39 points (5 transects) in zone III 30 points (3 transects) in zone IV and 21 points (2 transects) in zone V were laid. The numbers of points laid in each habitat was based on some preliminary survey so that in each zone the total area sampled is almost the same. The numbers of points sampled in higher zones are relatively low because of high visibility.

Each point was replicated 2-3 times in each of the four seasons viz. winter, summer, rainy and autumn covering a total of 1728 points in 22 transects. In total 438 points were sampled in Zone I, 410 points in Zone II, 344 points in Zone III, 334 points in Zone IV and 202 points in Zone V. Three additional transects consisting of 22 points were also laid and sampled once in zone IV but abandoned later due to difficulty in accessing and the logistics. All the five zones were covered equally in summer, monsoon and autumn but only zone I and II were sampled in winter.

Count in each point was conducted for five minutes, and all the birds seen were recorded. The bird was identified using field guide, Grimmet *et.al.* (2001). The distance of the bird from the center of the point as well as the position along with height from the ground was also noted. The regular sampling was conducted between 0600 hrs and 0930 hrs in the morning and occasionally in the evening. The sampling time in each point was changed to avoid chances of species being missed. Sampling was not done during rainy and foggy days due to the problem of visibility. The data presented here is based on surveys from June 2003 to November 2004.

Point count method was preferred over transect because of its easiness in laying and locating in steep difficult terrain (Bibby *et. al.* 1992, Raman 2001). In difficult terrain

transects need more attention on the path being walked missing more birds unlike the case with point counts where full attention could be given for sampling. The study area being large more points could be completed per unit time than transects.

The data on breeding of birds were also collected to the extent possible randomly in each habitat. The breeding birds were recorded when they were found engaged in such activities as building nest or feeding chicks in or outside the nest. The nest was located following nesting activity of the birds. Nest searching was also done after bird count. If a nest was found, the species was identified and the date, place, altitude, other ecological parameters were recorded.

C. Herpetofauna

Visual Encounter Survey – Taking into account the landscape, topography and altitude of the study area, time constrained visual encounter survey (Heyer *et. al.* 1994) was used. Considering the activity of reptiles and climatic conditions this method was fixed for three hours from 0900/1000 to 1200/1300 hrs. Two persons did searching rigorously in particular habitat. Overlapping of habitat was avoided strictly during each sampling. During sampling, all possible microhabitats such as boulders, fallen logs and epiphytes were thoroughly searched. In this method all species sighted during sampling were identified up to species and details such as encounter time, altitude, habit, habitat, height from ground and distance to water were noted. The forest was considered as macrohabitat and the location of species such as boulder, logs and grass were recorded as microhabitat. Morphometry of the encountered species were also recorded to the extent possible.

Forest transects: 2-4 belt transects (2m) of varying length depending upon the accessibility in the forest were laid in each habitat zones making total length of 2km in every zone. In total, there were 4 transects in zone I, 4 in zone II, 3 each in zones III and IV and 2 in zone V. Each transect was sampled once seasonally. Each transect was walked on slow pace observing animals within 2m on either side of it. On encountering animals various parameters such as species, individuals, encounter time, altitude and microhabitats were recorded.

Stream transects: 1km transects along 3 to 4 streams were marked in each habitat for surveying nocturnal amphibians. Due to the steepness of the terrain, climatic condition and logistics only 1 km transects were possible in all habitat zones. During sampling by this method two people walked slowly along both sides of the stream after dusk. Habitat was not disturbed during this method, as amphibians are known to be habitat specific especially during breeding season.

Opportunistic observation: Road kills, killed by local people and those species observed outside sampling area were considered as opportunistic observation. This information is used to prepare an inventory.

D. Butterflies

Collection of systematic data in the field was commenced in March 2003. The preliminary study was done in various habitats of zone I in and around Dalep (Altitude-550m; 88 28' N, 27 14' E), in south Sikkim. The study was conducted in four habitat types, namely disturbed forest (DF), Cardamom Agro-forest (CAF), degraded agricultural land (DAL) and paddy field (PF) for three months. The DF was a small forest patch sandwiched between agricultural lands and was typical representative of moist tropical semidecicuous forests, represented by trees such as *Ceiba malabarica, Schima wallichi, Gynocardia odorata, Amora rohituka, Pandanus furcatus,* and different species of shrubs such as *Strobilanthus, Polygonum* and *Ttridax.* CAF was similar to DF but the trees were sparser and undergrowth was replaced by cardamom. The DAL was represented by cornfield with retention of some native tree species. The paddy field at the time of study was without any crops but was planted later. The study in other zones was commenced only from June 2003 and the study sites on other four zones were same as that for birds.

Circular plot: Fixed width circular plot method was followed for butterfly count. Transects were laid as described for birds and point was placed at 50m interval. In zone I, two transects of 250m length containing six points each in all four habitat types mentioned above (DF, CAF, DAL and PF) were laid initially. In total there were 12 points in each habitat type and all points were visited four times making 48 point counts per habitat. But after three months, only transects of DF were sampled with additional transects laid for birds. Five minutes count in each plot was done in good

sunny days between 0900 to 1200hrs. All the butterflies seen within the radius of 5m was identified following Haribal (1992). All the species and individuals seen within five minutes were recorded. The data from four habitats of zone I was analyzed separately.

DATA ANALYSIS

Sightings from open width transect, belt transects, night survey, opportunistic transects and records have been used to estimate encounter rates per unit distance, which was taken as an index of abundance. The number of species seen during the sampling was taken as an index of species richness.

For small mammals, data from live trapping were used to estimate species richness and abundance. Capture rate was taken as an index of abundance. Capture rate was estimated for transect as, Capture Rate = (n/tn x 100).

Where, 'n' is the number of animals captured, 'tn' is the number of traps laid x number of days with trap sessions. Capture rate was estimated for all species together, and for each species separately. The number of species trapped in a vegetation type or overall was taken as the observed species richness. This however does not give an accurate estimate of species richness. Species richness was also estimated using various estimators available (Colwell, 1994) in the software EstimateS (Version 6.0b1). Among several models available Jackknife 1 was selected because this estimate reached an asymptote. It has also been widely used for estimating the species richness in similar situations. In order to estimate the species richness, the number of days on which the traps were laid on transect (transect days) was considered as sampling effort.

For birds, species richness, abundances, diversity, exclusive species, similarity index and foraging guilds in each zone and season were calculated. Comparison of each aspect was done among different zones and the seasons. Spearman rank correlation was used to find out the relation between the bird species richness, abundance and percentage of exclusive species with altitudinal zones. The calculation was done using SPSS software (version 10.0.). Diversity of birds and butterflies in different habitat was calculated using Shannon- Weiner index. Evenness (E) was calculated by formula

$E = H'/Hmax = H'/\ln S$

Where, H' is the Shannon-Weiner Index and S is the number of species observed.

All other analysis for Species richness and abundance in different seasons, zones and foraging guild of birds was done using Microsoft excel software.

Sightings from VES have been used to estimate encounter rates per hour of individuals and species of herpetofauna. The data from transects and stream surveys were excluded while calculating encounter rates because of very low sightings. The total number of species seen during VES, forest transects and stream surveys were added to get species richness. Percentages of relative abundance were also calculated. The species richness and abundance comparisons were done among different zones. The calculation has been done to find out percentages of exclusive species, diversity and similarity index in different zones. Diversity of reptiles in different habitats was calculated using Shannon- Weiner Index (H') along with Evenness.

Familywise species richness and abundances in total as well as in different habitat types and zones were calculated for butterflies. Diversity and evenness wasere calculated for different zones and habitats. Mann Whitney "U" test was performed to test the difference in species and abundances among habitat types and various zones using software SPSS (Version 10.0).

RESULTS

A. SECONDARY INFORMATION

Mammals

The compilation of inventory of 169 species of mammals shows that information on distribution and abundance is lacking in the case of mammals compared to birds and butterflies. Moreover, it is very likely that even species inventories for mammals (especially bats and rodents) might be incomplete and several species in the low altitude forests still remain to be reported. The altitudinal distribution of species shows two peaks in the case of mammals (**Fig. 1**). These peaks are evident despite the lack of information on most rodents and bats, which together make up nearly 50% of the mammalian fauna. The peak in the lower altitude is due to small mammals, while the peak in the higher altitudes is due to several species of mountain ungulates,

marmots, and pikas and their predators such as snow leopard, Tibetan wolf, and Tibetan fox. According to the secondary data, the species richness of mammals is very high even in the higher altitudes.

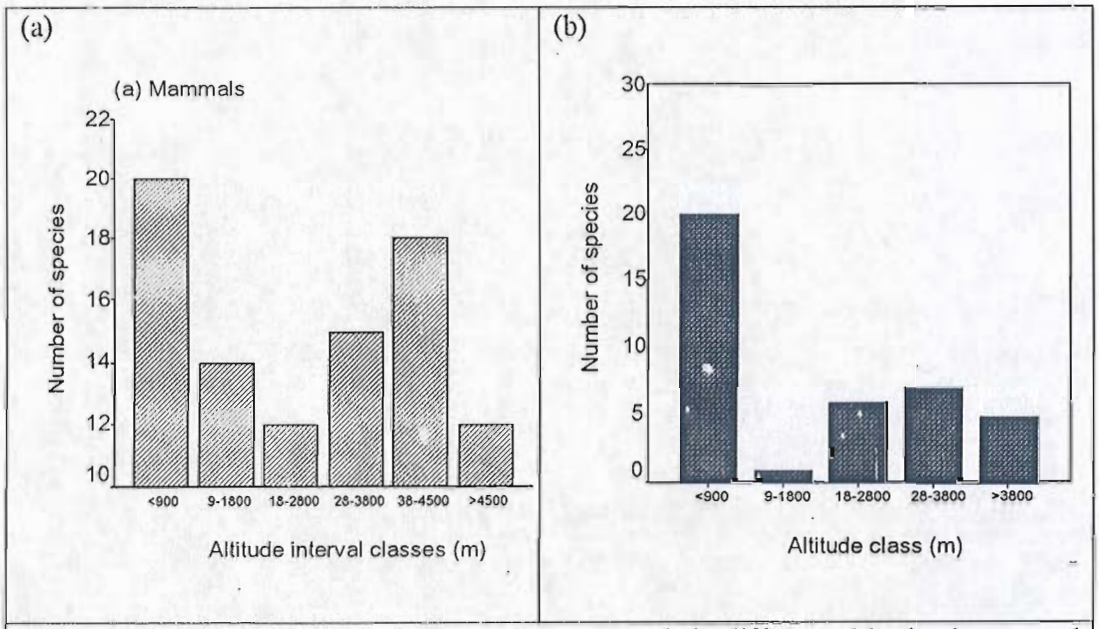


Figure 1: **(a)** Species richness in non-volant mammals in different altitude classes; and **(b)** the addition of new species with increasing altitude. Note that apart from bats, rodents also have been mostly excluded, due to paucity of data.

Birds

The analysis of secondary data shows that maximum number of species occurs in zone II and III but zone I possesses maximum number of exclusive species (occurring in that particular zone only). The compilation of inventory of over 500 species shows that considerable (but by no means complete) information on altitudinal range is available on birds of Sikkim, which is primarily due to the work of Ali (1989) and Ali & Ripley (2001). The present database of birds contains 540 species of which distribution data on 118 is not available (Appendix II). The secondary information indicates that the highest species richness is in the altitude between 900 m and 2800 m (**Fig. 2**). Although each altitude zone has its own exclusive resident species, the most notable feature is the altitudinal migration that many species show. As a result, most species use different altitudinal zones in different seasons. The relatively high species richness of birds at high altitude zones is also notable.

Table 2. Bird species richness in different vegetation (altitudinal) zones of Sikkim (based on secondary data).

Zones	No. of species	Exclusive species
I	195	24 (12.3%)
II	271	12 (4.42%)
III	281	10 (3.35%)
IV	176	6 (3.40%)
V	129	14 (10.8%)

It was observed that species richness followed unimodel pattern peaking at mid altitude (**Fig. 2**). The numbers of habitat specialists are more in the lowest and highest altitudinal zones (**Table 2**).

The common and widespread species reported to occur in all the five zones are only four, namely (1) White-capped Water Redstart *Chaimarrornis leucocephalus,* (2) Green Sandpiper *Tringa ochropus,* (3) Brown- wood Owl *Strix leptogrammica* and (4) White Wagtail *Motacilla alba.*

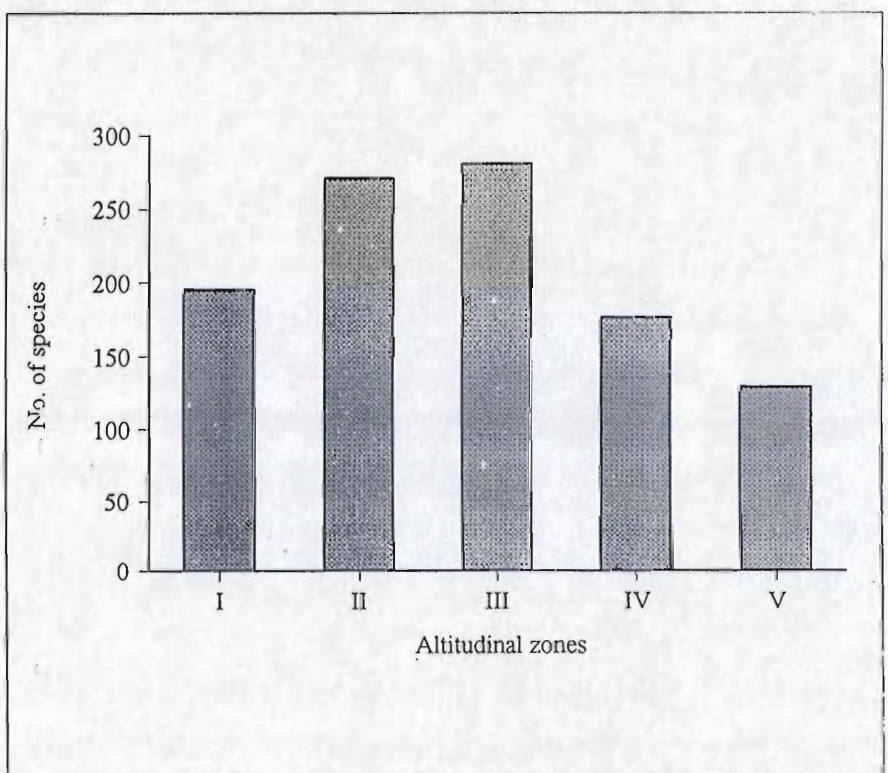


Figure 2. Bird species richness in different altitudinal zones of Sikkim

Out of the 540 species reported from Sikkim nine are globally threatened (two critical and seven vulnerable) including two endemics (**Table 3;** Birdlife International, 2001). The altitudinal ranges of many of these threatened species were not recorded.

Table 3. Threatened species of birds recorded from Sikkim

Species	Status	Altitude category
White rumped Vulture, *Gyps bengalensis*	Critical	*
Long-billed Vulture, *Gyps indicus*	Critical	*
Chestnut-breasted Partridge, *Arborophila mandedelli*	Vulnerable	I, II, III
Rusty-bellied Shortwing, *Brachypteryx hyperythra*	Vulnerable	IV
Beautiful Nuthatch, *Sitta Formosa*	Vulnerable	I, II, III
Hodgson's Bushchat, *Saxicola insignis*	Vulnerable	*
Baer's Pochard, *Aytha baeri*	Vulnerable	*
Black necked Crane, *Grus nigricolis*	Vulnerable	V
Wood Snipe, *Gallinago nemoricola*	Vulnerable	*

*Data on distribution is lacking

Herpetofauna

Secondary data showed 61 species of reptiles and 20 species of amphibians occurred in Sikkim (Jha and Thapa, 2002). The information on altitudinal distribution of herpetofauna is lacking. The compilation was done mostly based on the northeastern species (Molur and Walker, 1998) and recently published work on herpetofauna (Jha and Thapa, 2002).

The secondary information showed that species richness of reptiles was relatively higher in the lower two zones. Species richness pattern of amphibians and reptiles in various zones was different (**Fig. 3**). Species richness of reptiles decreased with increasing altitude. This may be due to the decrease in temperature and available resources. However, species richness is also high in zone III primarily due to the addition of new species that are not found in the lower altitudes. In case of amphibians, the pattern was different showing unimodel pattern with zone II being the most species rich region followed by zone III. Lower altitude zone (zone I) and the higher altitude zones (IV and V) had relatively low species richness. The low species

richness in both extremes may be due to extreme atmospheric temperatures and microhabitat limitations

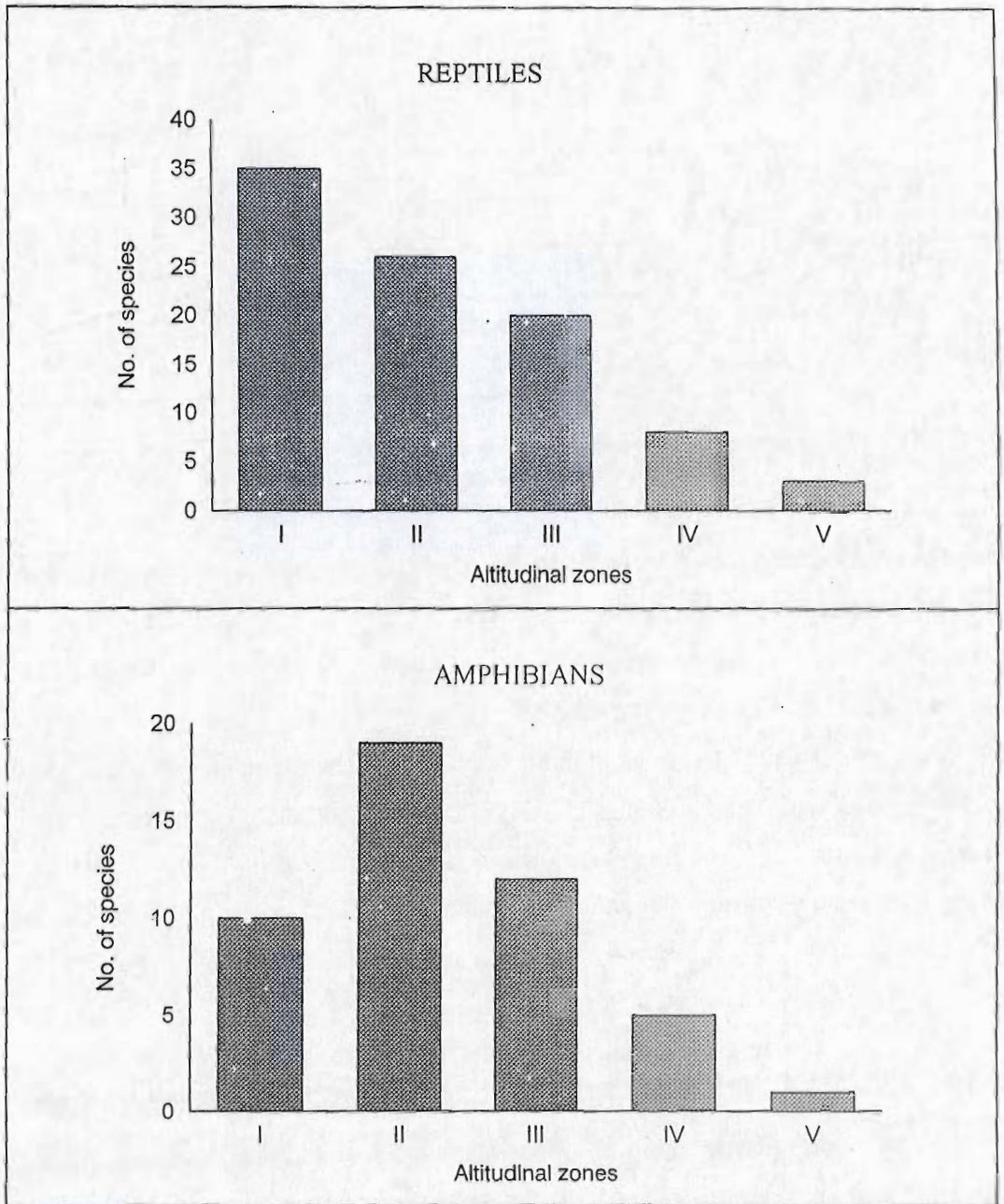


Figure 3. Reptile and Amphibian species richness in different habitat zones of Sikkim

Butterflies

The present checklist of butterflies consists of 689 species, including 254 without specific distributional data (Appendix IV). The secondary information indicated that the highest species richness was below 1800m in zones I and II (**Fig. 4**). Zone II is

the most species rich harbouring about 60% species with six exclusive (**Table 4**). The zone I is devoid of any specialist species. The species richness, although low in zone V, 25% are exclusive or restricted to this zone.

Table 4. Species richness of butterflies of Sikkim in different vegetation (altitudinal) zones

Zones	No. of species	Exclusive species
I	343	0
II	395	6
III	126	3
IV	36	2
V	24	6

Analysis of secondary data shows that maximum number of species occurred in zone II but zone V had maximum exclusive species (**Table 4**). The data shows that most of the butterflies occurring below 3800m were generalists whereas 25% species of zone V were specific to high altitude areas.

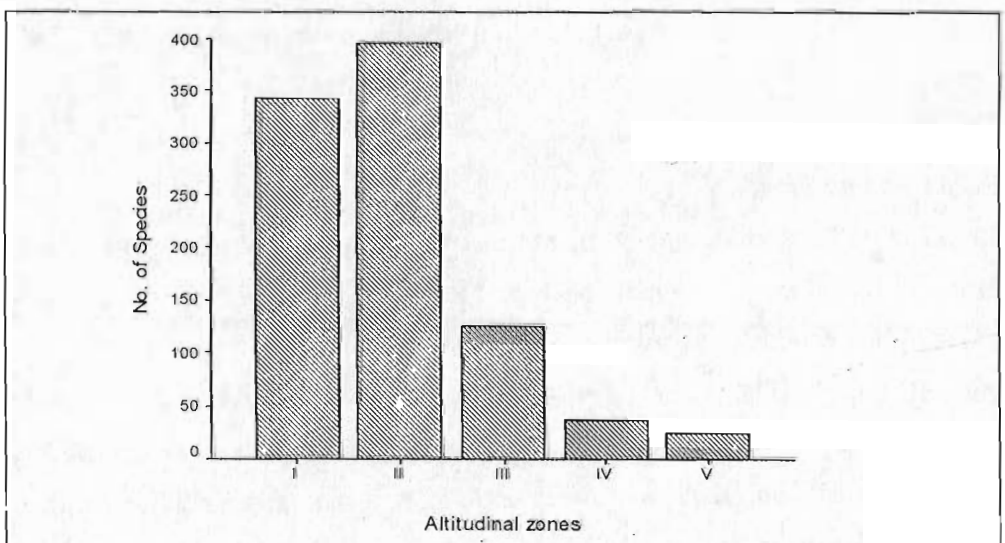


Figure 4. Distribution of butterflies in different vegetation (altitudinal) zones of Sikkim (based on literature).

B. PRIMARY DATA

Mammals

Direct Sightings

a. Species Richness: A total of 19 species (seven species of small carnivores, six species of arboreal mammals, two species of ungulates and four species of terrestrial mammals were observed in the belt transects, opportunistic transects, night surveys and vehicle surveys in all vegetation zones. Distance travelled in vehicle surveys was not included in data analysis, as the kilometers travelled in all occasions could not be accounted for, as most of the sightings from the vehicle were opportunistic. The highest number of species was sighted in zone III (8) followed by zone I (4), zone IV (3) and zone II (2).

b. Abundance: The encounter rate/ km of mammalian species differed in the four vegetation zones. For example, the encounter rate (ER) of Assamese macaque varied from 0.25 per km in zone I to 0.01 per km in zone III whereas the ER/ km of Hoary-bellied squirrel was comparatively same i.e. 0.18 in zone I to 0.12 in zone II. ER of Yellow-throated marten was 0.08/ km in zone I, 0.02 in zone III and 0.09 in zone IV. The ER also varied for species in each transects from four zones. Assamese macaque was encountered at 0.63/ km in transect 16 to 1.50/ km in transect 17 in zone I. Orange-bellied squirrel varied from 0.40 at transect 4 in zone III to 4.76 at transect 19 in zone II.

c. Species Composition:

The most common species sighted in zone I was the Assamese macaque (*Macaca assamensis)* with a total of 83 individuals in 10 sightings compared to zone II where only one troupe was sighted. It was sighted at an altitude range of 230 m to 2120 m. In zone II and zone III, Orange-bellied squirrel (*Dremomys lokhriah)* was more common and was sighted from an altitude range of 970 m to 2510 m. In zone III, the Himalayan-striped squirrel *(Tamiops mcclellandi)* was seen at an altitude of about 1910 m. It was sighted only in higher canopy forested areas. Below 900 m, Hoary-bellied squirrel (*Callosciurus pygerythrus)* was sighted near human habitation. A recently elevated new species of Langur i.e. the Nepal Langur *(Semnopithecus schistacius)*, whose range is restricted to the higher altitudes of Sikkim, Nepal and

Bhutan was sighted at 3070 m. Hodgson's flying squirrel (*Petaurista magnificus)* was sighted at 1960 m in zone III.

Among small carnivores, Yellow-throated marten (*Martes flavigula)* was more widespread in terms of altitude as it was sighted in all zones except zone II at an altitude of 620 m, 2110 m and 3380 m respectively in zone I, III and IV. The Himalayan palm civet (*Paguma larvata*) were sighted at three locations in zone III. Photographic evidence of Himalayan Palm Civet and Jackal (*Canis aureus)* was obtained through camera traps in zone I. Tibetian Fox *(Vulpes ferrilatus)* was sighted at 4800 m in the alpine meadows.

There was one sighting each of Stone marten *(Martes foina)* and Small Indian civet *(Viverricula indica)* in zone I and Himalayan stoat *(Mustela erminea)* in zone III. Among ungulates, the Barking Deer *(Muntiacus muntjak)* was sighted on several occasions on transects in zone I and zone III (upto 2010 m altitude).

Pika *(Ochotona* sp.*)* was the common species sighted in zone IV. The other sightings in higher altitudes (i.e. above Zone IV) while surveying from the vehicle were that of Blue Sheep *(Pseudois nayaur)*, Himalayan Marmot (*Marmota himalayana*), Woolly Hare *(Lepus oiostolus)*, Forresti's Pika *(Ochotona forresti)* and Nubra Pika *(O. nubra)*.

Indirect evidences

Till August 2004 a total of 252 droppings were recorded, a few photographed and most were collected. The encounter rate for all mammalian droppings found was 2.98/ km. These scats are being analyzed to identify species as well as food items contained in the scat. Encounter rate of mammalian droppings in different zones varied from 1.59/ km to 5.21/ km (**Table 5**). In the opportunistic transects the encounter rate was 2.11/ km in the four vegetation zones. Besides Zone I-IV, some areas of Zone V i.e. above 3800 m in the alpine scrub and grasslands, were also sampled. Besides direct sightings, encounter rates of scats was 2.69. The encounter rate of sightings per kilometer could not be estimated since most of the sightings in Zone V were recorded from the vehicle (**Table 6**).

Table 5. The encounter rate of sightings and mammalian droppings in transects in four vegetation zones along the Teesta Valley.

Zone	Length (km)	Altitude Range (m)	Replicates	No. of Dropping (148)	Encounter rate/ km (Dropping)	Encounter rate/ km (Sighting)
I	13.42	230-820	4	50	3.73	1.04
II	1.89	880-970	3	3	1.59	1.59
III	14.4	1860-2580	2-5	75	5.21	0.83
IV	5.67	3340-3700	2-3	20	3.53	0.71

Table 6: The encounter rate and sightings of mammalian droppings away from the transects (Opportunistic sighting) in five vegetation zones along the Teesta Valley.

Zone	Length (km)	Altitude Range (m)	No. of Droppings	Encounter rate/ km (Dropping)	Encounter rate/km (Sighting)
I	11.95	280-810	23	1.92	0.42
II	4.1	1040-1850	1	0.24	0.24
III	29	1800-2580	72	2.48	0.17
IV	4.07	3380-3600	8	1.97	1.48
V	5.20	3800-4800	14	2.69	-

Scats of at least four species of small carnivores were found along the transects, most probably Himalayan palm civet, Large Indian civet *(Viverra zibetha),* Leopard cat *(Prionailurus bengalensis)* and Jackal along with a few species of weasels and small cats. Evidences of Himalayan Palm Civet (*Paguma larvata*) visiting the area have been found especially during the fruiting season of large cardamom. Old and new scats of Jackals (*Canis aureus*) indicated their presence, besides their howling at dusk. Other indirect evidences of occurrence of mammalian species included hoof marks and horns of Serow *(Naemorhedus sumatraensis)*, pug marks and scats of Himalayan

black Bear *(Ursus thibetanus)*, hairs and skeleton of a Red Panda (*Ailurus fulgens)*, and Quills of porcupine (probably the Himalayan crestless porcupine, *Hystrix brachyura*). The most frequently encountered scat was that of the Himalayan palm civet.

The abundance of the forest ungulate, Serow seems to be high in some areas of Zone III as shown by frequent encounter of their droppings. For example, in T1 alone fresh Serow droppings were encountered seven times along with the accumulation of old droppings. Jackal scat was frequently encountered in the lower altitudes. The total list of species sighted and with indirect evidence is provided in Appendix I.

Small Mammals

A total of 181 individuals of 20 species of small mammals were captured in 3774 trap nights. The number of trap nights in a trapping site varied from 116 to 349.

a. Species richness: The small mammals captured in the four vegetation types were 20 species including 13 species of murids, six species of insectivores and one lagomorph. The highest number of species was trapped in zone III and zone IV followed by zone I and zone II (**Table 7**).

Table 7. Species richness and abundance of small mammals in four vegetation types along the Teesta Valley.

Vegetation types	Altitude range (m)	No of Transects	Traps nights	Individuals	Capture Rate	Species
Tropical semi-deciduous	< 900	6	1179	29	2.46 (1.86)	6
Tropical broad-leaf	900-1800	1	192	12	6.25 (-)	4
Temperate broadleaf	1800–2800	6	1450	42	2.90 (6.78)	7
Coniferous	2800-3800	6	953	98	10.28 (2.97)	7

* Number in paranthesis is Standard deviation

The curve by plotting the overall observed species richness against the transect days did not reach an asymptote (**Fig. 5**). This indicates that besides the captured 20 species there are more species dwelling in these habitats. However, when plotted for each vegetation types separately the curve for observed species reached an asymptote except in Zone II. The Jackknife 1 (species richness) estimator gave an estimate of 27 species for all vegetation types together compared to 20 observed species (**Fig. 5**).

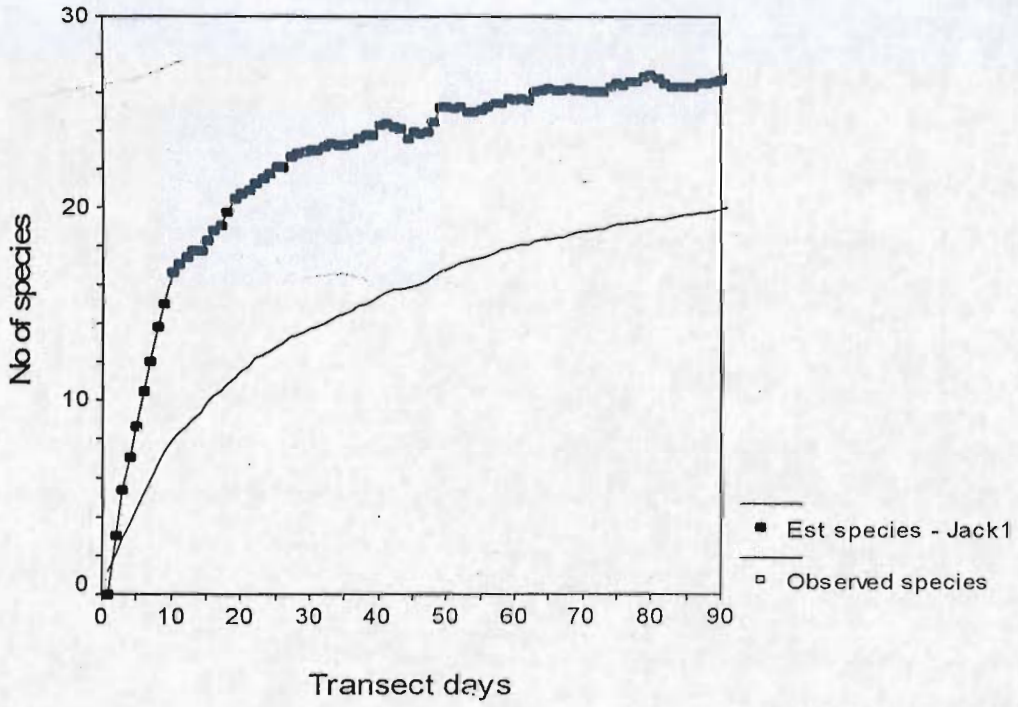


Figure 5: The observed and estimated species richness (Jackknife 1 estimator) plotted against the total transect sessions.

In the four zones the estimator gave an estimate of eight species each in zone I, III and IV compared to observed six species in zone I, seven each in zone III and zone IV. In zone II the estimated species was five compared to four observed species (**Fig. 6**).

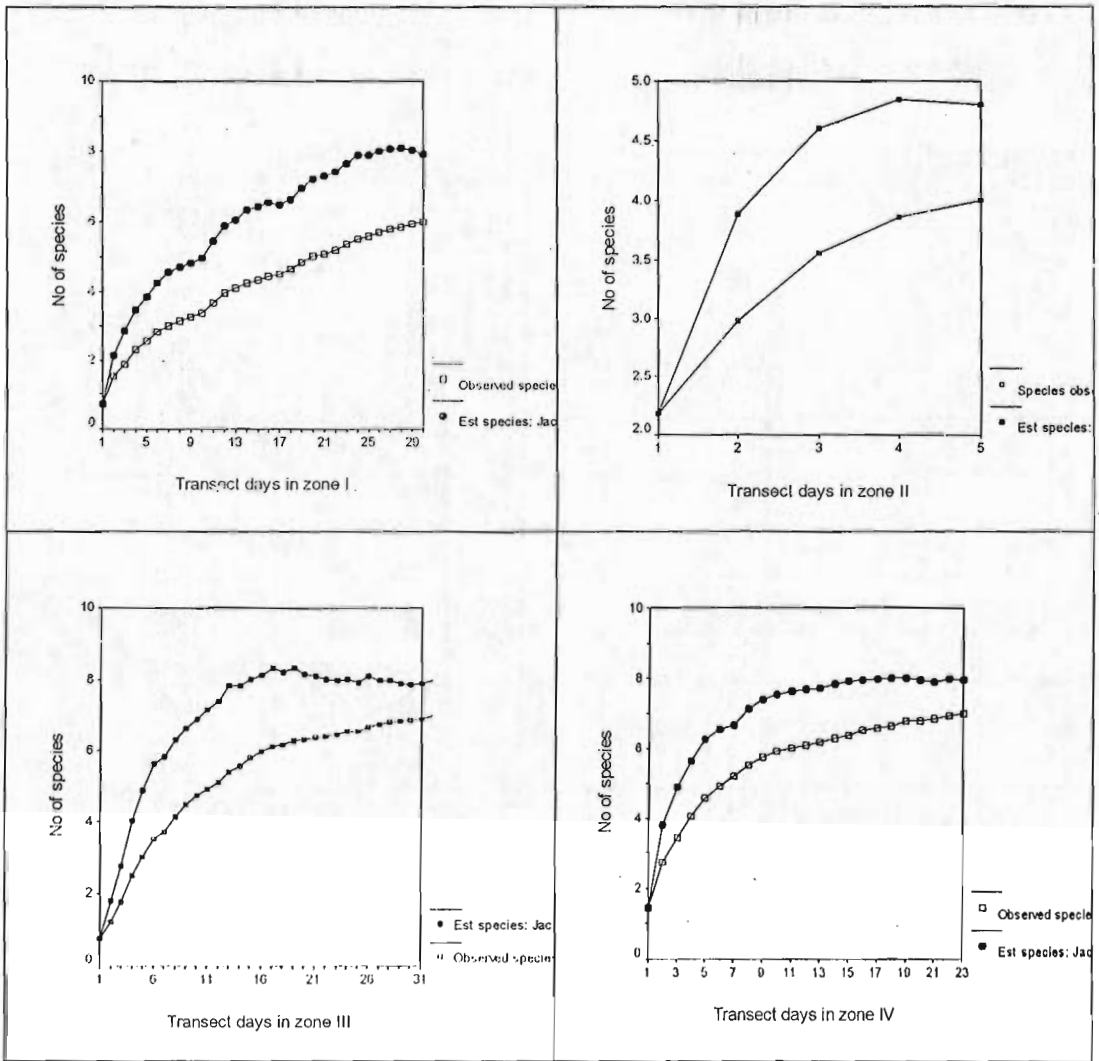


Figure 6: The observed and estimated species richness (Jackknife 1) in (a) zone I, (b) zone II, (c) zone III and (d) zone IV.

b. Aoundance

The capture rate overlapped considerably among the four zones. However, the capture rate varied significantly among zone I, III and IV (since zone II had only one transect it was excluded from analysis) (ANOVA, F = 4.694, P = .026).

The capture rate contrasted drastically among transects, varying from 0% in T16 to as high as 19.49% in T1, with an overall unweighted mean of 6.19 % (Table 5). Coniferous forest had a significantly higher capture rate (10.28 %) than tropical broadleaf (6.25 %), temperate broadleaf (2.90 %) and tropical semi-deciduous (2.46 %) **(Table 8).**

Table 8: Species richness and abundance of small mammals in 19 transects in four zones along the Teesta Valley.

Zone	Transect no.	Total trap nights	Capture Rate (%)	Species
I	13	200	01.00	2
I	14	197	04.06	2
I	15	188	02.13	2
I	16	198	0	0
I	17	199	02.01	1
I	18	197	05.58	3
II	19	192	06.25	4
III	1	118	19.49	4
III	2	118	06.78	3
III	3	349	00.86	1
III	4	249	00.40	1
III	5	316	00.94	2
III	6	298	01.33	2
IV	7	200	09.50	5
IV	8	199	11.56	5
IV	9	116	12.07	3
IV	10	119	12.61	2
IV	11	199	05.03	4
IV	12	119	14.29	5

The mean capture rate with standard error showed high difference between zone I and zone IV as there was virtually no overlap between species of these two zones. Zone III had high variability because of overlap between zone I, zone II and to a certain extent zone IV (**Fig. 7**). When compared between each pair of zones, difference between zone I and zone IV was significant (Scheffe, Multiple comparison analysis, P= 030) which was expected.

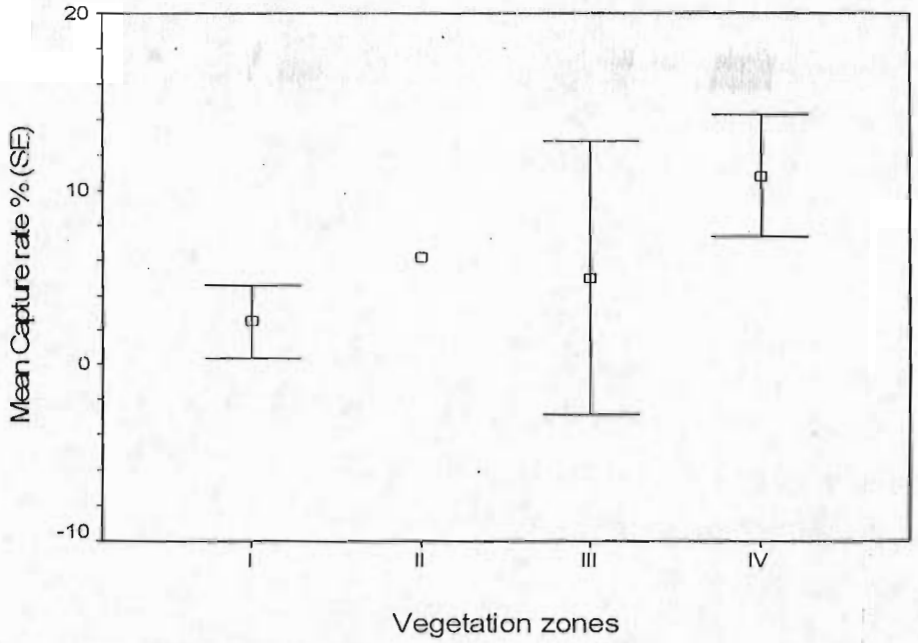


Figure 7. Standard error of mean capture rate of small mammals in four vegetation zones along the Teesta Valley

c. Species composition:

Among small mammals, the murids comprised the Chestnut rat *(Niviventer fulvescens)*, Smoke-bellied rat (*N. cha*), White-bellied rat *(N. niviventer)*, Sikkim rat *(Rattus sikkimensis)*, Himalayan rat *(Rattus nitidus)*, Sikkim mouse (*Mus pahari)*, Fawn cervicolor mouse *(Mus cervicolor)*, House mouse *(Mus musculus)*, White-tailed wood rat (*Cremnomys blanfordi)* and Indian mole rat *(Bandicota bengalensis)*. Shrews included the Sikkim large clawed shrew (*Soriculus nigrescens)*, Hodson's brown toothed shrew (*Soriculus caudatus)*, Grey musk shrew (*Suncus murinus)*, South Asian white toothed shrew (*Crocidura fulginosa)* and Tibetan shrew (*Sorex thibetanus)*. The Northern Tree Shrew or the Malay Tree Shrew *(Tupaia belangeri)* and Forrest's pika *(Ochotona forresti)* was also encountered.

Six species were captured in zone I, four in zone II and seven each in zones III and IV. The genus *Niviventer* was the most common in all the four forest types. The most common species was *N. fulvescens* found in three zones except zone 4 i.e. the coniferous forest. *Soriculus nigrescens* occurred in two zones i.e. zones III and IV.

N. fulvescens was the most dominant species in zone II (41.67 %), *N. eha* in zone IV (45.92 %), *Niviventer* in zone III (28.57 %) and *Mus* in zone I (51.72 %). The composition of species differed among vegetation types except in the case of *N. fulvescens* which was the dominant species in zone II and was also found in zones I and III.

Shrews formed 23.20% of the captured animals when data of all the four zones were combined. 34.69% of captured animals in the coniferous forest were shrews, 14.28% in temperate broadleaf, 8.33% in tropical broadleaf and 3.45% in tropical semi-deciduous forest (**Fig. 8**). The percentage of shrews captured increased with the increase in altitude while that of murids decreased but the difference in murids was not so high as in shrews (**Fig. 8**).

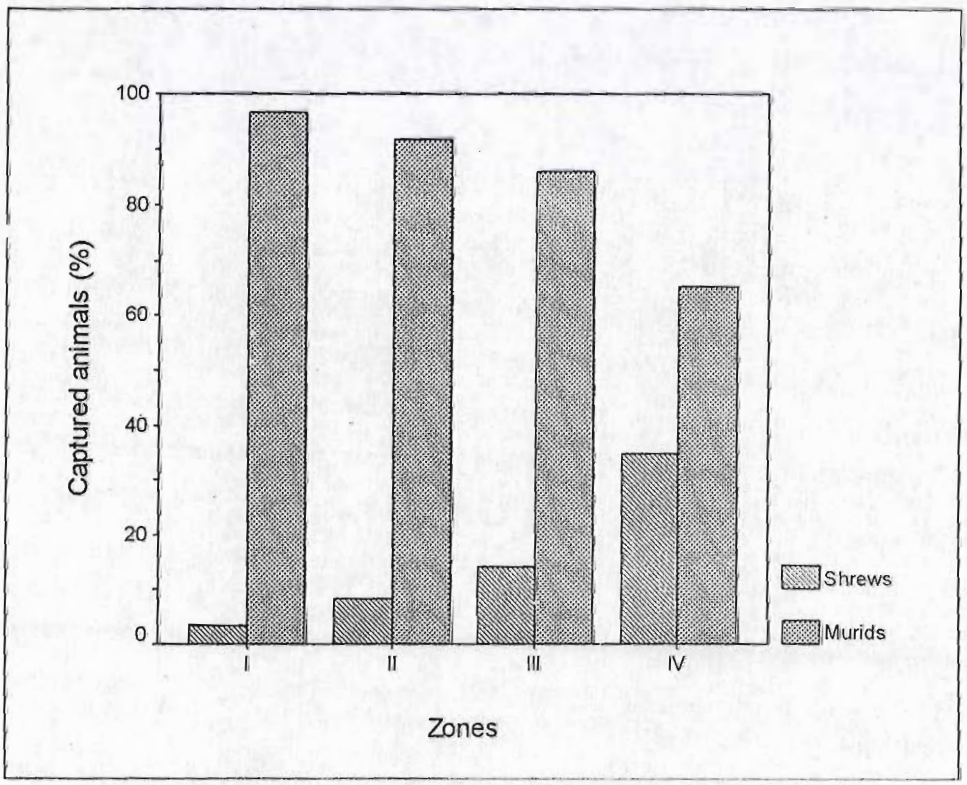


Figure 8: Percentage of captured shrews Vs murids in various zones along the Teesta Valley.

Northern Tree shrew (*Tupaia belangeri)*

Himalayan palm civet (*Paguma larvata)*

Hoary bellied squirrel (*Callosciurus pygerythus)*

Nepal langur (*Semnopithecus schistacius)*

Pellet pile of Serow *(Naemorhedus sumatraensis),*

Himalayan marmot *(Marmota himalayana)*

Plate 2. Some mammals of Teesta Valley, Sikkim

Birds

a) Bird species richness and abundance

In total 290 species belonging to 43 families of birds were observed in the study area including 256 (14602 individuals) during regular transects and 34 additional species outside transects. The mean number of species/ point in different altitudinal zones showed weak negative correlation with elevation ($z = 0.6$). Of the 290 species 117 occurred below 900 m followed by 122, 123, 73 and 42 species respectively in Zones II, III, IV and V (**Table 9, Fig. 9**).

The observed number of species in different altitudinal zones did not show much difference in the lower three zones (zones I, II and III). The species richness was relatively low in zones IV and V (**Fig. 9**). The bird abundance showed a different pattern as compared to that of richness. The number of individual birds/ point showed negative correlation with elevation ($z = 0.7$, $p<0.05$). Zone III was observed as the most abundant zone. The bird abundance was in the order of decreasing trend with rise in altitude except zone III (**Fig. 10**). The Black Bulbul (*Hypsipetes leucocephalus)* was more abundant in Zones I & II. Similarly, Rufous Sibia *(Heterophasia capistrata)* in Zone III, Coal Tit (*Parus ater*) in zone IV and Grandala (*Grandala coelicolor*) in zone V were the most abundantly recorded species. Bird density was the highest in zone III and lowest in zone V (Table 9).

Table 9. No. of Bird species and individuals observed in different vegetation (altitudinal) zones along the Teesta Valley.

Zones	Area sampled (hectare)	Number of species	Number of Individuals.	Species/Ha	Individual/Ha
I	19.8	117	4377	5.9	221
II	19.1	122	3286	6.38	172
III	12	123	4475	10.25	373
IV	19.1	73	1644	3.82	86
V	32	42	831	1.31	26

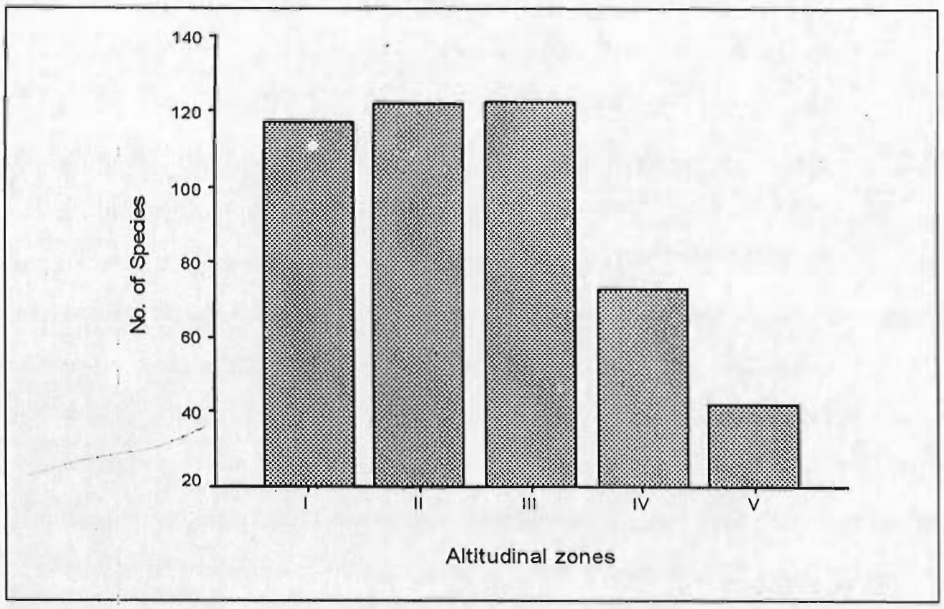


Figure 9. Observed species richness of birds in different altitudinal zones along the Teesta Valley.

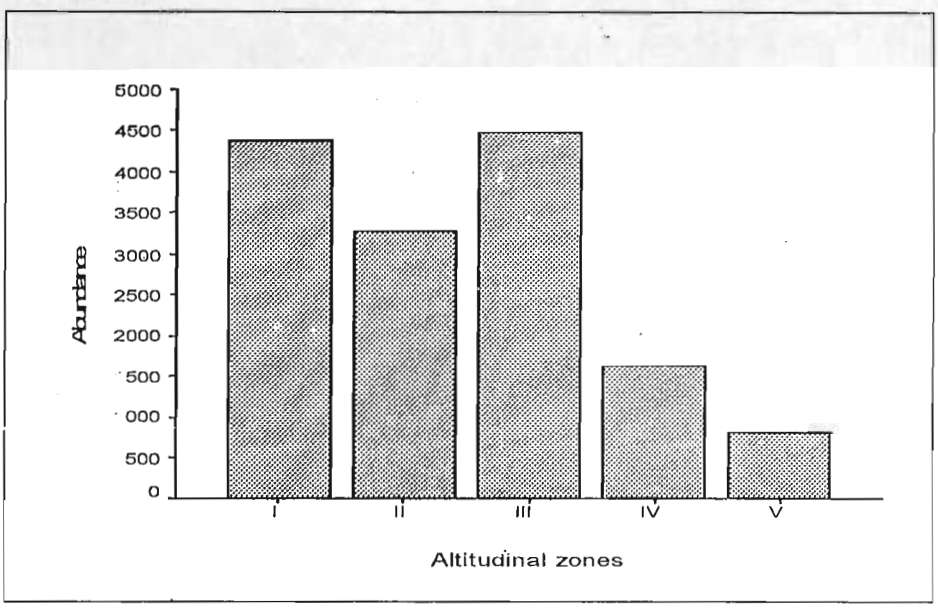


Figure 10. Bird abundance observed in different vegetation (altitudinal) zones along the Teesta Valley.

b) Species distribution range:

The distribution range of species varied from one (habitat specialist) to five zones (generalist). Out of 290 species, 133 (45.8%) were exclusive, restricted to one zone only (**Table 10**). Only two species (Blue whistling Thrush and White-capped Water Redstart) were common to all the five altitudinal zones and six species to four zones.

29 species were restricted to only Zone I. Similarly 22, 40, 28 and 14 species were restricted to Zones II, III IV and V respectively. The percentage of exclusive species showed significant positive correlation with altitude ($z=0.8$, $p<0.05$).

Table 10. Mean number of species and their abundance in different vegetation (altitudinal) zones along the Teesta Valley.

Zones	Mean no. of sp/point	Mean no. of ind/point	Exclusive Species
I	0.28	9.99	29 (24.78%)
II	0.30	8.01	22 (18.03%)
III	0.36	13.00	40 (32.52%)
IV	0.22	4.92	28 (38.35%)
V	0.20	4.11	14 (33.33%)

The species composition in different habitats was found to be different although species richness was almost same. Zones I and II shared most of their species followed by zones II & III. Zones I and V shared least number of bird species

Zones I and II showed 39.76% similarity in species composition followed by 26.28% between Zones II and III; 21.82% between III and I; 1.92 % between I &V (**Table 11**). The percentage of shared species in two consecutive zones is more in lower zones than in higher zones. The difference in percentage is almost same between Zones I and II, II and III and III and IV but it is higher between IV and V. Hence, zone IV seemed to be the transition zone beyond which there is a rapid change in species composition with elevation.

Table 11. Similarities of bird species observed in different vegetation (altitudinal) zones along the Teesta Valley.

Zones	I	II	III	IV	V
I	-	68 (39.6%)	43 (21.8%)	10 (5.5%)	3 (1.9%)
II		-	51 (26.2%)	17 (9.5%)	5 (31.1%)
III			-	25 (14.6%)	7 (4.4%)
IV				-	20 (21%)
V					-

c) Seasonality

The study was conducted during all seasons (winter, summer, monsoon and autumn). All five zones were covered during summer, monsoon and autumn, whereas only zones I and II were sampled in winter. Overall species richness as well as abundance was high during monsoon. Both richness and abundance were high in zone I in summer whereas it was monsoon in zones II, III and IV. Zone V showed different pattern where species richness was more during monsoon but abundance was more in summer. Overall diversity was more in zone III (H' = 3.742). Species diversity was high in zone III during monsoon (H' = 3.560) and autumn (H' = 3.368) where as diversity was in zone II (H'= 3.384) during summer. The overall evenness was more in zone V (E = 0.813). During summer (E = 0.827) and autumn (E = 0.821) evenness was high in zone II where as it was zone V during monsoon (E= 0.864; **Table 12**).

Table 12. Seasonal variation in species richness and abundance of birds in different vegetation (altitudinal) zones along the Teesta Valley.

Seasons	Altitudinal zones									
	I		II		III		IV		V	
	Sp.	Ind.	Sp.	Ind.	Sp.	Ind.	Sp.	Ind	Sp.	Ind
Winter	54	672	38	432						
Summer	65	820	60	606	67	920	36	399	21	403
Monsoon	53	750	62	1098	86	1542	36	515	23	272
Autumn	63	634	52	684	61	1027	21	255	16	73

Table 13. Seasonal variation of species diversity (H') and evenness (E) of birds in different vegetation (altitudinal) zones along the Teesta Valley.

Seasons	Altitudinal zones									
	I		II		III		IV		V	
	H'	E	H'	E	H'	E	H'	E	H'	E
Winter	3.140	0.787	2.576	0.708						
Summer	3.20	0.767	3.384	0.827	3.456	0.822	2.863	0.799	2.284	0.750
Monsoon	3.365	0.848	3.275	0.794	3.650	0.819	2.972	0.829	2.708	0.864
Autumn	3.287	0.793	3.242	0.821	3.368	0.819	2.423	0.796	2.083	0.751
Overall	3.549	0.745	3.607	0.751	3.742	0.778	3.318	0.773	3.04	0.813

d) Foraging Guilds

Insectivores dominated in terms of species richness as well as number comprising more than 50% in all the habitat types. Omnivores came in second in the list comprising 20% and 26% of species and individuals respectively (**Fig. 11**). The number of species of omnivores increased with altitude. In contrast, the species richness of granivores, frugivores and carnivores decreased with increase in altitude but there was not much change in the number of species of insectivores with altitude. The species richness and abundance of nectarivores were relatively lower. The number of nectarivorous species increased upto zone III but was absent in two higher zones. The abundance of birds belonging to different foraging guilds showed variation in different zones. The abundance of granivores, omnivores and carnivores increased with increase in altitude. As in the case of species richness, the abundance of frugivores decreased with altitude. The insectivore abundance showed two peaks one in zone II and another one in zone IV (**Table 14**). The pattern of nectarivores abundance was corresponding with the species richness.

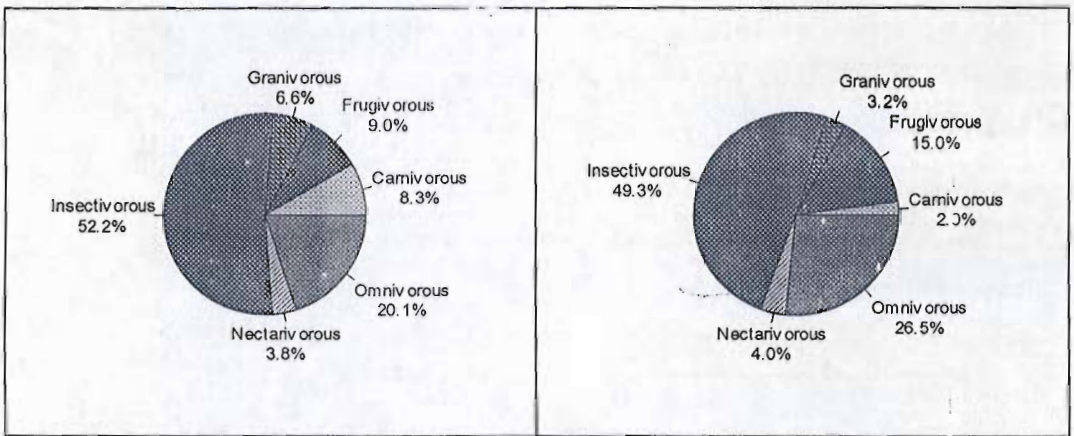


Figure 11: Species richness (left) and abundance (right) of birds in different guilds

Table 14. Guildwise species richness and abundance of birds in different vegetation (altitudinal) zones along the Teesta Valley.

Foraging Guilds	Altitudinal zones											
	I		II		III		IV		V		Total	
	Sp.	Ind.	Sp.	Ind.	Sp.	Ind.	Sp.	Ind.	Sp.	Ind.	Sp.	Ind
Carnivores	11	136	9	31	6	20	7	34	3	65	24	277
Frugivores	14	1565	11	485	5	170	5	75	1	1	26	2043
Granivores	7	103	4	37	9	183	10	122	9	162	19	439
Insectivores	65	1538	72	1707	64	2108	40	1219	16	289	151	6715
Nectarivores	3	24	4	20	7	89	0	0	0	0	11	539
Omnivores	15	658	21	802	30	1603	10	106	12	288	58	3608

Ind= Individuals of birds

e) Breeding birds

Breeding of birds was also recorded as and when observed; 42 nests of 26 species were recorded in four zones with zone III having the highest number of nests. The breeding season observed was April to July, June being the peak breeding period recording 22 nests of 13 species. In addition, breeding records of 16 species were also observed in different zones (Table 15).

Table 15. Number of breeding bird species and nests recorded in different altitudinal zones along the Teesta Valley.

Zones	No. of species	No. of nests
I	9	12
II	5	6
III	10	16
IV	6	9
V	0	0
Total	26	42

Common Pochard (*Aythya ferina*)

Striated Bulbul (*Pycnonotus striatus*)

White-collared Blackbird (*Turdus albocinctus*)

Green-backed Tit (*Parus monticolus*)

Chestnut-crowned Laughingthrush (*Garrulax erythrocephalus*)

Alpine Accentor (*Prunella* collaris)

Plate 3: Some birds of Teesta Valley, Sikkim

f) Endemic species:

Out of eight endemic species recorded from Sikkim, five could be recorded during this study, namely Rusty-bellied Shortwing, Broad-billed Warbler, Hoary-throated Barwing, Yellow-vented warbler and White-naped Yuhina. Rusty- bellied Shortwing, a threatened endemic, seems to be rare as it was sighted only twice in Zone IV, but the other four species are locally abundant and recorded frequently (Table 16). The distribution of endemics varied from one to three zones. No endemic bird species was seen in zone V.

Table 16. Abundances of endemic species of birds in different vegetation (altitudinal) zones along the Teesta Valley.

Species	Altitudinal zones				
	I	II	III	IV	V
Rusty-bellied Shortwing	-	-	-	2	-
Broad-billed Warbler	-	-	26	52	-
Hoary-throated Barwing	-	-	54	-	-
Yellow-vented Warbler	1	24	-	-	-
White-naped Yuhina	9	82	7	-	-
Chestnut-breasted partridge	-	-	-	-	-
Wedge-billed Wrenbabbler	-	-	-	-	-
Rufous-throated Wrenbabbler	-	-	-	-	-

HERPETOFAUNA

Due to the secretive nature of reptiles and amphibians and restricted temporal activity, a few species were encountered during regular sampling. Large study area and steep terrain narrowed the possibility of other methods such as quadrat and pitfall traps. Hence, VES was followed for regular sampling though other methods were also used seasonally.

a) Species composition

A total of 32 species with 970 individuals of reptiles and 14 species with 835 individuals of amphibians were recorded during 1354 hours of visual encounter survey. Seven families of reptiles were recorded (three lizards and four snakes) out of which Colubridae dominated with 44.8 % followed equally by Agamidae and Geckonidae. In the case of amphibians the present study could record only 4 families, as most of the amphibian species are nocturnal. The survey was carried out during day hours in which Ranidae dominated with 57.1 % followed equally by 3 families, Bufonidae, Rhacophoridae and Megophryidae (**Fig. 12**).

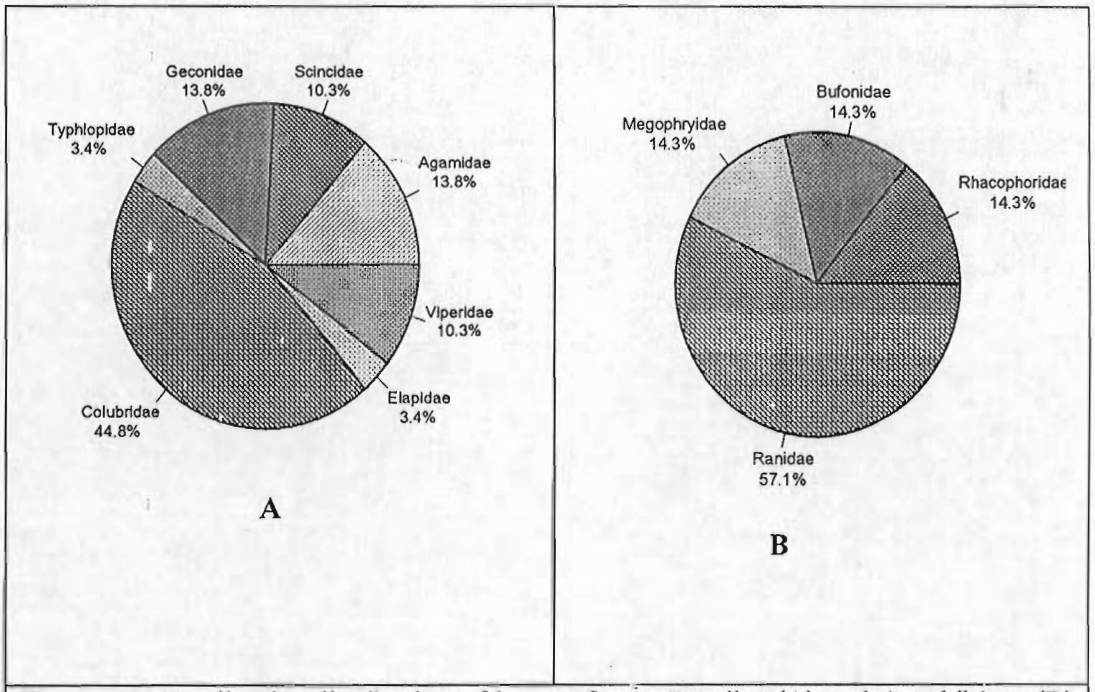


Figure 12: Familywise distribution of herpetofauna; Reptiles (**A**) and Amphibians (**B**) in different vegetation (altitudinal) zones along the Teesta Valley.

b) Species accumulation pattern

The species accumulation pattern of reptiles (when plotted for all the zones) showed that the detection of species along the Teesta valley is near complete as the curve reached an asymptode (**Fig. 13**). The accumulation pattern of amphibian species shows a constant addition of species with respect to additional hours of effort indicating more species with further surveys (**Fig. 14**).

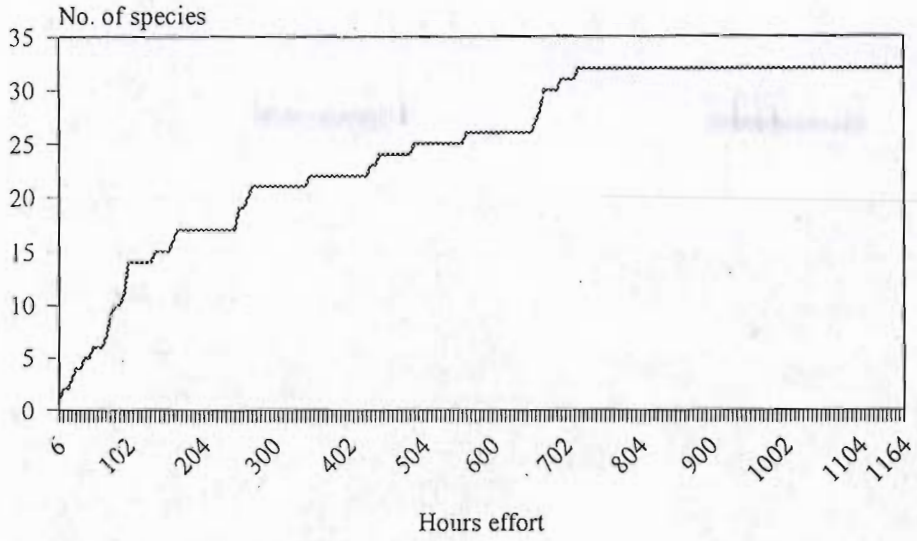


Figure 13. Species accumulation pattern of Reptiles along the Teesta Valley

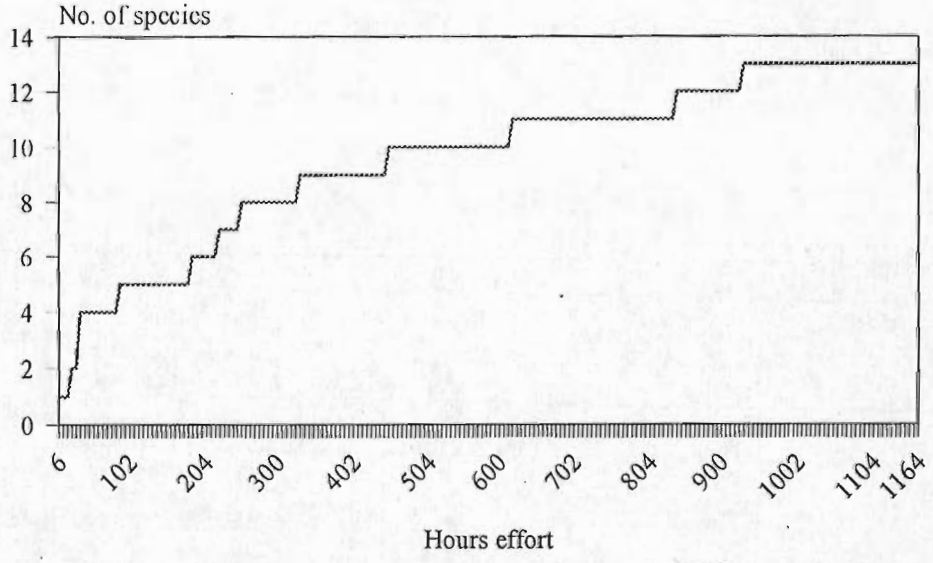


Figure 14. Species accumulation pattern of Amphibians along the Teesta Valley

c) Relative abundance

Trachischium guentheri was relatively the most abunadant (31.14%) species found along the Teesta Valley followed by *Leiolopisma sikkimense* (21.55%). Species such as *Typlops sp., Japalura variegata*, *Calotes versicolor* and *Spenomormous indicum* are other relatively common reptiles found along this valley (**Table 17**). Out of these 31 species, there were four venomous snakes namely *Naja kaouthia, Trimeresurus monticola, Trimeresurus* sp1 and *Trimeresurus* sp 2.

Himalayan toad *Bufo himalayana* was the most abundant species, with respect to amphibians contributing maximum relative abundance (73.96%) followed by

Limnonectes limnocharis (8.841%). *Bufo melanostictus* and *Rana sp4.* were seen twice but *Rana sp5.* was sighted only once (**Table 18**). The contrast in the relative abundances of two species of *Bufo*, namely *Bufo melanostictus* and *Bufo himalayana*, the former showing lowest and the later highest in high altitude and vice versa in lower altitude. *Bufo melanostictus* was restricted to zone I whereas *Bufo himalayana* showed wider distribution from zones II, III and IV. It may be noted that *Bufo melanosictus* may be marginally distributed as the range is taken over by its congener. All the five species of *Rana* observed during the study are yet to be identified. *Ichthyophis sikkimensis*, the only limbless amphibian reported from the North Indian region was observed opportunistically in the lower altitudes (~500 m). The Himalayan newt (*Tylototriton verrucosus*), though recorded fom Sikkim in the past could not be located during this study.

Table 17. Relative abundance of the reptiles found along the Teesta Valley.

Species	Individuals observed	Relative abundance (%)
Hemidactylus bowringi	1	0.107
Hemidactylus garnoti	5	0.538
Hemidactylus sp.	10	1.075
Gymnodactylus khasiensis	1	0.107
Calotes versicolor	44	4.731
Calotes sp.	7	0.753
Japalura variegata	113	12.150
Japalura sp.	8	0.860
Takydromus sexlineatus	13	1.398
Sphenomorphus maculatum	105	11.290
Sphenomorphus indicum	51	5.484
Leiolopisma sikkimense	200	21.505
Trimeresurus monticola	4	0.430
Trimeresurus sp1.	1	0.107
Trachischium guentheri	289	31.075
Amphiesma platyceps	17	1.828
Amphiesma himalayana	2	0.215

Species	Individuals observed	Relative abundance (%)
Rhabdophis subminiata	1	0.107
Elaphe cantoris	1	0.107
Elaphe radiata	1	0.107
Dendrolaphis pictus	1	0.107
Lycodon aulicus	1	0.107
Lycodon sp	1	0.107
Ptyas korros	5	0.538
Oligodon juglandifer	4	0.430
Naja kaouthia	1	0.107
Typhlops oligolepis	37	3.978
UISpecies 1.	2	0.215
UISpecies 2	1	0.107
UISpecies 3	1	0.107
UISpecies 4.	2	0.215
Total	930	-

UI- species to be identified

Table 18. Relative abundance of amphibians of Teesta valley.

Amphibian species	No. of individuals observed	% of relative abundance
Amolops sp.	20	2.389
Bufo melanostictus	2	0.239
Bufo himalayana	619	73.955
Limnonectes limnocharis	74	8.841
Megophrys parva	4	0.478
Polypedates leucomystax	26	3.106
Rana sp1. *	37	4.421
Rana sp2. *	5	0.597
Rana sp3. *	4	0.478
Rana sp4. *	2	0.239
Rana sp5. *	1	0.119
Rana liebigii	7	0.836
Scutiger sikkimensis	36	4.301

*Species to be identified.

d) Distributional range

Among the lizards *Takydromus sexlineatus* was distributed in a very narrow range (300-700 m). The most widely distributed species was *Leiolopisma sikkimensis* (**Table 19**). Among the snakes, the most being sighted only once, range could not be documented. *Amphiesma platyceps* is distributed widely (800-2600m). Among the amphibians *Bufo himalayana* and *Scutiger sikkimensis* were the most widely distributed species along the Teesta Valley. All other species showed very narrow range of distribution. From the data available it appears that species distributed in the lower altitude have narrow range compared to those found in the higher altitudes.

e) Species Richness and Diversity

Species richness and diversity (H') were calculated based on data from Visual Encounter Survey. The data from other methods were excluded because of the poor sightings. The highest number of species was obtained in zone I and zone II. Reptile species encounter rate was high in zone I followed by zone II but individual encounter rate was high in zone III. Amphibians did not show any pattern of encounter rates with habitat. Both species as well as individual encounter rates were high in zone IV (Table 20).

Table 19. Herpetofaunal distributional range at atitudinal gradient

Lizards		**Amphibians**	
Species	Range (m)	Species	Range (m)
Hemidactylus bowringi	500-1000	*Amolops sp.*	450-1350
Hemidactylus garnoti	500-1000	*Bufo melanostictus*	450
Hemidactylus frenatus	500-1000	*Bufo himalayana*	1200-3100
Gymnodactylus khasiensis	500-1000	*Limnonectes limnocharis*	250-800
Calotes versicolor	250-1000	*Megophrys parva*	1700-2300
Japalura variegata	800-2300	*Polypedates leucomystax*	400-800
Leiolopisma sikkimense	1300-2800	*Rana sp1.* *	800
Sphenomorphus indicum	300-1500	*Rana sp2.* *	250
Sphenomorphus maculatum	300-2000	*Rana sp3.* *	800
Takydromus sexlineatus	300-700	*Rana sp4.* *	800

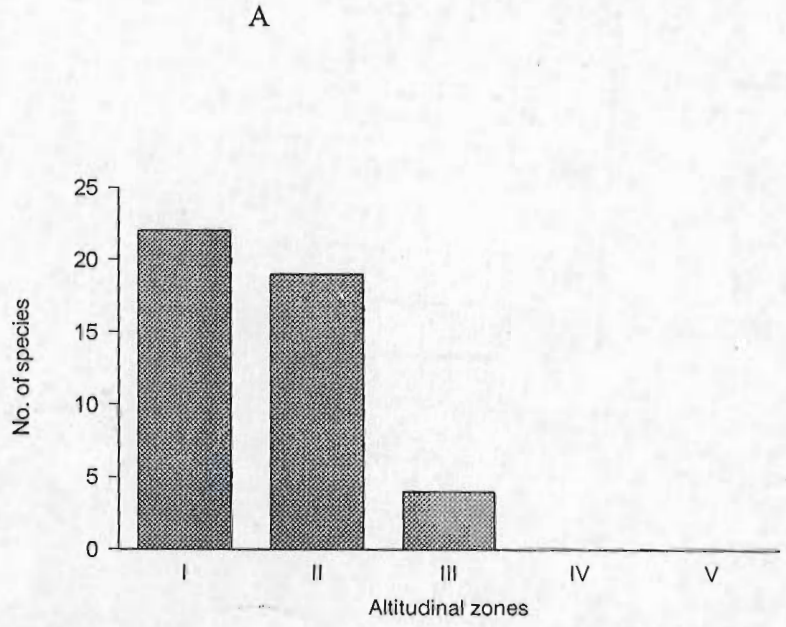
Snakes		*Rana sp5.* *	1800-2300
Amphiesma himalayana	700-1100	*Rana liebigii*	1800-2600
Amphiesma platyceps	800-2600	*Scutiger sikkimensis*	2800-4800
Dendrelaphis pictus	400-700		
Elaphe porphyracea	550		
Elaphe cantoris	1700		
Elaphe radiata	500-1000		
Lycodon aulicus	300-550		
Lycodon sp	800		
Naja kaouthia	550		
Oligodon juglandifer	1300-1700		
Ptyas korros	400-800		
Trimeresurus sp	1300-2000		
Trimeresurus monticola	1400-2000		
Trachischium guentheri	1700-2000		
Typlops oligolepis	380-700		
Amphiesma sp	550		

*Species to be identified.

Table 20. Encounter rate of herpetofauna in various zones of Teesta valley

Zones	Reptiles		Amphibians	
	Species/hr	Individuals/hr	Species/hr	Individuals/hr
I	0.054	0.645	0.022	0.402
II	0.052	0.582	0.011	0.160
III	0.010	1.264	0.010	1.359
IV	0	0	0.024	0.435
V	0	0	0.015	0.412

Tropical semi-deciduous and wet forest of zone I hold the maximum number of herpetofauna (reptile and amphibian species) followed by zone II. The species richness showed decreasing trend with increasing altitude (**Fig. 15**).



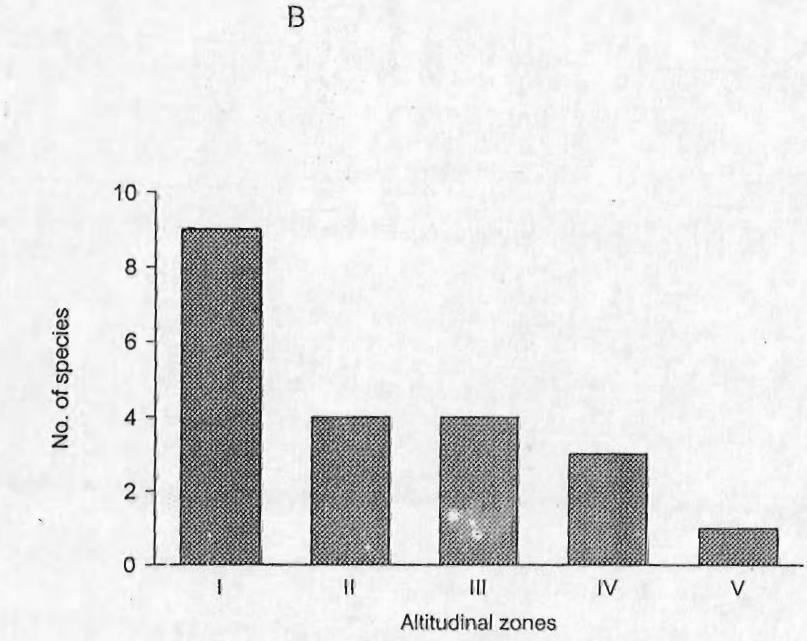


Figure 15. Observed reptile (A) and amphibian (B) species richness along the Teesta valley in different habitats.

Table 21: Herpetofaunal distribution pattern in various habitat (altitude) zones along the Teesta Valley.

Zones	No. of Hours.	No. of Rep. species	No. of Individuals.	No. of Amp. species	No. of Individuals.
I	408	22	263	9	164
II	368	19	214	4	59
III	390	4	493	4	530
IV	124	0	0	3	54
V	68	0	0	1	28

The amphibian species richness was very low in zone IV and V but no species of reptiles were seen in these two zones (**Table 21**). Only one species of amphibian *Scutiger sikkimensis* was found in alpine and subalpine habitats whereas no reptiles were encountered beyond 2800m. The abundance showed somewhat different pattern. The highest abundance was in zone III for both reptiles and amphibians.

Species diversity as well as evenness of reptiles was highest in zone I (H'=2.271; E= 0.735) and lowest in zone III (H'=0.809; E= 0.584). Lower reptile diversity in zone III could be due to colder climatic conditions and rapid increase of altitude. Similarly, amphibian species diversity and evenness was high in zone I (H'=1.473; E= 0.670) followed by zone IV (H'= 0.48; E= 0.437) and lowest in zone III (H'= 0.128; E=0.092 **Table 22**).

Table 22. Herpetofaunal diversity in various habitats of Teesta valley.

Habitat	Reptiles		Amphibians	
	Species diversity	Evenness	Species diversity	Evenness
Zone I	2.271	0.735	1.473	0.670
Zone II	1.894	0.643	0.318	0.229
Zone III	0.809	0.584	0.128	0.092
Zone IV	0		0.48	0.437
Zone V	0		0	

Both species richness and exclusive species were high in zone I followed by zone II for reptiles with no exclusive species beyond 2800m (**Table 23**). However, the number of amphibian species as well as exclusive although more in zone I, only one species was found exclusive to zones IV and V which was probably because of the marshes near the hotspring.

Table 23. Herpetofauna exclusive to various altitudinal zones of Teesta Valley

Zones	Reptiles		Amphibians	
	Number of species	Exclusive species	Number of species	Exclusive species
I	22	12	8	5
II	16	3	4	0
III	4	0	4	2
IV	0	0	3	1
V	0	0	1	0

Besides regular sampling, species such as *Dendrolaphis pictus*, *Elaphe radiata*, *Elaphe porphyracea*, *Boiga sp*, *Naja kaoutia* were recorded opportunistically.

BUTTERFLIES

a) Species richness

All together, 223 species and 5834 individuals of butterflies were observed in the study area. . In all 1558 point counts including 662 in zone I, 442 in zone II, 334 in zone III and 60 each in zones IV and V were done. The data collection in the middle and higher altitudes were commenced only in July 2003.

Elaphe sp (Black striped trinket snake)

Amphiesma sp (Keelback)

Trachischium sp
(Gunther's oriental slender snake)

Trimeresurus sp
(Pit viper)

Cyrtodactylus sp
(Eastern bent-toed gecko)

Japalura sp (Japalura)

Plate 4- Some reptiles of the Teesta Valley, Sikkim

Paa liebigii (Liebig's frog)

Megophrys sp. (Pelobatid toad)

Scutiger sikkimensis (Sikkimese pelobatid toad)

Bufo himalayana (Himalayan toad)

Plate 5- Some amphibians of Teesta Valley, Sikkim

Table 24: Species richness and abundance of butterflies along the Teesta Valley.

Zones	Area sampled (hectare)	Species /point	Individuals /point	Species /Ha	Individual /Ha
I	5.19	0.270	6.526	34.4	832
II	3.46	0.274	2.188	34.9	279
III	2.62	0.179	1.5	22.9	191
IV	0.47	0.1	0.4	12.8	51
V	0.47	0.067	0.367	8.5	47

The density of Butterflies was high in zone I and low in zone V. The species and individuals per hectare decreased with increase in altitude (Table 24).

b) Species diversity

Species/point as well as individuals/point showed negative correlation with altitude. Although the species richness (0.274 sp/point) was relatively more in zone II the diversity was more in Zone I (H'= 4.133).

c) Familywise composition

Nymphalidae was the most dominant family in terms of species richness followed by Papilionidae, but Pieridae was the next abundant family after Nymphalidae (**Figure 16**). Nymphalidae dominated all the zones. The trends of other families were different in different zones. Pieridae was the second dominant family in zone I, Lycaenidae in zones II and III and Papilionidae in zones IV and V. Pieridae was the second abundant family in all the zones. (**Figure 17 and 18**).

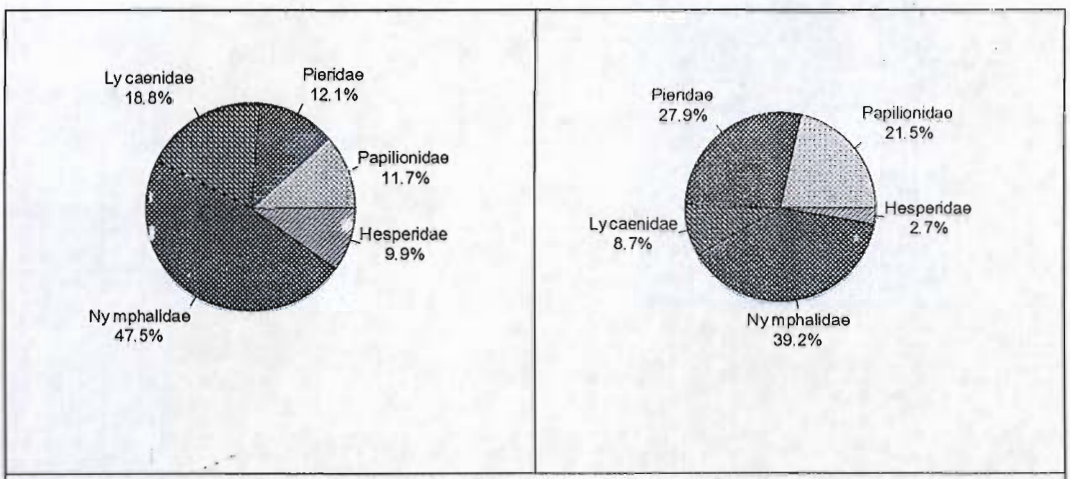


Figure 16: Composition of butterflies at family level
Species (Left) and abundance (Right).

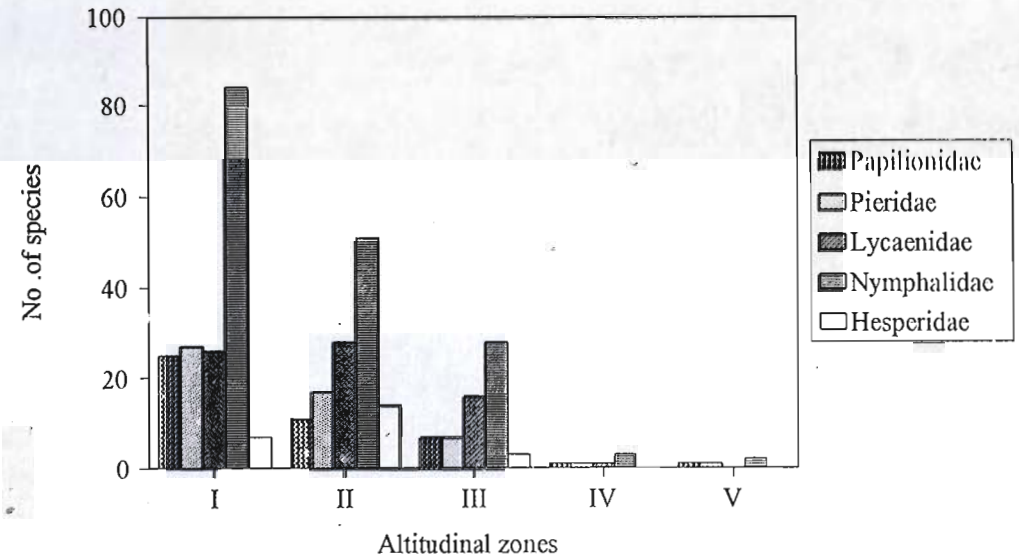


Figure 17: Familywise species richness of butterflies in different zones of Teesta Valley.

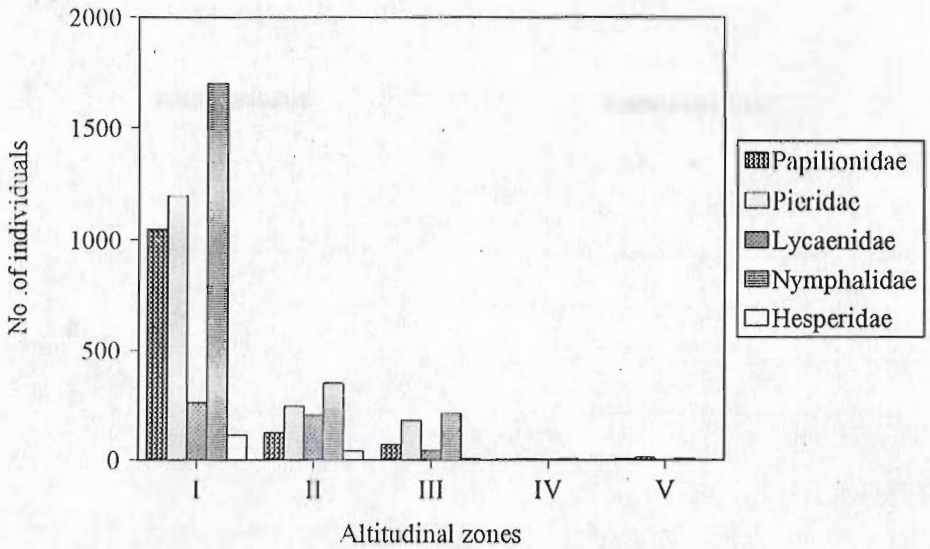


Figure 18. Familywise species abundance of butterflies in different zones of Teesta Valley.

There was significant difference among species between zones I and IV (U=0; p<0.01), zones I and V (U=0; p<0.01), zones II and IV (U=0;p<0.01), zones II and V (U=0; p=0.01) and zones III and V (U=0.5; p<0.01). Similarly the significant difference in abundances was observed between zones I and III (U=2; p<0.05), zones III and IV (U=2;p<0.05), zones III and V (U=3; p<0.05) zones I and IV (U=0; p<0.01), zones I and V (U=0;p<0.01), zones II and IV (u=0, p<0.01) & zones II and V (U=0; p<0.01; **Table 25 and 26).**

Table 25: Mann- Whitney 'U' Test showing difference in species richness of Butterflies in different zones

	I	II	III	IV	V
I		8.5, p=0.402	4.00, p=0.075	0, p= 0.008	0, p=0.009
II			5.50, p=0.141	0, p=.008	0, p=0.009
III				0.5, p=0.001	0, p=0.008
IV					10.00, p=0.572
V					

Table 26: Mann- Whitney 'U' Test showing difference in abundance of Butterflies in different zones

	I	II	III	IV	V
I		5.00, p=0.117	2, p= 0.028	0, p= 0.009	0, p=0.009
II			7.00, p=0.251	0, p=0.009	0, p=0.009
III				2.00, p= 0.028	3.00, p=0.047
IV					11.00, p=0.075
V					

d) Restricted species

Out of the 223 species of butterflies observed during the present study 116 species (52%) were habitat specialists. The percentage of restricted range species decreased with increase in altitude. Zone I had maximum number of exclusive species followed by zones II, III, IV and V.The percentage of restricted species was higher at lower and higher altitudes but less at middle altitudes (**Table 27**).

Table 27: Exclusive species of butterflies in different zones

Zones	Exclusive species	Percentage of exclusives
I	73	41
II	30	25
III	11	18
IV	1	17
V	1	25

Detailed studies in zone I:

During the initial stage of the project, studies were conducted in the lower altitude between 550 and 650m. This region had different types of habitats namely disturbed forest (DF), disturbed agricultural land (DAL), cardamom agroforest (CAF) and paddy field (PF). The count data is from March to May 2003.

In total 98 species and 2531 individuals of butterflies were seen in the four habitat types covering 192 point counts. This showed an average of 0.51 sp. /point. The most species rich family was Nymphalidae followed by Papilionidae and Pieridae. The

abundance pattern was very different; Papilionidae was the most dominant family followed by Pieridae and Nymphalidae (**Fig 19**).

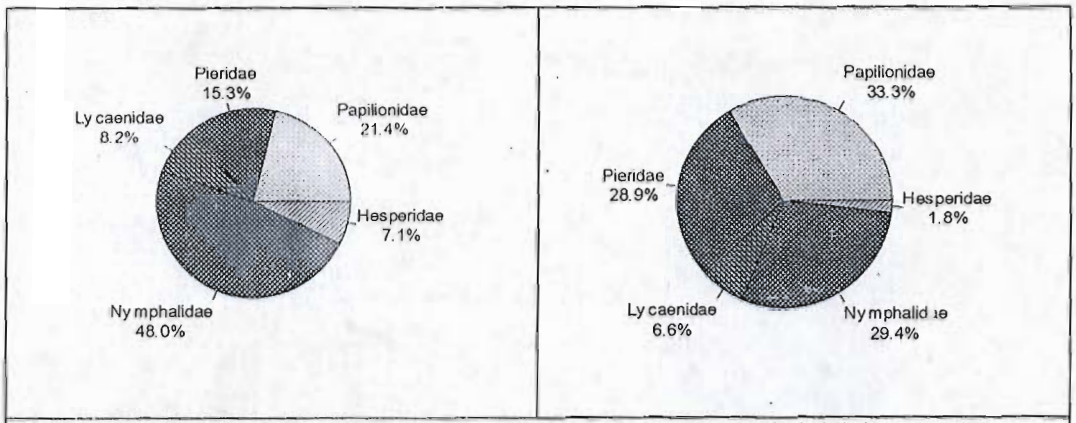


Figure 19: Familywise species richness (Left) and abundance (Right) in zone I

DF was rich in terms of species as well as abundance. The second rich habitat was CAF. Species diversity was high in DF (H'= 3.579) followed by CAF (H'= 3.443). The two agricultural fields were relatively poorer in species richness as well as abundance. The disturbed agricultural land was the poorest in terms of butterflies.

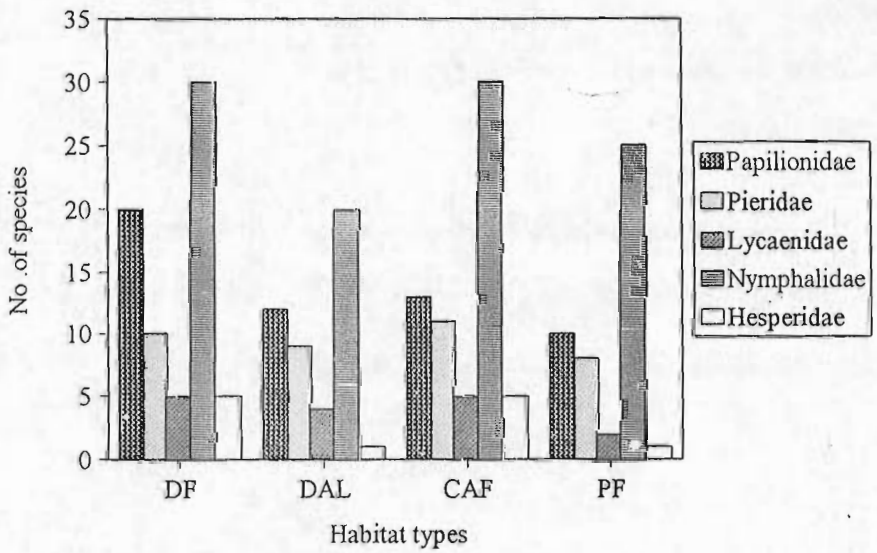


Figure 20. Familywise species richness of butterflies in different habitat types of zone I.

In terms of species richness Nymphalidae dominated all the habitat types (**Figure 20**). The second rich family was Papilionidae. The pattern of species richness among different families was same in all habitats. The species abundance showed different pattern as compared to richness. Papilionidae dominated DF, whereas it was Pieridae in DAL and PF and Nymphalidae in CAF. The DF and CAF were almost same in species richness and abundance (**Fig. 21**). There was no significant difference among the species and individuals in the different habitat types (**Table 28 and 29**).

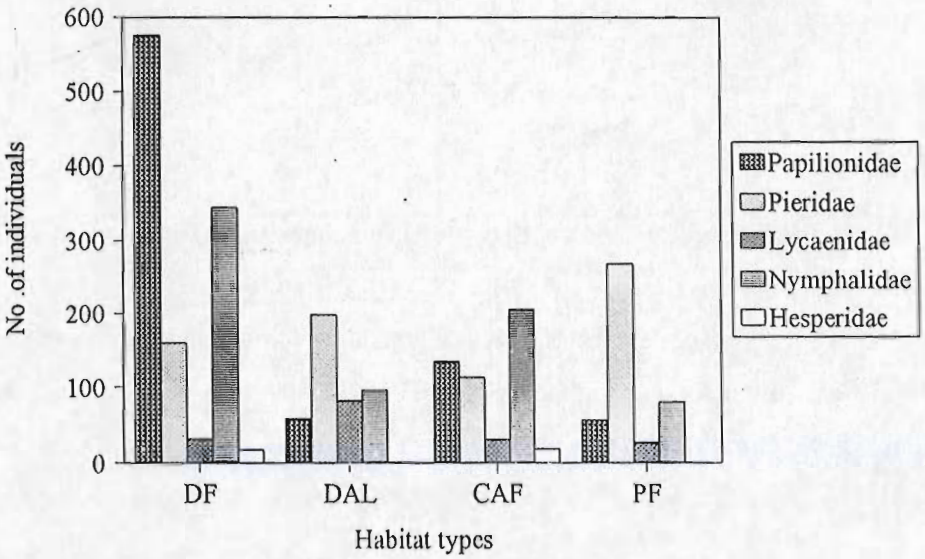


Figure 21. Familywise abundance in different habitats of zone I

Table 28: Mann- Whitney 'U' Test showing difference in species richness of butterflies between different habitats in zone I

	DF	DAL	CAF	PF
DF		8, p=0.343	13, p=0.078	10.00, p=0.359
DAL			8.00, p=0.346	12.00, p=0.196
CAF				8.5, p=0.401
PF				

Common Peacock (*Princeps polyctor)*

Blue Duchess (*Euthalia duda*)

Striped Blue Crow (*Euploa mulciber*)

Green Comodore (*Limenitis daraxa)*

Queen of Spain Fritillary (*Issoria lathonia)*

Red Lacewing (*Cethosia biblis*)

Plate 6: Some butterflies of Teesta Valley, Sikkim

Table 29. Mann- Whitney 'U' Test showing difference abundance of butterflies between different habitats in zone I

	DF	DAL	CAF	PF
DF		9.00,p=0.465	10.00, p=0.602	8.00, p= 0.347
DAL			10:00, p=0.602	11.5, p=0.834
CAF				10.00, p=0.602
PF				

DISCUSSION

According to the secondary data, 169 species of mammals supposedly occur in Sikkim. The survey for mammals in this study from May 2003 was done to look at the species richness, abundance and composition of various groups of mammals in different vegetation and altitudinal zones. But it was not possible to study the vast groups of mammalian species within a short time. More than 40 species of bats are found in Sikkim comprising the largest, Flying Fox *Pteropus giganteus* and perhaps the smallest, Little Bamboo Bat (Avasthe and Jha, 1999). The bats and high altitude ungulates accounting for most of the species already recorded from Sikkim were excluded from this study to focus on other groups for which no information was available from Sikkim. Though the methods required for studying bats differ, during this study there were a few sightings of bats in the coniferous and the temperate broadleaf forests.

Murid rodents are generally sampled by trapping in grids. But the slope of the area could not make it possible to lay grids. Therefore, traps were laid in line along the transect lines. Among all groups of mammals, shrews are highly localized species. They are extremely sensitive to slight fluctuation in temperature and other resources. Also due to their small size the movement is also limited locally.

The secondary data on mammals showed high species richness especially in zone I and zone II. But the richness estimated after our sampling shows that the zones III and

IV are more speciose than the lower zones. The species accumulation curve in Figure 1 also shows that with some additional sampling it is very likely that the number of species will increase. This contrasting result could be due to the fact that the lower altitude forests below 900 m are completely converted into agricultural fields. In altitudes ranging from 900 m to 1800 m, the major contributor to this cause is also the cardamom plantation. The patches of disturbed forest consists of one species of planted tree i.e. *Alnus nepaulensis,* with cardamom. In zone III i.e. from 1800 m to 2800 m, the ground cover is completely removed to make way for cardamom, but the natural tree species are retained. The removal of shrubs can considerably affect the species composition and richness of small mammals. In comparison to the lower zones, zone III had more species richness because of the presence of natural tree community. In zone II, only one transect could be sampled due to cancellation of work permit from the forest department. All the rodents are enlisted as Schedule V species under the Wildlife Protection Act (WPA) but most of the rodent species occurring in Sikkim are Data Deficient species under the IUCN category. Among the captured insectivores *Soriculus caudatus* and *S. nigrescens* are the two species of shrews, which are categorized as Vulnerable.

Similarly in the case of carnivores, arboreal mammals and ungulates also the secondary information showed high species richness in the lower altitudes. But as already discussed the habitats in the lower altitudes are not suitable for these species and their very existence in Sikkim is threatened due to the proximity to humans in these areas. There has been a constant decrease in population or even extinction of species in the lower altitudes due to pressure of human disturbances. Now only a few species which can adapt in the small fragmented patches of forests exist in zone I and zone II. For example, the squirrels have high abundance in the lower zones as they are not affected by the nearby human presence. *Macaca assamensis* are increasingly occupying the areas nearby the roadsides for easy food that is offered to them. The other group whose sighting was very few was the flying squirrels. In spite of probable occurrence of seven species only one species i.e. the Hodgson's flying squirrel was sighted on two occasions. A pair of **Himalayan Stoat** was sighted at an altitude of 2100 m. Its present known altitude range is 3200 m to 4200 m.

One new species of particular interest is the Nepal Langur, occurring in only a few areas in the high altitudinal forest of Pine and Rhododendron. This is a recently elevated species and its distribution in India is restricted to high altitudes of Sikkim. The forest areas near Lachen, where this langur was sighted is an important area where several species of small cats also occur. Zones I, II and III i.e. up to 2800 m asl seems to be very important areas for the mammalian communities.

Zones III and IV were the highest in species richness. *Ailurus fulgens* which is listed in the Endangered category of IUCN and as Schedule I species according to WPA occur in this altitude i.e. between 1800 m to 3800 m. Evidences of Vulnerable and Schedule I species were recorded in these two zones especially that of Serow, a forest ungulate. It has a restricted range from 1000 m to 3000 m altitude. As its habitat below 1500 m is already destroyed any kind of disturbance in its habitat above 1500 m will have an adverse effect. The high abundance of scats of leopard cat indicates its presence in zone III, which is also a Schedule I species according to the Wildlife Protection Act, 1972. The number of species of direct sightings and with indirect evidences makes it a total of forty-five species of mammals.

Total species of birds recorded earlier was 540. A record of 290 species of birds within 16 months of the present study shows that Teesta valley still harbours good habitats. Although the species richness was same in lower three zones i.e. I, II, III, species composition was different. In total 45.8% were habitat specialists. Zone I was dominated by woodpeckers, kingfishers, bulbuls, and drongos; zone II by doves, yuhinas, sunbirds and minivets, whereas zone III was represented mostly by undergrowth species such as babblers, laughing thrushes and fulvettas. The similarity in species richness may be due to similarity in vegetation structure and forest cover. The relatively low species richness with abrupt changes in species composition including more number of habitat specialists in zone IV and V shows that the transition zone lies between zone III and IV at about 3000m. The observed result differs from the existing one for zone V showing less number of species than expected probably because the zone was not equally covered in all seasons. The abundance in zone II was relatively lower as compared to other zones because this zone is mostly disturbed by cardamom plantation. Further, the undergrowths are removed and single species (*Alnus nepalensis)* tree dominated the forest reducing the quantity of resource

available to the birds.

There was marked seasonal variation in richness as well as abundance of birds. This shows that the birds show altitudinal movement seasonally. During rainy season most of the plant species were either flowering or fruiting supporting large populations of frugivorous species. Also, June being peak breeding season, presence of both migratory and resident species might have increased the number of total species during this season. Some of the lower altitude species showed upward migration for breeding.

Information available on herpetofauna (amphibians and reptiles) is far less or not available compared to the other taxa studied. The present checklist consists of 81 species, with several unconfirmed records (Appendix III). The species richness is highest in lower two zones (I & II). However, the abundance was high in zone III. As zone I and II have a warmer climate and tropical moist forest, conducive to reptiles and most amphibians, many of the species were seen exclusively in these zones making these the most diverse habitats. The highest abundance observed in zone III was due to the clumped distribution of some species like *Trachischium guntheri, Leiolopisma sikkimensis* and *Bufo himalayana.* Reptiles being cold-blooded animals they are sensitive to temperature and ecophysiological constraints, which affects the range of the species. Climatic severity in higher altitude may be the probable reason for the low species richness (**Navarro, 1992**).

The maximum sharing between zones I and II may be due to overlapping habitat structure both having tropical climate which is conducive for herpetofauna. No reptiles was recorded in zones IV and V which may be due to colder climatic condition. The species accumulation curve for all zones together has almost reached an asymptote but it is not the case when individual zones are considered separately. This might be due to rapid encountering of common species in the early sampling days. Although additional species were seen but the rate of sightings was very slow because the species were rare. The other possible reason may be due to large sampling area. The seasonal fluctuation observed is the usual feature for herpetofauna. Most of the reptiles hibernate during winter and late autumn. Hence, low richness and abundance was observed in these seasons as compared to summer and rainy. The

present study showed clear inverse pattern of number of species with altitude. As the altitude increased, number of species decreased. However, different zones have unique assemblage of species. The change in pattern from the existing data could be due to poor sampling for amphibians primarily during night stream survey as most of the streams are torrent.

Total species of butterflies recorded earlier was 689 species and the species recorded during this study was 223. The richness of species was high in the lower two zones than the higher zones showing that these habitats have got a great potential for conservation. The occurrence of very rare and specialist butterflies in high altitude areas, especially the alpine habitats needs research attention and management.
Decrease in species richness of butterflies with increase in altitude was observed. This might be due to the narrow tolerance of butterflies to weather conditions especially cold. Butterflies species appear to use warm and humid type of habitats. Hence there were more species in zone I than higher zones. The reason is also supported by the number of exclusive species present in zone I. Most of the species present in zone I was not seen in any other zones. A few species only were specialists of arid alpine and sub-alpine regions. The result obtained is consistent with the earlier records.

Dalep (Lower altitude) appears to be rich in butterflies both in terms of number of species and abundance. Record of 98 species within three months in lower altitude showed that the area harbors good habitat for butterflies. Haribal (1992) has reported 350 species of butterflies in low altitude area (below 900m) from Sikkim. As compared with this number the total record from Dalep represents 20% of species, which reflects high conservation value of the low altitude agro forests of Sikkim. The reason for high species richness might be (1) patches of forest with good tree cover sandwiched between agricultural land represented mostly by *Ceiba sp., Ostodes* sp, *Terminalia* sp, *Duabanga sp, Ailanthes grandis* and *Schima wallichi* forming the major habitat for butterflies, (2) the fallow lands adjoining agricultural field covered with shrubs also act as habitat for some specific butterflies and (3) the presence of two rivers (Pabong and Teesta) provides additional habitat for those species inhabiting moist habitats such as stream banks. Variety of crops grown in each season and the types of agricultural land it possesses also explains higher diversity of butterflies in this region.

LIMITATIONS OF THIS STUDY

The time allotted for the present study was more limited due to delay in getting permits for sampling. The permits were again cancelled during the study by the Sikkim Forest Department resulting in loss of field time and sampling seasons. More sampling is needed especially in the landscapes between temperate broad leaf and the coniferous forests. Also the sampling in the tropical broadleaf needs to be completed with more transects to come to a more definite conclusion about the difference in mammalian community in all four vegetation and altitudinal zones. Due to the secretive nature, limited activity period (hibernation or aestivation) and size (small) of herpetofauna considerable difficulties are encountered in sampling these taxa. Apart from this terrain, (especially steepness) and diurnal and nocturnal activity of them prevented from using many standard sampling methods.

Sampling in the higher altitudes above 3800 m could not be done regularly due to various reasons like the proximity of international borders and presence of security installations making it difficult to visit many areas. Massive landslides during the monsoon become problematic to sample the areas of North Sikkim.

CONCLUSIONS AND RECOMMENDATIONS

Analysis of existing information shows that the altitudinal zone of 1800 m to 2800 m in the temperate broadleaf forest has the highest species richness among mammals. Species richness is one of the most important criteria in the selection of areas for conservation of biodiversity. Moreover, zones with lower species richness have species that are not found in the other zones, typical example being the high altitude mammalian community. This zone also has Schedule I species (WPA). Therefore, it is extremely important to keep these habitats undisturbed for the mammalian community.

Altitudes <900 m is an important zone, especially for small mammals. However, this zone currently has no protected area coverage. There is, perhaps, very little scope for this at present, as this zone is almost entirely inhabited by people. The current land use in this zone predominantly consists of small patches of original forest (although

degraded), a variety of seasonal crops grown with very little use of agro-chemicals, and the retention of several species of native trees in agricultural fields as source of timber and fodder. This pattern of land use is very conducive to the retention of several species of mammals, birds, herpetofauna and butterflies. The need to retain remnant patches of forest, native tree cover in agricultural fields and crop diversity is therefore obvious.

It should, however, be noted that (a) the information compiled from secondary sources are based on surveys done a few decades ago; (b) such surveys have not equally covered different altitude zones and vegetation types; and (c) information on small mammals (such as rodents and bats) is grossly inadequate. The primary information gathered shows zone III and zone IV and zone I to be the rich in terms of species richness.

Altitudes <900 m is a very important zone as shown by secondary as well as primary data. The less number of observed exclusive species than as expected to occur (secondary data) shows that there was considerable alteration in habitat of zone I because birds and butterflies are the indicator of habitat disturbances. The major alteration observed is the fragmentation of forest because of random extraction of forest resources (fodder, timber and firewood) and unplanned developmental activities such as road building. However, this zone at present has no protected area coverage. These findings therefore invites attention for the conservation of low altitude vegetation for the preservation of rich faunal biodiversity. This short-term study also suggests detailed study of fauna and their association with particular habitat to implement conservation measures.

Zone II, the second species rich zone (as shown by primary and secondary data), is the habitat of many endemics including Chestnut-breasted Partridge, a vulnerable species. This zone is also slightly disturbed mainly due to cardamom plantation. Although, original forest trees are still maintained, the undergrowth are removed for the cardamom agricultural purposes affecting the habitats of shy and skulking birds. However, the preliminary study on bird and butterflies of these landscapes suggests that there is not much difference in overall species richness in cardamom agroforest and the original forests. Zone III was the most abundant and species rich zone among

all the zones with respect to birds. It harbors the habitat for many endemics and threatened birds such as Hoary-throated Barwing, Broad-billed Warbler, White-naped Yuhina and Chestnut-breasted Partridge. It also harbors maximum number of habitat specialists and many undergrowth birds species such as fulvettas, laughing thrushes, parrotbills and babblers, which are either absent or less abundant in other zones. Among the endemics Hoary-throated Barwing and Wedge billed Wren Babbler are restricted to this zone. The pristine vegetation with dense bamboo undergrowth is the peculiarity of this zone. There is not much pressure on forests and human habitation is low in this region. But still low level of poaching exsists with respect to pheasants. Large numbers of traps were recovered from forest quite often by us and Forest Department meant for capturing pheasants (Bhutia, pers comm.). The reason of the low abundance of pheasants in spite of such a good habitat may be due to the illegal killing of these vulnerable birds. This finding invites an immediate attention of conservation agencies for the preservation of these species. The higher two zones although, posses relatively low species, is the habitat of many high altitude birds which we never see in any of the other zones (exclusive spcies to the altitude or forest type). These zones are the breeding grounds for many migratory waterfowl including the Black-necked crane.

Earlier workers from Sikkim recorded a total of 61 species of reptiles and 20 species of amphibians (Jha and Thapa, 2002). This short-term study could record 32 and 14 species respectively of reptiles and amphibians from the study area. Zones I and II are very important for herpetofauna. However, this zone currently has no protected area coverage and is severely degraded due to anthropogenic pressure. The highest species richness in these two zones is an indication of the great conservation potential of this landscape. Both amphibians and reptiles are known to be microhabitat specific such as under boulder or decayed logs, hence any alteration in microhabitat will have severe effect on the taxa. Agamids such as *Japalura variegata* and many tree dwelling snakes usually bask in small tree and shrubs (0.5 to 2m above ground). Fragmentation or disturbances of any kind in the forest may have an adverse effect on these species.

Trimeresurus monticola and *Trimeresurus* spl are found to occur abundantly in cardamom plantation in Temperate broadleaved Forest, which may be due to rich moist litter content. Clearing of ground for cardamom during breeding season i.e.

rainy season and large-scale killing may lead to population decline. All the reptiles and amphibians of Sikkim are protected under Schedule II and IV of Wildlife Protection Act 1972. The only Schedule I species *Tylototriton verrucosus* is reported to occur in Sikkim but its status is still unknown. Further research on this species may yield information on its range. The present study showed the occurrence of Indo-Malayan species like *Elaphe porphyracea, Takydromus sexlineatus* and *Trimeresurus* sp that is yet to be confirmed. Detailed study of these species may throw more light on biodiversity and biogeography. The study was conducted for very short period. Hence long-term study is essential for any concrete conclusion to draw.

Out of 689 species of butterflies 116 species are protected under different schedules of wildlife Protection Act (1972); 29 (schedule I), 92 (schedule II) and eight (schedule IV). Most of these butterflies are recorded from zones I and II which attract research and conservation plans.

The data generated from this study indicate high species diversity in low altitude agro forestry landscape. This may be due to the mixing up of two climatic zones (the tropical and temperate). Inspite of all these facts most of the low altitude forests are fragmented and degraded mostly because of unplanned land use pattern and resource utilization. Further, altitude upto 2000m is marginally under Protected Area network. This finding, therefore, invites an immediate concern for the conservation of low altitude vegetation for the preservation of rich faunal diversity.

In all, 798 vertebrates and 689 species of butterflies have been reported from Sikkim including 169 mammals, 541 birds, 61 reptiles and 20 amphibians. During our present sampling for obout one year, 375 species of vertebrates and 223 species of butterflies were observed. This records form 40.4% of the total species present in the state. The sampling area of the presnt study is restricted within two kilometers (on either side) from the vicinity of the Teesta River covering about 600 sq km, which is about 8.5% of the total area of Sikkim (7096 sq km). The record of over 40% species within this small area within one year of field sampling indicates that Teesta Valley is rich in terms of biodiversity. It is expected that further intensive and long-term sampling would result in more species. Hence, Teesta Valley is vital for the conservation of biodiversity in Sikkim.

This short-term study also suggests the need for a detailed study on fauna and their association with particular reference to habitat to implement conservation measures in different landscapes. The present data give the baseline information on all the habitats and forest types mentioned above for immediate research and conservation attention. Therefore a long-term study taking all these shortcomings into consideration is needed for specific conclusions and recommendations.

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APPENDIX I

Checklist of wild mammals (169 species) in Sikkim from secondary and primary source

(1 – present)

Source of secondary data: Avasthe & Jha (1999), Nameer (2000) and Mandal (2003)

Order	Family	Common name	Scientific name	Sighted species	Indirect evidence
Artio-dactyla	Bovidae	Yak	*Bos grunniens*	1	
		Takin	*Budorcas taxicolor**		
		Himalayan Tahr	*Hemitragus jemlahicus*		
		Goral	*Naemorhedus goral*		1
		Serow	*Naemorhedus sumatraensis*		1
		Blue sheep – Bharal	*Pseudois nayaur*	1	
		Nayan, argali	*Ovis ammon*		
		Tibetan gazelle	*Procapra picticauda*		
	Cervidae	Barking Deer	*Muntiacus muntjak*	1	
	Moschidae	Musk deer	*Moschus chrysogaster*		
		Musk deer	*Moschus fuscus*		
	Suidae	Indian wild boar	*Sus scrofa*		1
	Tragulidae	Mouse deer	*Moschiola meminna*		
Carnivora	Ailuro-podidae	Red Panda	*Ailurus fulgens*		1
	Canidae	Jackal	*Canis aureus*	1	
		Wolf (Tibetian wolf)	*Canis lupus*		
		Dhole	*Cuon alpinus*		
		Tibetian fox	*Vulpes montanus*	1	
	Felidae	Leopard	*Panthera pardus*		
		Snow leopard	*Panthera uncia*		
		Clouded leopard	*Neofelis nebulosa*		
		Leopard cat	*Prionailurus bengalensis*		1
		Marbled cat	*Felis marmorata*		1
		Fishing cat	*Felis viverrina*		
		Jungle cat	*Felis chaus*		1
		Golden cat	*Felis temminckii*		

Order	Family	Common name	Scientific name	Sighted species	Indirect evidence
		Pallas cat	*Otocolobus manul**		
	Herpesti-dae	Common mongoose	*Herpestes edwardsii*		
		Crab-eating mongoose	*Herpestes urva*		
	Mustelidae	Clawless otter	*Aonyx cinerea*		
		Hog badger	*Arctonyx collaris*		
		Common otter	*Lutra lutra*		
Carnivora	Mustelidae	Himalayan yellow-throated marten	*Martes flavigula*	1	
		Beech marten	*Martes foina*	1	
		Himalayan stoat	*Mustela erminea*	1	
		Burmese ferret badger	*Melogale personata*		
		Yellow-bellied weasel	*Mustela kathiah*		
		Himalayan weasel	*Mustela sibirica*		
		Striped-backed weasel	*Mustela strigidorsa*		
	Ursidae	Himalayan black bear	*Ursus thibetanus*		1
		Sloth bear	*Melursus ursinus**		
		Brown bear	*Ursus arctos*		
	Viverridae	Binturong	*Arctictis binturong*		
		Small-toothed palm civet	*Arctogalidia trivirgata**		
		Himalayan palm civet	*Paguma larvata*	1	
		Spotted linsang	*Prionodon pardicolor*		
		Small Indian civet	*Viverricula indica*	1	
		Large Indian civet	*Viverra zibetha*		1
Chirop-tera	Emballo-	Naked-rumped	*Taphozous nudiventris*		

Order	Family	Common name	Scientific name	Sighted species	Indirect evidence
	nuridae	tomb bat			
	Hipposide-ridae	Great Himalayan leaf-nosed bat	*Hipposideros armiger*		
		Fulvous leaf-nosed bat	*Hipposideros fulvus*		
		Andersen's Leaf-nosed bat	*Hipposideros pomona*		
	Megader-matidae	Indian false vampire bat	*Megaderma lyra*		
		Asian false vampire bat	*Megaderma spasma**		
	Molossi-dae	European free-tailed bat	*Tadarida teniotis*		
		Wrinkled-lipped bat	*Tadarida plicata**		
		European free-tailed bat	*Tadarida teniotis*		
	Pteropo-didae	Short-nosed fruit bat	*Cynopteris sphinx*		
		Dawn bat	*Eonycteris spelaea*		
		Greater long-tongued fruit bat	*Macroglossus sobrinus*		
		Niphan's fruit bat	*Megaerops niphanae*		
		Indian flying fox	*Pteropus giganteus*		
		Fulvous fruit bat	*Rousettus leschenaulti*		
		Mountain fruit bat	*Sphaerias blanfordi*		
		Great Eastern horse-shoe bat	*Rhinolophus luctus*		
	Rhinolo-phidae	Greater horseshoe bat	*Rhinolophus ferrumequinum*		
		Horsfield's horseshoe ba	*Rhinolophus pearsoni*		
		Rufous horseshoe bat	*Rhinolophus rouxii*		

Order	Family	Common name	Scientific name	Sighted species	Indirect evidence
		Trefoil horse-shoe bat	*Rhinolophus trifoliatus*		
		Least horse-shoe bat	*Rhinolophus pusillus*		
Chirop-tera	Rhinolo-phidae	Little Indian horse-shoe bat	*Rhinolophus lepidus*		
	Vesperti-lionidae	Eastern barbestelle bat	*Barbastell'a leucomelas*		
		Northern serotine bat	*Eptesicus nilssoni**		
		Silky serotine bat	*Eptesicus serotinus*		
		Sombre bat	*Eptesicus tatei*		
		Hairy winged bat	*Harpiocephalus harpia lasyurus*		
		White bellied tube nosed bat	*Murina leucogaster*		
		Round eared tubenosed bat	*Murina cyclotis*		
		Peter's tube nosed bat	*Murina huttoni*		
		Scully's tube nosed bat	*Murina tubinaris*		
		Little tube nosed bat	*Murina aurata*		
		Painted bat	*Kerivoula picta*		
		Hardwicke's bat	*Kerivoula hardwickei*		
		Nepalese whiskered bat	*Myotis muricola*		
		Nepal bat	*Myotis mystacinus*		
		Hodgson's bat	*Myotis formosus*		
		Mandelli's mouse eared bat	*Myotis sicarius*		
		Small-toothed whiskered	*Myotis siligorensis*		
		Himalayan	*Nyctalus montanus**		

Order	Family	Common name	Scientific name	Sighted species	Indirect evidence
		noctule			
		Common noctule	*Nyctalus noctula*		
		Babu pipistrelle	*Pipistrellus babu*		
		Indian pipistrelle	*Pipistrellus coromandra*		
		Himalayan pipistrelle	*Pipistrellus javanicus**		
		Pegu pipistrelle	*Pipistrellus pegu:ensis*		
		Brown longeared bat	*Plecotus auritus*		
		Harlequin bat	*Scotomanes emarginatus*		
		Bamboo bat	*Tyloylonycteris pachypus*		
		Asian/Eastern barbestell	*Barbastella leucomela*		
Insect-ivora	Soricidae	Himalayan Water Shrew	*Chimmarogale himalayica*		
		Szechuan Water Shrew	*Nectogale elegans*		
		Asiatic shrew	*Soriculus caudatus*	1	
		Indian long-tailed shrew	*Soriculus leucops*		
		Small long-tailed shrew	*Soriculus macrurus*		
		Sikkim large-clawed shrew	*Soriculus nigrescens*	1	
		Tibetian shrew	*Sorex thibethanus*	1	
		House shrew/Musk shrew	*Suncus murinus*	1	
		South asian white toothed shrew	*Crocidura fulginosa*	1	
	Talpidae	Blyth's mole	*Talpa leucura**		
		Eastern mole	*Talpa micrura*		
	Tupaiidae	Tree shrew	*Tupaia belangeri*	1	
Lago- morpha	Leporidae	Woolly hare	*Lepus oiostolus*	1	

Order	Family	Common name	Scientific name	Sighted species	Indirect evidence
		Blacknaped hare	*Lepus nigricolla*		
	Ochoto-nidae	Black-lipped pika	*Ochotona curzoniae*		
		Forrester's pika	*Ochotona forresti*	1	
		Large eared pika	*Ochotona macrotis*		
		Mountain pika	*Ochotona tibethana*		
		Nubra pika	*Ochotona nubrica*		
		Himalayan pika	*Ochotona royeli*		
Perisso-dactyla	Equidae	Kiang	*Equus kiang*		
Pholidota	Manidae	Chinese pangolin	*Manis pentadactyla*		
Primates	Cercopi-thecidae	Assamese macaque	*Macaca assamensis*	1	
		Rhesus macaque	*Macaca mulatta*		
		Common langur	*Semnopithecus schistaceus*	1	
	Lorisidae	Slow loris	*Nycticebus benghalensis**		
Rodentia	Hystri-cidae	Himalayan crestless porc	*Hystrix brachyura/hodgsoni*		1
		Indian porcupine	*Hystrix indica**		
	Muridae	Stocliczka's Mountain Vole	*Alticola stoliczka*		
		Thomas's Mountain Vole	*Alticola stracheyi*		
		Miller's wood mouse	*Apodemus rusiges**		
		Wood mouse	*Apodemus sylvaticus**		
		Wroughton's wood mouse	*Apodemus wardi**		
		Indian mole rat	*Bandicota bengalensis*	1	
		Bandicoot rat	*Bandicota indica*		
		Bay bamboo rat	*Cannomys badius*		
		Large-toothed giant rat/	*Dacnomys millardi*		
		Edward's giant	*Leopolda edwardsii*		

Order	Family	Common name	Scientific name	Sighted species	Indirect evidence
		rat			
		Sikkim Vole	*Microtus sikkimensis*		
		Indian field mouse	*Mus booduga**		
		Fawn-coloured mouse	*Mus cervicolor*	1	
		House mouse	*Mus musculus*	1	
		Sikkim mouse	*Mus pahari*	1	
		Short-tailed bandicoot rat	*Nesokia indica**		
		Smoke bellied rat	*Niviventer eha*	1	
	Muridae	Chestnut rat	*Niviventer fulvescens*	1	
		Langbian rat	*Niviventer langbianis**		
		White-bellied rat	*Niviventer niviventer*	1	
		Himalayan rat	*Rattus nitidus*	1	
		Brown rat	*Rattus norvegicus*		
		Common house rat	*Rattus rattus*	1	
		Sikkim rat	*Rattus sikkimensis*	1	
		Turkestan rat	*Rattus turkestanicus*		
		Long-tailed tree mouse	*Vandeleuria oleracea*		
		Chinese Birch Mouse	*Sicista concolor**		
	Ptero-myidae	Kashmir woolly flying squirrel	*Eupetaurus cinereus*		
		Particoloured flying squrrel	*Hylopetes alboniger*		
		Grey-headed flying squirrel	*Petaurista elegans*		
		Hodgson's flying squirrel	*Petaurista magnificus*	1	
		Noble giant flying squirrel	*Petaurista nobilis*		
		Giant red flying	*Petaurista petaurista*		

Order	Family	Common name	Scientific name	Sighted species	Indirect evidence
		squirrel			
		Hairy-footed flying squirrel	*Belomys pearsonii*		
	Sciuridae	Himalyan marmot	*Marmota himalayana*	1	
		Eastern red marmot	*Marmota hemachalanus*		
		Malayan Giant squirrel	*Ratufa bicolor*		
		Red-bellied tree squirrel	*Callosciurus erythraceus*		
		Hoary-bellied Himalayan squirrel	*Callosciurus pygerythrus*	1	
		Orange-bellied Himalayan squirrel	*Dremomys lokriah*	1	
		Pernyi's ground squirrel	*Dremomys pernyi**		
		Red-cheeked squirrel	*Dremomys rufigenis**		
		Five-striped palm squirrel	*Funambulus pennanti**		
		Himalayan striped squirrel	*Tamiops mcclellandii*	1	

APPENDIX II

Checklist of birds of Sikkim and their altitudinal distribution

(1= present, Blank= absent, - = no data, WPA= Wildlife Protection Act, 1972)

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
Phalacrocoracidae	Indian cormorant	*Phalacrocorax fuscicollis*	1					IV
	Great cormorant*	*Phalacrocorax carbo*	1					IV
	Black necked grebe	*Podiceps nigricollis*						IV
	Little grebe	*Podiceps ruficollis*						IV
Aredeidae	Goliath heron	*Ardea goliath*						IV
	Cattle egret	*Bubulcus ibis*						IV
	Little heron	*Butorides striatus*						IV
	Chinese Pond Heron*	*Ardeola bacchus*						IV
Anatidae	Common Merganser	*Mergus merganser*	-	-	-	-	-	IV
	Tufted duck	*Aythya fuligula*	-	-	-	-	-	IV
	Northern pintail	*Anas acuta*						IV
	Common teal	*Anas crecca*						IV
	Eurasian wigeon	*Anas Penelope*						IV
	Gadwall	*Anas strepera*						IV
	Mallard	*Anas platyrhynchos*			1			IV
	Baer's pochard	*Aythya baeri*			1			IV
	Common pochard*	*Aythya ferina*						IV
	Ruddy shelduck	*Tadorna ferruginea*						IV
	Bar headed Goose	*Anser indicus*						IV
Accipitridae	Black kite	*Milvus migrans govinda*				1		IV
	Black kite	*Milvus migrans lineatus*					1	IV
	Black shouldered kite	*Elanus caeruelus*						IV
	Northen Goshawk	*Accipiter gentilis*				1		I
	Bersa*	*Accipiter virgatus affinis*		1	1			I
	Eurasian Sparrowhawk	*Accipiter nisus melaschistos*		1	1			I
	Crested Goshawk*	*Accipiter trivirgatus indicus*	1	1				I

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Long-legged Buzzard	*Buteo rufinus*		1				IV
	Common Buzzard	*Buteo buteo*	1	1	1			IV
	Mountain Hawk Eagle	*Spizaetus nipalensis nipalensis*	1	1	1			IV
	Bonelli's eagle	*Hieraaetus fasciatus*	1	1	1			IV
	Booted Eagle	*Hieraaetus pennatus*	1	1	1			IV
	Rufous bellied eagle	*Hieraaetus kienerii*						IV
	Black Eagle	*Ictinaetus malayensis*	1	1	1			IV
	Palla's Fish Eagle	*Haliaeetus leucoryphus*	1	1	1	1		IV
	Red-headed vulture	*Sarcogyps calvus*	1	1	1			IV
	Himalayan Griffon	*Gyps himalayensis*	1	1	1	1	1	IV
	Eurasian Griffon	*Gyps fulvus*						IV
	Long billed vulture	*Gyps indicus*						IV
	White rumped vulture	*Gyps bengalensis*						IV
	Jerdon's Baza	*Aviceda jerdoni*						I
	Black Baza	*Aviceda leuphotes*						I
	Oriental honeybazzard	*Pernis ptilorhyncus*						IV
	Osprey	*Pandion haliaetus*						IV
	Cinereous vulture	*Aegypius monachus*						IV
	Lammergeir	*Gypaetus barbatus*		1	1	1	1	I
	Hen Harrier	*Circus cyaneus*	1	1	1	1	1	IV
	Crested Serpent Eagle	*Spilornis cheela cheela*	1	1	1			IV
Falconidae	Collared Falconet	*Microhierax caerulescens*	1	1	1			IV
	Peregrine Falcon	*Falco peregrinus peregrinator*		1	1			I
	Common Kestrel	*Falco tinnunculus*		1	1	1	1	IV
	Amur Falcon	*Falco amurensis*						IV
	Eurasian hobby	*Falco subbuteo*						IV
	Oriental hobby	*Falco severus*						IV
Turnicidae	Small button Quail	*Turnix sylvatica*						IV
	Yellow legged button Quail	*Turnix tanki*						IV
	Barred button Quail	*Turnix suscitator*						IV

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
Rallidae	Ruddy breasted crake	*Porzana fusca*						IV
	Common Moorhen	*Gallinula chloropus*						IV
	Purple swamphen	*Porphyrio porphyrio*						IV
	Common coot	*Fulica atra*		1				IV
	Black necked crane	*Grus nigricollis*					1	I
Phasianidae	Snow partridge	*Lerwa lerwa*				1	1	IV
	Tibetan Snowcock	*Tetraogallus tibetanus*					1	IV
	Hill Partridge*	*Arborophila torqueola*			1	1		IV
	Himalayan snowcock	*Tetraogallus himalayensis*			1			IV
	Indian Pea-fowl	*Pavo cristatus*		1				IV
	Rufous Throated Partridge	*Arborophila rufogularis*		1	1			IV
	Chestnut breasted Hill partridge	*Arborophila mandellii*	1	1	1			IV
	Blood Pheasant*	*Ithaginis cruentus*				1	1	I
	Satyr Tragopan	*Tragopan satyra*			1	1	1	IV
	Himalayan Monal*	*Lophophorus impejanus**					1	I
	Kaleej Pheasant*	*Lophura leucomelanos melanota*	1	1	1	1		IV
	Red junglefowl*	*Gallus gallus*	1	1	1			IV
Charadriidae	River lapwing*	*Vanellus duvaucelii*	1					IV
	White tailed lapwing	*Vanellus leucurus*						IV
	Red wattled lapwing	*Vanellus indicus*						IV
	Lesser Sand Plover	*Charadrius mongolus*	-	-	-	-	-	IV
	Little ring plover	*Charadrius dubius*						IV
	European golden plover	*Pluvialis apricaria*						IV
	Woodsnipe	*Gallinago nemoricola*						IV
	Pintail snipe	*Gallinago stenura*						IV
Pteroclididae	Tibetan sandgrouse	*Syrrhaptes tibetanus*						IV
Scolopacidae	Common Redshank	*Tringa totanus*					1	IV
	Green Sandpiper	*Tringa ochropus*	1	1	1	1	1	IV
	Common Sandpiper*	*Actitis hypoleucos*	1					IV

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Solitary Snipe	*Gallinago solitaria*				1	1	IV
	Eurasian Woodcock	*Scolopax rusticola*		1	1	1		IV
	Temminck's Stint	*Calidris temminckii*					1	IV
Recurvirostridae	Ibisbill*	*Ibidorhyncha struthersii*				1	1	IV
Columbidae	Pintailed Green pigeon*	*Treron apicauda*	1	1	1			IV
	Wedgetailed Green Pigeon*	*Treron sphenura*	1	1	1			IV
	Snow Pigeon*	*Columba leconota*			1	1	1	IV
	Hill Pigeon	*Columba rupestris*					1	IV
	Speckled Wood Pigeon*	*Columba hodgsonii*		1	1	1	1	IV
	Ashy Wood pigeon*	*Columba pulchricollis*		1	1	1		IV
	Barred Cuckoo dove*	*Macropygia unchall*	1	1	1	1		IV
	Spotted dove*	*Streptopelia chinensis suratensis*	1	1				IV
	Emerald dove*	*Chalcophaps indica*	1	1	1			IV
	Oriental Turtle-dove*	*Streptopelia orientalis*	1	1	1	1	1	IV
Psittacidae	Redbreasted Parakeet	*Psittacula alexandri*	1	1	1			IV
	Slatyheaded Parakareet	*Psittacula himalayana*		1				IV
	Alexandrine parakeet	*Psittacula eupatria*						IV
	Plum headed parakeet	*Psittacula cynocephala*						IV
	Vernal hanging parot	*Loriculus vernalis*						IV
Cuculidae	Large hawk-cuckoo	*Hierococcyx sparverioides*		1	1			IV
	Hodgson's hawk-cuckoo*	*Hierococcyx fugax*	1	1	1			IV
	Common hawk cuckoo*	*Hierococcyx varius*						IV
	Indian Cuckoo	*Cuculus micropterus*	1	1	1			IV
	Eurasian Cuckoo*	*Cuculus canorus*	1					IV
	Oriental Cuckoo*	*Cuculus saturatus*		1	1	1		IV
	Lesser Cuckoo*	*Cuculus Poliocephalus*		1	1			IV
	Plaintive Cuckoo*	*Cacomantis merulinus*	1	1	1			IV

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Asian Emerald Cuckoo	*Chrysococcyx maculatus*		1				IV
	Drongo-Cuckoo	*Surniculus lugubris*		1	1			IV
	Chestnut winged cuckoo	*Clamator coromandus*	1					IV
	Pied cuckoo	*Clamator jacobinus*						IV
	Greater Coucal	*Centropus sinensis*						IV
	Lesser coucal	*Centropus bengalensis*						IV
	Sirkeer malkoha	*Phaenicophaeus leschenaultii*						IV
	Green-billed Malkoha*	*Phaenicophaeus tristis*	1	1	1			IV
Tytonidae	Oriental Bay Owl	*Phodilus badius*	1					IV
Strigidae	Collared scops owl	*Otus bakkamoena lettia*	1	1	1			IV
	Mountain scops owl	*Otus spilocephalus*		1	1			IV
	Eurasian scops owl	*Otus scops*						IV
	Spot-bellied eagle owl	*Bubo nipalensis*	1	1	1			IV
	Eurasian eagle owl	*Bubo bubo tibetanus*						IV
	Tawny Fish owl	*Ketupa flavipes*	1	1	1			IV
	Brown fish owl*	*Ketupa zeylonensis*						IV
	Collared owlet	*Glaucidium brodiei*	1	1	1			IV
	Asian Barred owlet*	*Glaucidium cuculoides cuculoides*	1	1	1			IV
	Brown Wood Owl	*Strix leptogrammica newarensis*	1	1	1	1	1	IV
	Tawny owl	*Strix aluco nivicola*			1	1	1	IV
	Short-eared Owl	*Asio flammeus*	1	1	1			IV
	Brown hawk owl	*Ninox scutulata*						IV
	Little owl	*Athene noctua*						IV
Podargidae	Hodgson's Frogmouth	*Batrachostomus hodgsoni*		1				I
Caprimulagidae	Grey Nightjar	*Caprimulgus indicus*		1	1	1		IV
	Large-tailed Nightjar	*Caprimulgus macrurus*	1	1				IV
Apodidae	Himalayan Swiftlet*	*Collocalia brevirostris*		1	1			
	White-rumped Needle	*Zoonavena sylvatica*	1	1				

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	tail*							
	White-throated Needle tail	*Hirundapus caudacutus*				1	1	
	Fork-tailed Swift	*Apus pacificus*		1	1			
	House Swift	*Apus affinis*		1	1			
	Alpine swift	*Tachymarptis melba*						
Trogonidae	Red-headed Trogon*	*Harpactes erythrocephalus*	1	1	1			IV
Alcedinidae	Crested Kingfisher*	*Megaceryle lugubris*		1				IV
	Blyth's Kingfisher	*Alcedo hercules*	1					IV
	Common kingfisher*	*Alcedo atthis*	1					IV
	Blue-eared Kingfisher	*Alcedo meninting*	1					IV
	Oriental Dwarf Kingfisher	*Ceyx erithacus erithacus*	1					IV
	Stork-billed Kingfisher	*Halcyon capensis*	1					IV
	Ruddy Kinfisher	*Halcyon coromanda*	1					IV
	White throated Kingfisher*	*Halcyon smyrensis*	1					IV
Meropidae	Blue-beared bee-eater	*Nyctyornis athertoni*	1	1				
	Green bee-eater	*Merops orientalis*						
	Chestnut headed bee-eater	*Merops leschenaultii*						
Coraciidae	Dollarbird*	*Eurystomus orientalis*	1					
	Indian roller	*Coracias benghalensis*						IV
Upupidae	Common Hoopoe*	*Upupa epops*		1	1	1	1	
Bucerotidae	Rufous-necked Hornbill	*Aceros nipalensis*	1					IV
	Great Hornbill	*Buceros bicornis*	1	1				IV
	Oriental pied Hornbill*	*Anthracoceros albirostris*						IV
Capitonidae	Great Barbet*	*Megalaima virens*	1	1	1			IV
	Golden -throated Barbet*	*Megalaima franklinii*		1	1			IV
	Blue-throated Barbet*	*Megalaima asiatica*	1	1	1			IV
	Lineated Barbet	*Megalaima lineata*						IV

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Blue-eared Barbet	*Megalaima australis*						IV
Indicatoridae	Yellow-rumped Honeyguide	*Indicator xanthonotus*	-	-	-	-	-	
Picidae	Eurasian Wryneck	*Jynx torquilla*						IV
	Speckled Piculet	*Picumnus innominatus*	1	1	1			IV
	White-browed Piculet	*Sasia ochracea*	1	1	1			IV
	Rufous Woodpecker*	*Celeus brachyurus*	1	1	1			IV
	Grey-headed Woodpecker	*Picus canus*	1	1	1			IV
	Greater Yellownape*	*Picus flavinucha*	1	1	1			IV
	Lesser Yellownape *	*Picus chlorolophus chlorolophus*	1	1	1			IV
	Himalayan Flameback*	*Dinopium shorii*	1					IV
	Pale-headed Woodpecker*	*Gecinulus grantia*	1	1				IV
	Great Slaty Woodpecker	*Mulleripicus pulverulentus*	1					IV
	Rufous-bellied Woodpecker*	*Dendrocopos hyperythrus*			1	1	1	IV
	Crimson-breasted Woodpecker	*Dendrocopos cathpharius*			1	1		IV
	Fulvous-breasted Woodpecker	*Dendrocopos macei*	1	1				IV
	Darjeeling Woodpecker	*Dendrocopos darjellensis*			1	1		IV
	Grey-capped Pygmy Woodpecker	*Dendrocopos canicapillus*		1	1			IV
	Bay Woodpecker*	*Blythipicus pyrrhotis*	1	1	1			IV
	Greater Flameback*	*Chrysocolaptes lucidus*	1	1				IV
	White-naped Woodpecker*	*Chrysocolaptes festivus*						IV
Eurylaimidae	Silver-breasted Broadbill	*Serilophus lunatus*	1	1				
	Long-tailed Broadbill*	*Psarisomus dalhousiae*	1	1	1			
Pittidae	Blue-naped Pitta	*Pitta nipalensis*	1	1	1			IV

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Indian Pitta	*Pitta brachyura*						IV
	Hooded Pitta	*Pitta sordida*						IV
Alaudidae	Hume's Short-toed Lark*	*Calandrella acutirostris*					1	IV
	Greater Short-toed Lark*	*Calandrella brachydactyla*					1	IV
	Eurasian Skylark	*Alauda arvensis*		1				IV
	Oriental Skylark	*Alauda gulgula*						IV
	Horned Lark*	*Eremophila alpestris elwesi*		1			1	IV
	Tibetan Lark	*Melanocorypha maxima*					1	IV
Hirundinidae	Barn Swallow	*Hirundo rustica*	1	1	1	1		
	Red-rumped Swallow	*Hirundo daurica nipalensis*		1	1			
	Eurasian Crag Martin	*Hirundo rupestris*						
	Plain Martin*	*Riparia paludicola*						
	Northern House Martin*	*Delichon urbica*				1	1	
	Nepal House Martin*	*Delichon nipalensis*	1	1	1			
Campephagidae	Black-winged Cuckooshrike*	*Coracina melaschistos*	1	1	1			
	Large Cuckooshrike	*Coracina macei*						
	Grey-chinned Minivet*	*Pericrocotus solaris*	1	1	1	1		IV
	Long-tailed Minivet*	*Pericrocotus ethologus*	1	1	1	1		IV
	Short-billed Minivet*	*Pericrocotus brevirostris*	1	1				IV
	Scarlet Minivet*	*Pericrocotus flammeus*	1	1	1			IV
	Rosy Minivet	*Pericrocotus roseus*						IV
	Bar-winged Flycatcher-shrike	*Hemipus picatus capitalis*	1	1				
	Large Woodshrike	*Tephrodornis gularis*	1	1				
Irenidae	Golden-fronted Leafbird*	*Chloropsis aurifrons aurifrons*	1	1				IV
	Orange-bellied Leafbird*	*Chloropsis hardwickii*	1	1	1			IV

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Asian Fairy Bluebird	*Irena puella*	1	1				IV
	Common Iora	*Aegithina tiphia*						IV
Pycnonotidae	Striated Bulbul*	*Pycnonotus striatus*		1	1			IV
	Black-crested Bulbul*	*Pycnonotus melanicterus*	1	1				IV
	Himalayan Bulbul*	*Pycnonotus leucogenys*	1	1	1			IV
	Red-vented Bulbul*	*Pycnonotus cafer bengalensis*	1	1	1			IV
	Red-whiskered bulbul	*Pycnonotus jocosus*						IV
	White-throated Bulbul	*Alophoixus flaveolus*	1	1				IV
	Mountain Bulbul	*Hypsipetes mcclellandii*		1	1			IV
	Ashy Bulbul *	*Hemixos flavala*	1	1				IV
	Black Bulbul *	*Hypsipetes leucocephalus*		1	1	1		IV
Muscicapidae	Black-naped Monarch	*Hypothymis azurea*						IV
	Dark-sided Flycatcher	*Muscicapa sibirica*	1	1	1	1	1	IV
	Ferruginous Flycatcher*	*Muscicapa ferruginea*		1	1			IV
	Brown-breasted Flycatcher	*Muscicapa muttui*						IV
	Slaty-backed Flycatcher	*Ficedula hodgsonii*		1	1	1		IV
	Rufous-gorgeted Flycatcher*	*Ficedula strophiata*	1	1	1	1	1	IV
	White-gorgeted Flycatcher	*Ficedula monileger monileger*	1	1	1			IV
	Snowy-browed Flycatcher*	*Ficedula hyperythra*		1	1			IV
	Little Pied Flycatcher	*Ficedula westermanni collini*		1	1			IV
	Ultramarine Flycatcher	*Ficedula superciliaris aestigma*	1	1	1			IV
	Slaty-blue Flycatcher*	*Ficedula tricolor*	1	1	1	1		IV
	Yellow-rumped Flycatcher*	*Ficedula zanthopygia*						IV
	Sapphire Flycatcher*	*Ficedula sapphira*	1	1	1			IV

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Verditer Flycatcher*	*Eumyias thalassina*	1	1	1	1		IV
	Large Niltava *	*Niltava grandis*		1	1			IV
	Small Niltava*	*Niltava macgrigoriae*		1	1			IV
	Rufous-bellied Niltava*	*Niltava sundara*	1	1	1	1		IV
	Pale Blue Flycatcher	*Cyornis unicolor*	1	1	1			IV
	Blue-throated Flycatcher	*Cyornis rubeculoides*	1	1				IV
	Pale-chinned Flycatcher	*Cyornis poliogenys*						IV
	Hill Blue Flycatcher*	*Cyornis banyumas*						IV
	Pygmy Blue Flycatcher	*Muscicapella hodgsonii*	1	1	1	1		IV
	Grey-headed Canary Flycatcher*	*Culicicapa ceylonensis*	1	1	1			IV
	Yellow-bellied Fantail*	*Rhipidura hypoxantha*	1	1	1	1	1	IV
	White-throated Fantail*	*Rhipidura albicollis albicollis*	1	1	1	1		IV
	Puff-throated Babbler *	*Pellorneum ruficeps mandellii*	1	1	1	1		IV
	Rusty-cheeked Scimitar Babbler	*Pomatorhinus erythrogenys*	1	1	1			IV
	White-browed Scimitar Babbler	*Pomatorhinus schisticeps*	1	1	1			IV
	Streak-breasted Scimitar Babbler *	*Pomatorhinus ruficollis*	1	1	1	1		IV
	Coral-billed Scimitar Babbler	*Pomatorhinus ferruginosus*		1	1	1	1	IV
	Slender-billed Scimitar Babbler *	*Xiphirhynchus superciliaris*		1	1			IV
	Scaly-breasted Wren Babbler*	*Pnoepyga albiventer albiventer*		1	1	1		IV
	Pygmy Wren Babbler	*Pnoepyga pusilla*	1	1	1			IV
	Rufuous-throated Wren Babbler	*Spelaeornis caudatus*				1		IV
	Spotted Wren Babbler	*Spelaeornis formosus*			1			IV
	Wedge-billed Wren	*Sphenocichla humei*	-	-	-	-	-	IV

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Babbler	*humei*						
	Long-billed Wren Babbler	*Rimator malacoptilus*		1				IV
	Rufous-capped Babbler	*Stachyris ruficeps*	1	1	1			IV
	Rufous-fronted Babbler	*Stachyris rufifrons*	1	1				IV
	Golden Babbler*	*Stachyris chrysaea chrysaea*	1	1	1			IV
	Grey-throated Babbler	*Stachyris nigriceps*	1	1	1			IV
	Striped Tit Babbler	*Macronous gularis*	1					IV
	Chestnut-capped Babbler	*Timalina pileata*	1	1				IV
	Abbott's Babbler	*Malacocincla abbotti*						IV
	Jungle Babbler	*Turdoides striatus*						IV
	White-throated Laughingthrush*	*Garrulax albogularis*			1	1		IV
	White-crested Laughingthrush *	*Garrulax leucolophus*	1	1	1			IV
	Lesser Necklaced Laughingthrush	*Garrulax monileger*	1	1				IV
	Greater Necklaced Laughingthrush *	*Garrulax pectoralis*	1	1	1			IV
	Striated Laughingthrush *	*Garrulax striatus*	1	1	1			IV
	Rufous-necked Laughingthrush	*Garrulax ruficollis*	1	1	1			IV
	Rufous-chinned Laughingthrush	*Garrulax rufogularis rufogularis*	1	1	1	1	1	IV
	Spotted Laughingthrush *	*Garrulax ocellatus*				1	1	IV
	Grey-sided Laughingthrush	*Garrulax caerulatus*		1	1			IV
	Streaked Laughingthrush	*Garrulax lineatus*		1				IV

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Blue-winged Laughingthrush	*Garrulax squamatus*		1	1	1	1	IV
	Scaly Laughingthrush	*Garrulax subunicolor*		1	1	1	1	IV
	Black-faced Laughingthrush *	*Garrulax affinis*			1	1	1	IV
	Chestnut-crowned Laughingthrush*	*Garrulax erythrocephalus*		1	1	1	1	IV
	Variegated Laughingthrush	*Garrulax variegatus*						IV
	Red-faced Liocichla	*Liocichla phoenicea*	1	1	1			IV
	Silver-eared Mesia*	*Leiothrix argentauris*	1	1	1			IV
	Red-billed Leiothrix *	*Leiothrix lutea*		1	1			IV
	Fire-tailed Myzornis*	*Myzornis pyrrhoura*			1	1	1	
	Cutia*	*Cutia nipalensis*		1	1			
	Black-headed Shrike Babbler	*Pteruthius rufiventer*			1			IV
	White-browed Shrike Babbler *	*Pteruthius flaviscapis*	1	1	1	1		IV
	Green Shrike Babbler	*Pteruthius xanthochlorus*			1	1		IV
	Black-eared Shrike Babbler	*Pteruthius melanotis*	1	1	1	1		IV
	White-hooded Babbler	*Gampsorhynchus rufulus*	1					IV
	Hoary-throated Barwing*	*Actinodura nipalensis*			1	1		IV
	Rusty-fronted Barwing	*Actinodura egertoni egertoni*		1	1			IV
	Red-tailed Minla *	*Minla ignotincta*	1	1	1	1		
	Chestnut-tailed Minla*	*Minla strigula*	1	1	1	1	1	
	Blue-winged Minla*	*Minla cyanouroptera*	1	1	1			
	Striated Yuhina *	*Yuhina castaniceps rufigenis*	1	1				
	White-naped Yuhina *	*Yuhina bakeri*	1	1	1			
	Whiskered Yuhina*	*Yuhina flavicollis flavicollis*	1	1	1	1		

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Stripe-throated Yuhina *	*Yuhina gularis*			1	1	1	
	Rufous-vented Yuhina*	*Yuhina occipitalis*			1	1	1	
	Black-chinned Yuhina *	*Yuhina nigrimenta*	1	1				
	White-bellied Yuhina	*Yuhina zantholeuca*	1	1	1			
	Golden-breasted Fulvetta*	*Alcippe chrysotis chrysotis*			1	1		
	Yellow-throated Fulvetta	*Alcippe cinerea*		1	1			
	Rufous-winged Fulvetta	*Alcippe castaneceps*		1	1	1		
	White-browed Fulvetta*	*Alcippe vinipectus*			1	1	1	
	Nepal Fulvetta*	*Alcippe nipalensis*	1	1	1			
	Rufous-backed Sibia	*Heterophasia annectans*	1	1	1			
	Rufous Sibia *	*Heterophasia capistrata*	1	1	1	1		
	Long-tailed Sibia	*Heterophasia picaoides*	1	1				
	Great Parrotbill *	*Conostoma oemodium*			1	1	1	
	Brown Parrotbill *	*Paradoxornis unicolor*			1	1		
	Grey-headed Parrotbill	*Paradoxornis gularis*		1	1			
	Black-breasted Parrotbill	*Paradoxornis flavirostris*			1			
	Fulvous Parrotbill	*Paradoxornis fulvifrons*				1	1	
	Black-throated Parrotbill *	*Paradoxornis nipalensis humii*		1	1	1		
	Lesser Rufous-headed Parrotbill	*Paradoxornis atrosuperciliaris*			1			
	Greater Rufous-headed Parrotbill	*Paradoxornis ruficeps ruficeps*	1	1				
	Chestnut-headed Tesia*	*Tesia castaneocoronata*				1	1	
	Grey-bellied Tesia *	*Tesia cyaniventer*	1					
	Slaty-bellied Tesia	*Tesia olivea*						
	Pale-footed Bush Warbler	*Cettia pallidipes pallidipes*		1				

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Brownish-flanked Bush Warbler	*Cettia fortipes fortipes*		1	1			
	Chestnut-crowned Bush Warbler	*Cettia major*				1		
	Aberrant Bush Warbler*	*Cettia flavolivacea*		1	1	1		
	Yellowish-bellied Bush Warbler*	*Cettia acanthizoides*				1		
	Grey-sided Bush Warbler	*Cettia brunnifrons*		1	1	1	1	
	Spotted Bush Warbler	*Bradypterus thoracicus*		1	1	1		
	Brown Bush Warbler	*Bradypterus luteoventris*			1			
	Dusky Warbler	*Phylloscopus fuscatus*	1					
	Smoky Warbler *	*Phylloscopus fuligiventer*					1	
	Tickell's Leaf Warbler *	*Phylloscopus affinis*			1	1		
	Buff-barred Warbler *	*Phylloscopus pulcher*		1	1	1	1	
	Ashy-throated Warbler	*Phylloscopus maculipennis*	1	1	1	1		
	Yellow-browed Warbler	*Phylloscopus inornatus*		1				
	Greenish Warbler *	*Phylloscopus trochiloides*		1	1	1	1	
	Large-billed Leaf Warbler	*Phylloscopus magnirostris*			1	1	1	
	Western Crowned Warbler	*Phylloscopus occipitalis*	1	1	1			
	Blyth's Leaf Warbler*	*Phylloscopus reguloides*	1	1	1			
	Yellow-vented Warbler	*Phylloscopus cantator*	1	1	1			
	Lemon-rumped Warbler *	*Phylloscopus chloronotus*						
	Hume's Warbler	*Phylloscopus humei*						
	Goldcrest	*Regulus regulus*		1	1	1	1	
	White-spectacled Warbler*	*Seicercus affinis*		1	1			

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Golden-spectacled Warbler	*Seicercus burkii*	1	1	1			
	Grey-hooded Warbler*	*Seicercus xanthoschistos xanthoschistos*	1	1	1			
	Grey-cheeked Warbler*	*Seicercus poliogenys*	-	-	-	-	-	
	Chestnut-crowned Warbler*	*Seicercus castaniceps*	1	1	1			
	Yellow-bellied Warbler	*Abroscopus superciliaris*	1	1				
	Black-faced Warbler*	*Abroscopus s. schisticeps*	1	1	1			
	Rufous-faced Warbler	*Abroscopus albogularis*						
	Thick-billed Warbler	*Acrocephalus aedon*						
	Grasshopper Warbler	*Locustella naevia*						
	Broad-billed Warbler*	*Tickellia hodgsoni*		1	1			
	Mountain Tailorbird *	*Orthotomus cuculatus*	-	-	-	-	-	
	Common Tailorbird*	*Orthotomus sutorius*		1	1			
	Rufescent Prinia*	*Prinia rufescens*	1	1				
	Hill Prinia*	*Prinia atrogularis atrogularis*		1	1	1		
	Striated Prinia*	*Prinia criniger*						
	Ashy Prinia	*Prinia socialis*						
	Yellow-bellied Prinia*	*Prinia flaviventris*						
	Indian Blue Robin	*Luscinia brunnea*			1	1		
	White-tailed Rubythroat	*Luscinia pectoralis tschebaiewi*					1	
	Siberian Rubythroat*	*Luscinia calliope*					1	
	Golden Bush Robin *	*Tarsiger chrysaeus*	1	1	1	1	1	
	Orange-flanked Bush Robin *	*Tarsiger cyanurus*		1	1	1	1	
	White-browed Bush Robin *	*Tarsiger indicus*	1	1	1	1	1	
	Rufous-breasted Bush Robin	*Tarsiger hyperythrus*		1	1	1	1	

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	White-tailed Robin	*Myiomela leucura*						
	Blue-fronted Robin	*Cinclidium frontale*			1	1		
	Grandala *	*Grandala coelicolor*				1	1	
	White-bellied Redstart	*Hodgsonius phaenicuroides*		1	1	1		
	Blue-fronted Redstart*	*Phoenicurus frontalis*		1	1	1	1	
	White-throated Redstart	*Phoenicurus schisticeps*		1	1	1	1	
	Hodgson's Redstart	*Phoenicurus hodgsoni*	1	1	1			
	Daurian Redstart	*Phoenicurus auroreus*						
	Black Redstart *	*Phoenicurus ochruros rufiventris*		1	1	1	1	
	White-winged Redstart*	*Phoenicurus erythrogaster*		1	1	1	1	
	Blue-capped Redstart*	*Phoenicurus coeruleocephalus*					1	
	White-capped Water Redstart*	*Chaimarrornis leucocephalus*		1	1	1	1	
	Plumbeous Water Redstart*	*Rhyacornis fuliginosus*	1	1	1	1	1	
	Oriental Magpie Robin *	*Copsychus saularis*	1	1	1			
	White-rumped Shama	*Copsychus malabaricus*						IV
	Eurasian Blackbird	*Turdus merula maximus*					1	IV
	White-collared Blackbird *	*Turdus albocinctus*			1	1	1	IV
	Grey-winged blackbird *	*Turdus boulboul*			1	1		IV
	Chestnut Thrush	*Turdus rubrocanus rubrocanus*			1	1		IV
	Kessler's Thrush	*Turdus kessleri*				1	1	IV
	Dark-throated Thrush	*Turdus ruficollis ruficollis*	-	-	-	-	-	IV
	Eyebrowed Thrush	*Turdus obscurus*						IV
	Dusky Thrush	*Turdus naumanni*						IV
	Tickell's Thrush*	*Turdus unicolor*						IV

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Pied Thrush	*Zoothera wardii*						IV
	Orange-headed Thrush	*Zoothera citrina citrina*		1	1			IV
	Plain-backed Thrush*	*Zoothera mollissima*		1	1	1	1	IV
	Long-tailed Thrush	*Zoothera dixoni*		1	1	1		IV
	Scaly Thrush *	*Zoothera dauma*		1	1	1		IV
	Long-billed Thrush	*Zoothera monticola*	1	1	1	1		IV
	Dark-sided Thrush *	*Zoothera marginata*	1	1	1			IV
	Blue-capped Rock Thrush *	*Monticola cinclorhynchus*		1	1	1		IV
	Chestnut-bellied Rock Thrush*	*Monticola rufiventris*	1	1	1	1		IV
	Blue Rock Thrush	*Monticola solitarius pandoo*	1	1				IV
	Hodgson's Bushchat	*Saxicola insignis*	-	-	-	-	-	
	Common Stonechat*	*Saxicola torquata*		1	1	1		
	Grey Bushchat*	*Saxicola ferrea*		1	1	1		
	Pied Bushchat	*Saxicola caprata*						
	Gould's Shortwing*	*Brachypteryx stellata*				1	1	
	***Rusty-bellied Shortwing** *	*Brachypteryx hyperythra*				1		
	Lesser Shortwing	*Brachypteryx leucophrys*		1	1	1	1	
	White-browed Shortwing*	*Brachypteryx montana*	1	1	1	1		
	Blue Whistling Thrush*	*Myophonus caeruleus*	1	1	1	1	1	
	Purple Cochoa*	*Cochoa purpurea*				1		
	Green Cochoa	*Cochoa viridis*	1	1				
	Little Forktail *	*Enicurus scouleri*	1	1	1	1		
	Black-backed Forktail *	*Enicurus immaculatus*		1				
	Slaty-backed Forktail*	*Enicurus schistaceus*	1	1	1			
	White-crowned Forktail	*Enicurus leschenaulti*	1	1				
	Spotted Forktail *	*Enicurus maculatus*	1	1	1	1		
Troglodytidae	Winter Wren *	*Troglodytes troglodytes*			1	1	1	IV

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
		nipalensis						
Cinclidae	White-throated Dipper *	*Cinclus cinclus*				1	1	
	Brown Dipper*	*Cinclus pallasii*	1	1	1	1		
Prunellidae	Alpine Accentor *	*Prunella collaris*			1	1	1	
	Altai Accentor	*Prunella himalayana*			1	1	1	
	Robin Accentor*	*Prunella rubeculoides*		1	1	1	1	
	Rufous-breasted Accentor *	*Prunella strophiata*		1	1	1	1	
	Maroon-backed Accentor *	*Prunella immaculata*			1	1	1	
	Brown Accentor	*Prunella fulvescens*						
Motacillidae	White Wagtail *	*Motacilla alba alboides*	1	1	1	1	1	
	White-browed Wagtail	*Motacilla maderaspatensis*	1					
	Citrine Wagtail	*Motacilla citreola*				1	1	
	Grey Wagtail *	*Motacilla cinerea*	1	1	1			
	Forest Wagtail	*Dendronanthus indicus*						
	Blyth's Pipit *	*Anthus godlewskii*				1	1	IV
	Olive-backed Pipit *	*Anthus hodgsoni*	1	1	1	1	1	IV
	Rosy Pipit*	*Anthus roseatus*					1	IV
	Water Pipit	*Anthus spinoletta*						IV
	Long-billed Pipit*	*Anthus similis*						IV
	Paddyfield Pipit	*Anthus rufulus*						IV
Laniidae	Brown Shrike	*Lanius cristatus cristatus*	1	1				
	Longed-tailed Shrike*	*Lanius schach tricolor*		1	1			
	Grey-backed Shrike *	*Lanius tephronotus*			1	1	1	
Artamidae	Ashy Woodswallow	*Artamus fuscus*	1	1	1			
Dicruridae	Ashy Drongo*	*Dicrurus leucophaeus hopwoodi*	1	1	1	1		
	Bronzed Drongo *	*Dicrurus aeneus*	1	1	1			IV
	Lesser Racket-tailed Drongo *	*Dicrurus remifer*	1	1				IV

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Spangled Drongo*	*Dicrurus hottentottus*	1	1	1			IV
	Black Drongo*	*Dicrurus macrocercus*						IV
	Crow-billed Drongo*	*Dicrurus annectans*						IV
Oriolidae	Maroon Oriole*	*Oriolus traillii*	1	1	1			IV
	Black-naped Oriole*	*Oriolus chinensis*						IV
	Eurasian Golden Oriole	*Oriolus oriolus*						IV
Corvidae	Eurasian Jay	*Garrulus glandarius*			1	1	1	IV
	Yellow-billed Blue Magpie *	*Urocissa flavirostris flavirostris*		1	1	1		IV
	Red-billed Blue Magpie	*Urocissa erythrorhyncha*	1	1	1			IV
	Common Green Magpie*	*Cissa chinensis*	1	1	1			IV
	Grey Treepie*	*Dendrocitta formosae*	1	1	1			IV
	Collared Treepie	*Dendrocitta frontalis*		1				IV
	Rufous Treepie	*Dendrocitta vagabunda*						IV
	Black-billed Magpie	*Pica pica*				1	1	IV
	Hume's Groundpecker	*Pseudopodoces humilis*					1	IV
	Spotted Nutcracker*	*Nucifraga caryocatactes*				1	1	
	Red-billed Chough*	*Pyrrhocorax pyrrhocorax*				1	1	
	Yellow-billed Chough*	*Pyrrhocorax graculus*					1	
	House Crow*	*Corvus splendens splendens*		1	1	1		V
	Large-billed Crow*	*Corvus macrorhynchos*			1	1	1	
	Common Raven*	*Corvus corax tibetanus*				1	1	
Sturnidae	Spot-winged Starling	*Saroglossa spiloptera*	1	1				IV
	Common Myna *	*Acridotheres tristis tristis*	1	1	1			IV
	Hill Myna *	*Gracula religiosa*	1					IV
Paridae	Rufous-vented Tit *	*Parus rubidiventris beavani*				1	1	IV
	Coal Tit *	*Parus ater*				1	1	IV
	Grey-crested Tit*	*Parus dichrous*				1	1	IV
	Green-backed Tit*	*Parus monticolus*	1	1	1	1		IV
	Black-lored Tit	*Parus xanthogenys*		1	1	1	1	IV

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Yellow-browed Tit	*Sylviparus modestus*		1	1	1		IV
	Sultan Tit *	*Melanochlora sultanea*	1	1	1			IV
Aegithalidae	Black-throated Tit*	*Aegithalos concinnus*		1	1			IV
	Rufous-fronted Tit	*Aegithalos iouschistos*			1	1	1	IV
Remizidae	Fire-capped Tit	*Cephalopyrus flammiceps*	1	1	1	1		IV
Sittidae	Wallcreeper*	*Tichodroma muraria*	1	1	1	1	1	
	Chestnut-bellied Nuthatch *	*Sitta castanea*	1	1	1			
	White-tailed Nuthatch*	*Sitta himalayensis*		1	1	1		
	Velvet-fronted Nuthatch *	*Sitta frontalis*	1	1	1			
	Beautiful Nuthatch	*Sitta formosa*	1	1	1			
	Kashmir Nuthatch*	*Sitta cashmirensis*						
Certhiidae	Eurasian Treecreeper*	*Certhia familiaris mandellii*			1	1	1	
	Rusty-flanked Treecreeper*	*Certhia nipalensis*		1	1	1		
	Brown-throated Treecreeper	*Certhia discolor discolor*		1	1	1	1	
Dicaeidae	Yellow-bellied Flowerpecker	*Dicaeum melanoxanthum*		1	1	1		IV
	Thick-billed Flowerpecker*	*Dicaeum agile*						IV
	Yellow-vented Flowerpecker	*Dicaeum chrysorrheum*						IV
	Scarlet-backed Flowerpecker	*Dicaeum cruentatum*						IV
	Fire-breasted Flowerpecker *	*Dicaeum ignipectus*	1	1	1	1	1	IV
Nectariniidae	Mrs Gould's Sunbird*	*Aethopyga gouldiae gouldiae*		1	1	1		IV
	Green-tailed Sunbird*	*Aethopyga nipalensis*	1	1	1	1	1	IV
	Black-throated Sunbird	*Aethopyga saturata*	1	1	1			IV

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	*							
	Fire-tailed Sunbird*	*Aethopyga ignicauda*	1	1	1	1	1	IV
	Streaked Spiderhunter*	*Arachnothera magna*	1	1				IV
	Little Spiderhunter	*Arachnothera longirostra*						IV
	Purple sunbird	*Nectarinia asiatica*						IV
	Crimson sunbird*	*Aethopyga siparaja*						IV
Zosteropidae	Oriental White-eye*	*Zosterops palpebrosus*			1			IV
Passeridae	House Sparrow *	*Passer domesticus*						
	Russet Sparrow	*Passer rutilans*	1	1	1			
	Eurasian Tree Sparrow	*Passer montanus malaccensis*	1	1	1	1		
	Tibetan Snowfinch	*Montifringilla adamsi*					1	IV
	Rufous-necked Snowfinch	*Pyrgilauda ruficollis*					1	IV
	Plain-backed Snowfinch	*Pyrgilauda blanfordi*					1	IV
	Small Snowfinch	*Pyrgilauda davidiana*					1	IV
Estrildidae	White-rumped Munia*	*Lonchura striata*	1	1	1			IV
	Scaly-bellied Munia	*Lonchura punctulata*			1			IV
Fringillidae	Yellow-breasted Greenfinch *	*Carduelis spinoides spinoides*		1	1	1	1	IV
	Tibetan Siskin *	*Carduelis thibetana*		1	1	1		IV
	Plain Mountain Finch*	*Leucosticte nemoricola*				1	1	IV
	Brandt's Mountain Finch	*Leucosticte brandti*					1	IV
	Blanford's Rosefinch	*Carpodacus rubescens*		1	1	1	1	IV
	Dark-breasted Rosefinch *	*Carpodacus nipalensis*		1	1	1	1	IV
	Common Rosefinch *	*Carpodacus erythrinus roseatus*		1	1	1	1	IV
	Beautiful Rosefinch	*Carpodacus pulcherrimus pulcherrimus*			1	1	1	IV
	Pink-browed Rosefinch *	*Carpodacus rodochrous*				1		IV

Family	Common name (Inskipp et. al., 2001)	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Dark-rumped Rosefinch *	*Carpodacus edwardsii*			1	1	1	IV
	White-browed Rosefinch *	*Carpodacus thura*			1	1	1	IV
	Streaked Rosefinch	*Carpodacus rubicilloides*	-	-	-	-	-	IV
	Great Rosefinch	*Carpodacus rubicilla*	-	-	-	-	-	IV
	Red-fronted Rosefinch	*Carpodacus puniceus*					1	IV
	Crimson-browed Finch	*Propyrrhula subhimachala*				1	1	IV
	Scarlet Finch *	*Haematospiza sipahi*	1	1	1			IV
	Spectacled Finch	*Callacanthis burtoni*						IV
	Twite	*Carduelis flavirostris*						IV
	Red Crossbill	*Loxia curvirostra*		1	1	1		IV
	Brown Bullfinch	*Pyrrhula nipalensis*			1	1	1	IV
	Red-headed Bullfinch*	*Pyrrhula erythrocephala*		1	1	1	1	IV
	Grey-headed Bullfinch	*Pyrrhula erythaca*			1	1	1	IV
	Collared Grosbeak	*Mycerobas affinis*				1	1	IV
	Spot-winged Grosbeak	*Mycerobas melanozanthos*	1	1	1	1	1	IV
	White-winged Grosbeak *	*Mycerobas carnipes*			1	1	1	IV
	Gold-naped Finch	*Pyrrhoplectes epauletta*		1	1	1	1	IV
Emberizinae	Crested Bunting	*Melophus lathami*	1	1	1			IV
	Little Bunting	*Emberiza pusilla*		1	1			IV
	Black-faced Bunting	*Emberiza spodocephala*				1		IV
	Chestnut-eared Bunting	*Emberiza fucata*						IV
	Yellow-breasted Bunting	*Emberiza aureola*						IV
	Chestnut Bunting	*Emberiza rutila*						IV

* Species recorded by the study.

(APPENDIX III)

Checklist of Herpetofauna (156 species) of Sikkim and their altitudinal distribution

(1= Present, Blank= absent, - = no data, WPA= Wildlife Protection Act 1972)

Source: Molur *et al.* (1998a), Jha and Thapa 2002)

Family	Genera	Species	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
		AMPHIBIA						
Ranidae	*Amolops*	*afghanus*		1				*IV*
	Amolops	*formosus-*	1	1	1			*IV*
	Chaparana	*sikkimensis*		1				*IV*
	Limnonectes	*limnocharis*	-	-	-	-	-	*IV*
	Euphlyctis	*cyanophlyctis*	1	1				*IV*
	Rana	*macrodon*		1				*IV*
	Rana	*alticola*	1	1	1	1		*IV*
	Rana	*livida*	1	1	1			*IV*
	Rana	*annandalii*	1	1	1			*IV*
	Paa	*lichigii*	1	1	1	1		*IV*
Rhacophoridae	*Philautus*	*jerdonii*	1					*IV*
	Polypedates	*leucomystax*		1				*IV*
	Rhacophorus	*jerdoni*		1	1			*IV*
	Rhacophorus	*maximus*		1	1	1		*IV*
	Rhacophorus	*reinwardtii*		1				*IV*
Bufonidae	*Bufo*	*himalayana*	1	1	1			*IV*
	Bufo	*melanostictus*	1	1	1	1		*IV*
Megophryidae	*Megophrys*	*parva*	1	1	1			*IV*
	Scutiger	*sikkimensis*		1	1	1	1	*IV*
Salamandridae	*Tylototrioton*	*verrucosus*		1	1			*I*
Ichthyophidae	*Ichtjyophis*	*sikkimensis*		1				*IV*
		REPTILIA						
Testudinidae	*Indotestudo*	*elongata*	?					*IV*
Agamidae	*Calotes*	*jerdoni*		1	1			*IV*

Family	Genera	Species	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Calotes	*versicolor*						*IV*
	Japalura	*tricarinata*	1	1				*IV*
	Japalura	*variegata*	-	-	-	-	-	*IV*
	Draco	*blanfordi*	1					
	Laudakia	*himalayana*					?	*IV*
	Phrynocephalus	*theobaldi*					?	*IV*
Gekkonidae	*Cosymbotes*	*platyurus*	1	1	1			*IV*
	Hemidactylus	*bowringi*	1					*IV*
	Hemidactylus	*garnoti*	1					*IV*
	Hemidactylus	*flaviviridis*	1					*IV*
Scincidae	*Mabuya*	*carinata*	1	1				*IV*
	Sphenomorphus	*indicum*			1			*IV*
	Sphenomorphus	*maculatum*	1	1	1			*IV*
	Leiolopisma	*sikkimense*		1	1	1		*IV*
Anguidae	*Ophisaurus*	*gracilis*	1					*IV*
Varanidae	*Varanus*	*bengalensis*	1					*II*
Typhlopidae	*Typhlops*	*jerdoni*		1				*IV*
	Typhlops	*oligolepis*		1				*IV*
Boidae	*Python*	*molurus*	-	-	-	-	-	*I*
	Eryx	*conicus*	1					*IV*
Colubridae	*Ahaetulla*	*prasina*	1	-	-			*IV*
	Amphiesma	*platyceps*	-	-	-	-	-	*IV*
	Amphiesma	*parallela*	-	-	-	-	-	*IV*
	Boiga	*gokool*	-	-	-	-	-	*IV*
	Boiga	*trigonata*	1	1				*IV*
	Boiga	*ochracea*	-	-	-	-	-	*IV*
	Dendrelaphis	*cyanochloris*	-	-	-	-	-	*IV*
	Dendrelaphis	*pictus*	-	-	-	-	-	*IV*
	Chrysopelea	*ornata*	1					
	Dinodon	*gammiei*				1		
	Elaphe	*prasina*	1	1	1	-	-	*IV*
	Elaphe	*hodgsoni*	1	-	-	-	-	*IV*
	Elaphe	*radiata*	1					*IV*

Family	Genera	Species	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Elaphe	*porphyracea*	1	1	1	-	-	*IV*
	Elaphe	*cantoris*	1					*IV*
	Liopeltis	*stoliczkae*		1	1			*IV*
	Liopeltis	*rappi*	1	1	1			*IV*
	Oligodon	*albocinctus*	1	1	1			*IV*
	Pareas	*monticola*	-	-	-	-	-	*IV*
	Pseudoxenodon	*macrops*			1	1		*IV*
	Psammodynastes	*pulverulentus*	1					*IV*
	Ptyas	*mucosus*	1	1				*IV*
	Ptyas	*korros*	1					*IV*
	Zaocys	*nigromarginatus*	1	1	1	1		*IV*
	Argyrogena	*fasciolata*	1					*IV*
	Rhabdophis	*subminiata*		1				*IV*
	Rhabdophis	*himalayana*		1	1			*IV*
	Trachischium	*fuscum*			1	1		*IV*
	Trachischium	*guentheri*			1			*IV*
	Trachischium	*tenuiceps*			1			*IV*
	Xenochrophis	*piscator*	1	1				*II*
Elapidae	*Bungarus*	*bungaroides*	-	-	-	-	-	*IV*
	Bungarus	*caeruleus*	1	1				*IV*
	Callophiss	*macclellandi*	1	1	1	1		*IV*
	Naja	*kaouthia*	1					*II*
	Ophiophagus	*hannah*	1	1				*IV*
Viperidae	*Vipera*	*russelli*	1	1	1			*II*
	Gloydius	*himalayanus*		1	1	1	1	*IV*
	Trimeresurus	*gramineus*	1	1				*IV*
	Ovophis	*monticola*	1	1				*IV*
	Protobothrops	*jerdonii-*			?	?	?	

APPENDIX IV

Checklist of Butterflies of Sikkim and their altitudinal distribution

(1=present, Blank= absent, - = no data, WPA= Wildlife Protection Act, 1972)

Source: Haribal (1992)

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
Papilionidae	Apollo	*Parnassius acdestis*	-	-	-	-	-	
	Imperial Apollo	*Parnassius imperator agustus*				1		I
	Varnished Apollo	*Parnassius acco*	-	-	-	-	-	
	Hannyngton's Apollo	*Parnassius acco hunningitoni*	-	-	-	-	-	I
	*Common Blue Apollo	*Parnassius hardwickii virdicans*			1	1		
	Common Red Apollo	*Parnassius epaphus sikkimensis*					1	II
	Blackedged Apollo	*Parnassius simo*	-	-	-	-	-	
	Bhutan Glory	*Bhutanitis lidderdalii lidderdalii*			1	1		II
	Brown Gorgon	*Meandrusa gyas gyas*	-	-	-	-	-	
	Yellow Gorgon	*Meandrusa payeni evan...*		1	1			
	Kaiser-I-Hind	*Teinopalpus imperialis imperialis*			1			II
	Sixbar Swordtail	*Pazala eurous sikkimica*	1	1	1			
	Spectacle Swordtail	*Pazala mandarinus paphus*	1	1				
	Chain Swordtail	*Pathysa aristeus anticrates*	1	1				
	Fivebar Swordtail	*Pathysa antiphates pompilius*	1	1				
	Fourbar Swordtail	*Pathysa agetes agetes*	1	1				
	Spot Swordtail	*Pathysa nomius nomius*	1	1				
	*Great Zebra	*Pathysa xenocles*	1	1				

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
		phrontis						
	*Lesser Zebra	*Pathysa macareus indicus*	1	1				
	Spotted Zebra	*Pathysa megarus megarus*	-	-	-	-	-	
	*Common Bluebottle	*Graphium sarpedon sarpedon*	1	1				
	*Glassy Bluebottle	*Graphium cloanthus*	1	1	1			
	*Tailed Jay	*Graphium agammemnon agammemnon*	1	1				
	Veined Jay	*Graphium bathycles chiron*	1	1				
	Great Jay	*Graphium eurypylus cheronus*	1	1				II
	*Common Jay	*Graphium doson axion*	1	1				
	Pemberton's Windmill	*Atrophaneura plutonius pembertoni*	1	1				
	*Rose Windmill	*Atrophaneura latreillei*	1	1	1			
	*Common Windmill	*Atrophaneura polyeuctes*		1	1			
	Great Windmill	*Atrophaneura dasarada dasarada*	1	1	1			
	*Lesser Batwing	*Atrophaneura aidoneus*	1	1				
	*Common Batwing	*Atrophaneura varuna astorion*	1	1				
	Common Rose	*Pachliopta aristolochiae aristolochiae*	1	1				
	Crimson Rose	*Pachliopta hector*	1	1				I
	Golden Birdwing	*Triodes aeacus*	1	1				
	*Common Birdwing	*Triodes helena cereberus*	1	1				
	Blue Striped Mime	*Chilasa slateri slateri*	1	1				
	Lesser Mime	*Chilasa epycides epycides*	1	1				II
	Twany Mime	*Chilasa agestor agestor*		1	1			
	*Common Mime	*Chilasa clytia clytia*	1	1	1			I
	*Yellow Swallowtail	*Papilio machaon sikkimensis*			1	1	1	II

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Lime Butterfly	*Princeps demoleus*	1	1				
	*Spangle	*Princeps protenor euprotenor*		1	1			
	Tailed Redbreast	*Princeps janaka*	1	1				
	*Redbreast	*Princeps alcmenor*	1	1				
	Blue Mormon	*Princeps polymnestor*	-	-	-	-	-	
	*Great Mormon	*Princeps memnon agenor*	1	1	1			
	*Common Mormon	*Princeps polytes romulus*	1	1				
	*Red Helen	*Princeps helenus helenus*	1	1				
	*Yellow Helen	*Princeps nephelus chaon*	1	1				
	*Common Raven	*Princeps castor polas*	1	1				
	*Common Peacock	*Princeps polyctor ganesa*	1	1				
	*Paris Peacock	*Princeps paris paris*	1	1	1			
	*Blue Peacock	*Princeps arcturus arcturus*	1	1	1	1		
	*Krishna Peacock	*Princeps krishna*		1	1			
Pieridae	*Psyche	*Leptosia nina nina*	1	1				
	Butler's Dwarf	*Baltia butleri sikkima*				1		I
	Thibet Blackvein	*Aporia peloria*	-	-	-	-	-	
	Great Blackvein	*Aporia agathon agathon*		1				IV
	Chumbi White	*Pieris dubernardi chumbiensis*				1	1	
	Greenvein White	*Pieris montana verity*				1	1	
	Chumbi Greenvein White	*Pieris melaina*	-	-	-	-	-	
	*Indian Cabbage White	*Pieris canidia indica*	1	1	1	1	1	
	*Large Cabbage White	*Pieris brassicaenepalensis*	1	1	1	1	1	
	*Spotted Swatooth	*Prioneris thestylis thestylis*	1	1				
	Redspot Swatooth	*Prioneris clemanthe clemanthe*	-	-	-	-	-	
	Pioneer	*Anapheis aurota aurota*	1	1				

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Orange Albatross	*Appias nero galba*	1	1				IV
	Chocolate Albatross	*Appias lyncida elenora*	1	1				II
	*Plain Puffin	*Appias indra indra*	1	1				II
	*Spot Puffin	*Appias lalage durvasa*	1	1				
	*Common Albatross	*Appias albina darada*	1	1				II
	Common Wanderer	*Pareronia valeria hippia*	1	1				
	Pale Wanderer	*Pareronia avatar avatar*	1	1				
	*Common Gull	*Cepora nerissa nerissa*	1	1				II
	*Lesser Gull	*Cepora nadina nadina*	1	1				II
	*Yellow Orangetip	*Ixias pyrene familiaris*	1	1				
	*Great Orangetip	*Hebomoia glaucippe glaucippe*	1	1				
	*Common Jezebel	*Delias eucharis*	1	1				
	*Hill Jezebel	*Delias belladona ithiela*	1	1	1			
	Redspot Jezebel	*Delias descombesi descombesi*		1	1			
	*Yellow Jezebel	*Delias agostina agostina*	1	1	1			
	Pale Jezebel	*Delias samaca oreas*	-	-	-	-	-	I
	Dark Jezebel	*Delias berinda boyleae*	-	-	-	-	-	
	*Redbreast Jezebel	*Delias thysbe pyramus*	-	-	-	-	-	
	Painted Jezebel	*Delias hyparete indica*	1	1				
	*Redbase Jezebel	*Delias aglaia*	1	1	1			
	*Common Emigrant	*Catopsilia pomona*	1	1	1			
	*Mottled Emigrant	*Catopsilia pyranthe*	1	1	1			
	*Tailed Sulphur	*Dercas verhuelli doubledayi*	1	1	1			
	Plain Sulphur	*Dercas lycoris lycoris*	1	1				II
	Common Brimstone	*Gonepteryx rhamni nepalensis*			1	1	1	
	*Tree Yellow	*Gandaca harina assamica*	1	1				
	*Small Grass Yellow	*Eurema brigitta rubella*	1	1				
	*Spotless Grass Yellow	*Eurema laeta sikkima*	1	1				

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	*Three Spot Grass Yellow	*Eurema blanda silhetana*	1	1				
	*Common Grass Yellow	*Eurema hecabe contubernalis*	1	1				
	Scarce Grass Yellow	*Eurema jordani*	-	-	-	-	-	
	Onespot Grass Yellow	*Eurema andersoni andersoni*	1	1				II
	Chocolate Grass Yellow	*Eurema sari sodalis*		1				
	Orange Clouded Yellow	*Colias stoliczakana miranda*	-	-	-	-	-	II
	Everest Clouded Yellow	*Colias berylla*	-	-	-	-	-	
	Fawcett's Clouded Yellow	*Colias nina nina*	-	-	-	-	-	
	Dwarf Clouded Yellow	*Colias dubia*	-	-	-	-	-	I
	*Dark Clouded Yellow	*Colias fieldii*	1	1	1	1	1	
Lycaenidae	Common Gem	*Poritia hewitsoni hewitsoni*	1	1				II
	Moth Butterfly	*Liphyra brassolis*	1	1				I
	Common Brownie	*Miletus boisduvali assamensis*	1	1				
	Crenulate Darkie	*Allotinus drumila*	-	-	-	-	-	I
	Great Darkie	*Allotinus multistrigatus multistrigatus*	-	-	-	-	-	
	Forest Pierrot	*Taraka hamada mendesia*	1	1				
	Apefly	*Spalgis epius epius*	1	1				
	Bright Sunbeam	*Curetis bulis*	1	1				
	*Angled Sunbean	*Curetis dentata*	1	1				
	Metallic Green Hairstreak	*Chrysozephyrus duma duma*		1				
	Metallic Green Hairstreak	*Chrysozephyrus sikkimmensis*	-	-	-	-	-	
	Powdered Hairstreak	*Chrysozephyrus zoa*	1	1				
	Silver Hairstreak	*Chrysozephyrus syla*			1	1		

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
		assamica						
	Kirbari Hairstreak	*Chrysozephyrus kirbarensis*	-	-	-	-	-	
	Lilac Oakblue	*Narathura camadeo camadeo*	1	1				
	Doherty's Dull Oakblue	*Narathura khamti*	-	-	-	-	-	
	Indian Oakblue	*Narathura alemon*	-	-	-	-	-	
	Powdered Oakblue	*Narathura bazalus*		1				
	Large Oakblue	*Arhopala amantes amantes*	1	1				
	Green Oakblue	*Arhopala eumolphus eumolphus*	1	1				
	Dark Himalayan Oakblue	*Arhopala paramuta*						
	Aberrant Bushblue	*Arhopala abseus indicus*	1	1				
	Bifid Plushblue	*Flos diardi*	-	-	-	-	-	
	Shining Plushblue	*Flos fulgida*	-	-	-	-	-	
	Spangled Plushblue	*Flos asoka*	1	1				
	Chinese Plushblue	*Flos chinensis*	-	-	-	-	-	
	Tailless Plushblue	*Flos areste*	-	-	-	-	-	
	Variegated Plushblue	*Nilasera adriana*	1	1				
	Spotless Oakblue	*Narathura fulla ignara*	-	-	-	-	-	
	*Centaur Oakblue	*Nilasera centaurus pirithous*	1	1				
	Yellow Disc Oakblue	*Panchala singla*	1	1				
	Yellow Disc Tailless Oakblue	*Arhopala perimuta perimuta*	-	-	-	-	-	
	*Dusky Bushblue	*Acesina paraganesa paraganesa*	1	1				
	*Common Acacia Blue	*Surendra quercetorum quercetorum*	1	1				
	Silverstreaked Acaciablue	*Surendra todara distorta*	1	1				II
	Sylhet Oakblue	*Amblypodia silhetensis*	-	-	-	-	-	II

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
		silhetensis						
	Singapore Oakblue	*Amblypodia yendava*	-	-	-	-	-	II
	Common Leaf Blue	*Amblypodia anita anita*	1	1				
	*Hewitson's Dull Oakblue	*Narathura aenea*	1	1				
	Dark Himalayan Oakblue	*Narathura rama rama*	1	1				
	Silverstreak	*Iraota timoleon*	1	1				
	Common Tinsel	*Catapaecilma elegans major*	1	1				
	Dark Tinsel	*Catapaecilma delicatum*	1	1				
	*Yamfly	*Loxura atymnus continentalis*	1	1				
	Branded Yamfly	*Yasoda tripunctuata*	1	1				II
	Common Onyx	*Horaga onyx onyx*	1	1				
	Yellow Onyx	*Horaga moulmenia*	-	-	-	-	-	
	Brown Onyx	*Horaga viola*	-	-	-	-	-	
	Monkey Puzzle	*Rathinda amor*	1	1				
	Common Imperial	*Cheritra freja freja*	1	1				
	Truncate Imperial	*Cheritrella truncipennis*	1	1				II
	Blue Imperial	*Ticherra acte*	1	1				
	Blue Posy	*Biduanda melisa cyara*	1	1				
	Khaki Shot Silverline	*Spindasis ictis*	1	1				
	Common Silverline	*Spindasis vulcans fusca*	1	1				
	Silvergrey Silverline	*Spindasis sani*	1	1				
	Khaki Silverline	*Spindasis rukmini*	1	1				I
	Club Silverline	*Spindasis syama peguanus*	-	-	-	-	-	
	Elwes's Silverline	*Spindasis elwesi*	1	1				I
	Longbranded Silverline	*Spindasis iohita himalayanus*	1	1	1			II
	Straightline Royal	*Iolaus diaeus*	-	-	-	-	-	
	Dark Blue Royal	*Pratapa icetas extensa*	1	1				II

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Pallid Royal	*Tajuria albiplaga*	-	-	-	-	-	II
	Chestnut And Black Royal	*Tajuria yajna isotroidea*	-	-	-	-	-	I
	Branded Royal	*Tajuria melastigma*	-	-	-	-	-	II
	Spotted Royal	*Tajuria maculata*	1	1				
	Slate Royal	*Maneca bhotea*	1	1	1			
	Pale Grand Imperial	*Jacoona fabronia*	-	-	-	-	-	
	Banded Royal	*Charana (=Rachana) jalindra indra*	1	1				II
	Mandarinus Blue	*Charana mandarinus*	1	1				
	White Royal	*Tajuira illurgis*	1	1				
	Chocolate Royal	*Ramelana jangala ravata*	1	1				
	Bi-Spot Royal	*Ancema ctesia*	1	1	1			
	Whitebanded Royal	*Ancema(=Pratapa) cotys*		1	1			
	Silver Royal	*Ancema blanka argentea*	1	1	1			
	Broad Tail Royal	*Camena cleobis*	1	1				
	White Royal	*Camena deva lila*	1	1				
	Common Tit	*Hypolycaena erylus himavantus*	1					
	Blue Tit	*Chliaria kina cachara*	1	1				
	Orchid Tit	*Chliaira othona*	1	1				
	*Fluffy Tit	*Zeltus amasa*	1	1				
	Cornelian	*Deudorix epijarbus amatius*	1	1	1			
	Green Flash	*Artipe eryx*		1	1			II
	Common Guava Blue	*Virachola isocrates*	1	1	1			
	Large Guava Blue	*Virachola perse perse*	1	1	1			
	Pale Spark	*Sinthusa virgo*	-	-	-	-	-	I
	Broad Spark	*Sinthusa chandrana grotei*	-	-	-	-	-	
	Narrow Spark	*Sinthusa nasaka amba*	1	1				
	Witch	*Araotes lapithis*	1	1				II
	Plane	*Bindahara phocides*	1	1				II

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
		phocides						
	Indigo Flash	*Rapala varuna oresis*	1	1				II
	Refulgent Flash	*Rapala refulgens*	1	1	1			II
	Slate Flash	*Rapala manae schistacea*	1	1	1			
	Scarce Slate Flash	*Rapala scintilla*	-	-	-	-	-	II
	Shot Flash	*Rapala buxaria*	-	-	-	-	-	II
	Common Red Flash	*Rapala jarbas(=iarbas)*	-	-	-	-	-	
	Common Flash	*Bidaspa nissa nissa*	-	-	-	-	-	
	Copper Flash	*Vadebra petosivis*	-	-	-	-	-	
	Chumbi Green Underwing	*Lycaena younghusbandi*				1	1	
	Lister's Hairstreak	*Pamela dudgeoni*	-	-	-	-	-	-
	Common Copper	*Lycaena phalaeas flavens*	-	-	-	-	-	-
	*Purple Sapphire	*Heliophorus epicles indicus*		1	1	1		
	*Golden Sapphire	*Heliophorus brahma*		1	1			
	*Hybrid Sapphire	*Heliophorus hybrida*	-	-	-	-	-	I
	*Azure Sapphire	*Heliophorus androcles moorei*		1	1			II
	Powdery Green Sapphire	*Heliophorus tamu*		1	1			
	Ciliate Blue	*Anthene emolus*	-	-	-	-	-	-
	Straightwing Blue	*Orthomiella pontis pontis*	-	-	-	-	-	II
	Pointed Pierrot	*Niphanda cymbia*	-	-	-	-	-	II
	Dingy Line Blue	*Petrelaea dana*	-	-	-	-	-	-
	Large 4-Lineblue	*Nacaduba pactolus continentalis*	1	1				II
	Violet-4-Lineblue	*Nacaduba pavana vajuva*	-	-	-	-	-	-
	Pointed Lineblue	*Nacaduba helicoin meriguiana*	-	-	-	-	-	II
	*Pale 4-Lineblue	*Nacaduba hermus nabo*	1	1				II
	*Transparent 6-Lineblue	*Nacaduba kurava euplea*	1	1				
	Opaque 6-Lineblue	*Nacaduba beroe gythion*	1	1				

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	*Banded Lineblue	*Prosotas aluta coelestis*	1	1				
	Bhutya Lineblue	*Prosotas bhutea*	1	1				
	*Tailless Lineblue	*Prosotas dubiosa sivoka*	1	1				
	Angled Pierrot	*Caleta caleta decidia*	1	1				
	Elbowed Pierrot	*Caleta elna noliteia*	1	1				
	*Common Cerulean	*Jamides celeno celeno*	1	1				
	*Metallic Cerulean	*Jamides alecto eurysaces*	1	1				II
	*Forget-Me-Not	*Catochrysops strabo*	1	1				
	*Peablue	*Lampides boeticus*	1	1				II
	*Dark Cerulean	*Jamides bochus*	1	1	1			
	*Glistening Cerulean	*Jamides elpis palissa*	1	1				
	*Zebra Blue	*Syntarucus plinius*	1	1				
	Common Pierrot	*Castalius rosimon rosimon*	1	1				I
	Striped Pierrot	*Tarucus nara*	1	1				
	*Dark Pierrot	*Tarucus ananda*	1	1				IV
	Assam Pierrot	*Tarucus venosus dharata*	1	1				II
	Pointed Pierrot	*Tarucus callinara*	-	-	-	-	-	II
	Dark Grass Blue	*Zizeeria knyasna*	-	-	-	-	-	-
	*Grass Jewel	*Zizeeria trochilus trochilus*	1	1				
	Pale Grass Blue	*Pseudozizeeria maha*	1	1				
	*Tiny Grass Blue	*Zizula hylax*	-	-	-	-	-	-
	Tailed Cupid	*Everes argiades hellotia*	-	-	-	-	-	-
	Chapman's Cupid	*Everes hugelli dura*	-	-	-	-	-	-
	Dusky Blue Cupid	*Everes dipora*	-	-	-	-	-	
	Forest Quaker	*Pithecops corvus*	-	-	-	-	-	-
	*Bright Babul Blue	*Azanus ubaldus*	1	1				
	Dull Babul Blue	*Azanus uranus*	-	-	-	-	-	-
	Margined Hedge Blue	*Lycaenopsis marginata*		1	1			
	White Banded Hedge Blue	*Lycaenopsis transpectus*	1	1	1			
	*Quaker	*Neopithecops zalmora*	1	1				

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Malayan	*Megisba malaya sikkima*	1	1				
	Albocerulean	*Celastrina albocerulea*	1	1				
	*Plain Hedge Blue	*Celastrina lavendularis placida*	1	1	1			
	Pale Hedge Blue	*Celastrina cardia dilecta*		1	1			
	Large Hedge Blue	*Celastrina hugelii oreana*		1	1			
	Hill Hedge Blue	*Celastrina argiolus sikkima*		1	1			
	Hill Hedge Blue	*Celastrina argiolus jyntea*	-	-	-	-	-	-
	*Common Hedge Blue	*Acetolepis puspa gisca*	1	1	1	1		
	Gram Blue	*Euchrysops cnejus*	1	1				
	Chumbi Argus	*Polyommatus semiargus annulata*					1	
	Common Meadow Blue	*Polyommatus eros arene*	-	-	-	-	-	-
	Mountain Blue	*Albulina pheretes pharis*					1	
	Chapman's Blue	*Everes diporides*	-	-	-	-	-	II
	Azure Mountain Blue	*Albulina pheretes arcaseia*					1	
	Lime Blue	*Chilades laius*	1	1	1			
	Plain's Cupid	*Edales pandava*	1	1				
	*Punchinello	*Zemeros flegyas indicus*		1	1			
	*Lesser Punch	*Dodona dipaea dipaea*		1	1			II
	*Tailed Punch	*Dodona eugenes venox*	1	1	1			
	*Mixed Punch	*Dodona ouida ouida*		1	1			
	*Striped Punch	*Dodona adonira adonira*		1	1			II
	*Orange Punch	*Dodona egeon*		1	1			II
	*Dark Judy	*Abisara fylla*	1	1				
	Tailed Judy	*Abisara neophron neophron*	1	1				
	Spot Judy	*Abisara chela chela*	1	1				
	*Plum Judy	*Abisara echerius suffusa*	1	1				
Nymphalidae	Common Faun	*Faunis canens arcesilaus*	1	1				
	Yellow Dryad	*Aemona amathusia*	-	-	-	-	-	II

Family	Common Name	Scientific name	Altitude classes (in metres) <900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
		amathusia						
	Chocolate Junglequeen	*Sticopthalma nourmahal nourmahal*	1	1				II
	Northern Junglequeen	*Sticopthalma camadeva camadeva*	1	1				
	Jungle Glory	*Thaumantis diores diores*	1					
	Kohinoor	*Amathuxidia amythaon*	1					
	*Common Duffer	*Discophora sondiaca*	1					
	Great Duffer	*Discophora timora timora*	1					II
	Red Caliph	*Enispe euthymius euthymius*	1					
	Blue Caliph	*Enispe cyncus*	1					II
	*Common Evening Brown	*Melanitis leda ismene*	1					
	*Dark Evening Brown	*Melanitis phedima bela*	1	1	1			
	*Great Evening Brown	*Melanitis zitenius zitenius*	1	1				
	Branded Evening Brown	*Cyllogenes suradeva*	-	-	-	-	-	II
	Common Palmfly	*Elymnias hypermnestra undularis*	1					
	Tiger Palmfly	*Elymnias nesaea timandra*	-	-	-	-	-	-
	*Spotted Palmfly	*Elymnias malelas malelas*	1	1				II
	Blue Striped Palmfly	*Elymnias patna patna*	1	1				
	Jezebel Palmfly	*Elymnias vasudeva vasudeva*	-	-	-	-	-	II
	White-Edged Woodbrown	*Lethe visarava*	1	1				
	Scarce Woodbrown	*Lethe siderea*		1	1			
	Common Woodbrown	*Lethe sidonis sidonis*		1	1	1		
	*Small Woodbrown	*Lethe nicetella*		1	1			
	Barred Woodbrown	*Lethe maitbrya*			1			
	Yellow Woodbrown	*Lethe nicetas*		1	1			
	Spotted Mystic	*Lethe tristigmata*	-	-	-	-	-	-

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Dismal Mystic	*Lethe ocellata lyncus*	-	-	-	-	-	I
	*Bamboo Treebrown	*Lethe europa niladana*	1	1				I
	Common Treebrown	*Lethe rhoria rhoria*	1	1				
	Bhutan Treebrown	*Lethe margarita*	-	-	-	-	-	I
	Common Red Forester	*Lethe mekara mekara*	1	1				
	*Angled Red Forester	*Lethe chandica chandica*	1	1				
	Scarce Red Forester	*Lethe distans*	1	1				I
	Common Forester	*Lethe insana dinarbas*	1	1	1			II
	Brown Forester	*Lethe serbonis serbonis*			1	1		II
	Brown Forester	*Lethe serbonis teesta*	-	-	-	-	-	II
	Black Forester	*Lethe vindhya*	1	1				
	Bamboo Forester	*Lethe kansa*	1	1				
	Tailed Red Forester	*Lethe sinorix*	1	1				
	*Blue Forester	*Lethe scanda*		1	1			II
	Pale Forester	*Lethe latiaris*		1	1			II
	Forester	*Lethe bhairava*	-	-	-	-	-	II
	*Straight Banded Treebrown	*Neope verma sintica*		1	1			
	*Banded Treebrown	*Neope confusa confusa*		1	1			
	*Veined Labyrinth	*Neope pulaha pulaha*		1	1			
	Scarce Labyrinth	*Neope pulahina*		1	1			
	*Tailed Labyrinth	*Neope bhadra*		1	1			
	*Dusky Labyrinth	*Neope yama yama*		1	1			
	*Small Silverfork	*Zophoessa jalaurida elwesi*			1	1		
	*Moeller's Silverfork	*Zophoessa moelleri*		1	1	1		
	Small Goldenfork	*Zophoessa atkinsonia*			1	1		
	Large Goldenfork	*Zophoessa goalpara goalpara*			1	1		
	*Lilacfork	*Zophoessa sura*			1			
	Scarce Lilacfork	*Zophoessa dura gammiei*	-	-	-	-	-	-
	*Treble Silverstripe	*Zophoessa baladeva baladeva*		1	1			

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	*Single Silverstripe	*Zophoessa ramadeva ramadeva*	-	-	-	-	-	-
	*Chumbi Wall	*Chonala masoni*			1	1		
	Large Tawny Wall	*Raphicera satricus satricus*			1	1		
	Small Twany Wall	*Raphicera moorei mantra*			1	1		
	Tiger Brown	*Orinoma damaris*		1	1			
	Dusky Diadem	*Ethope himachala*	1	1				
	*Yellow Owl	*Neorina hilda*	1	1				II
	Whitebar Bushbrown	*Mycalesis anaxias oemate*	1	1				II
	*Lilacine Bushbrown	*Mycalesis franscica santana*	1	1				
	Chinese Bushbrown	*Mycalesis gotama charaka*	-	-	-	-	-	II
	*Common Bushbrown	*Mycalesis perseus blasius*	1	1				
	*Darkbrand Bushbrown	*Mycalesis mineus mineus*	1	1				
	*Long-Brand Bushbrown	*Mycalesis visala visala*	1	1				
	Wood-Mason's Bushbrown	*Mycalesis suavolens tylteri*	-	-	-	-	-	
	White-Edged Bushbrown	*Mycalesis mestra vetus*	1	1				II
	*Moore's Bushbrown	*Mycalesis heri*	1	1				II
	Salmon Branded Bushbrown	*Mycalesis misenus*	-	-	-	-	-	II
	*Bright Eye Bushbrown	*Mycalesis nicotia*	1	1				
	*Whiteline Bushbrown	*Mycalesis malsara*	1	1				II
	*Nigger	*Orsotrioena medus medus*	1	1				
	Ringlet	*Ragdia crisilda crito*	1	1				
	*Dark Catseye	*Zipoetis scylax*	1	1				
	*Himalayan Fivering	*Ypthima sakra sakra*		1	1			
	Variegated Fivering	*Ypthima methora methora*	1	1				II
	*Eastern Fivering	*Ypthima persimilis*	-	-	-	-	-	-

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	*Common Fivering	*Ypthima baldus baldus*	1	1				
	Jewel Four Ring	*Ypthima avanta*	-	-	-	-	-	
	*Common Three Ring	*Ypthima asterope maharatta*	1	1				
	*Common Four Ring	*Ypthima hubneri hubneri*	1	1				
	Large Three Ring	*Ypthima newara*	1	1				
	Pallid Argus	*Callerbia scanda scanda*	1	1				
	*Pallid Argus	*Callerbia scanda opima*	-	-	-	-	-	-
	Ringed Argus	*Callerbia ananda ananda*	-	-	-	-	-	-
	Ringed Argus	*Callerbia ananda caeca*	-	-	-	-	-	-
	Mottled Argus	*Callerbia narasingha narasingha*	-	-	-	-	-	-
	Mountain Argus	*Paraoeneis pumilus bicolor*				1	1	
	Arctic Argus	*Paraoeneis palaearcticus sikkimensis*				1	1	
	Narrow Banded Satyr	*Aulocera brahminus brahminiodes*			1	1		
	Great Satyr	*Aulocera padma padma*			1	1		
	Great Satyr	*Aulocera padma loha*	-	-	-	-	-	-
	Common Satyr	*Aulocera swaha swaha*		1	1			
	Striated Satyr	*Aulocera saraswati*		1	1			
	*Freak	*Calinaga buddha gautama*		1	1			II
	Tawny Rajah	*Charaxes polyxena hierax*	1	1				II
	Scarce Twany Rajah	*Charaxes aristogiton*	1	1				II
	Yellow Rajah	*Charaxes marmax*	1	1				II
	Variegated Rajah	*Charaxes kaharuba*	-	-	-	-	-	II
	Black Rajah	*Charaxes fabius fabius*	1	1				II
	*Common Nawab	*Polyura athamas athamas*	1	1				
	Pallid Nawab	*Polyura arja*	1	1				
	Malayan Nawab	*Polyura moori sandakanus*	-	-	-	-	-	-

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Jeweled Nawab	*Polyura delphis delphis*	-	-	-	-	-	-
	*Stately Nawab	*Polyura dolon centralis*	1	1				
	Great Nawab	*Polyura eudamippus eudamippus*	1	1				
	White Emperor	*Helcyra hemina*	1	1				I
	Golden Emperor	*Dilipa morgiana*	1	1				
	Sordid Emperor	*Apatura sordida sordida*	1	1				II
	Sergeant Emperor	*Apatura chevana*	1	1				II
	*Indian Purple Emperor	*Apatura ambica ambica*	1	1				
	*Black Prince	*Rohana parisatis parisatis*	1	1				
	Brown Prince	*Rohana parvata*	1	1				
	*Pasha	*Herona marathus marathus*	1	1				
	*Eastern Courtier	*Sephisa chandra*	1	1				
	Painted Courtesan	*Euripus consimilis consimilis*	1	1				
	Courtesan	*Euripus halitheres*	1	1				
	*Circe	*Hestina nama*	1	1				
	Siren	*Hestina persimilis persimilis*	1	1				
	*Popinjay	*Stibochiona nicea nicea*	1	1				
	Constable	*Dichorragia nesimachus*	1	1				
	Yellow Kaiser	*Penthema lisrada lisrada*	-	-	-	-	-	II
	*Tabby	*Psuedergolis wedah*	1	1				
	Angled Castor	*Ariadne ariadne pallidior*	1	1	1			
	Common Castor	*Ariadne merione assama*	1	1	1			
	Rustic	*Cupha erymanthis lotis*	1	1				
	Common Leopard	*Phalanta phalantha*	1	1				
	Small Leopard	*Phalanta alcippe alcippoides*	1	1				
	*Large Yeoman	*Cirrochroa aoris aoris*	1	1				
	*Common Yeoman	*Cirrochroa tyche mithila*	1	1				

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			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Vagrant	*Issoria sinha sinha*	1	1				
	*Queen Of Spain Fritillary	*Issoria lathonia issaea*		1	1	1	1	
	*Indian Fritillary	*Argyreus hyperbius hyperbius*	1	1	1			
	*Large Silverstripe	*Childrena childreni childreni*		1	1			
	Common Silverstripe	*Fabriciana kamala*	-	-	-	-	-	-
	Silverstreak	*Melitaea clara*	-	-	-	-	-	-
	Blackvein Fritillary	*Melitaea arcesia thibetana*	-	-	-	-	-	-
	Blackvein Fritillary	*Melitaea arcesia sikkimensis*					1	
	*Gem Silverspot	*Argynnis gemmata gemmata*				1	1	
	Mountain Silverspot	*Argynnis gemmata altissima*					1	
	Straightwing Silverspot	*Boloria pales eupales*	-	-	-	-	-	-
	Yellow Pansy	*Precis hierta magna*	1	1	1			
	Blue Pansy	*Precis orithya ocyale*	1	1	1			
	*Lemon Pansy	*Precis lemonias lemonias*	1	1	1			
	*Peacock Pansy	*Precis almana almana*	1	1				
	*Grey Pansy	*Precis atlites atlites*	1	1				
	*Chocolate Soldier	*Precis iphita iphita*	1	1	1			
	*Indian Red Admiral	*Vanessa indica indica*		1	1	1		
	*Painted Lady	*Cynthia cardui*	1	1	1	1	1	
	*Blue Admiral	*Kaniska canace canace*		1	1			
	Eastern Comma	*Polygonia egea agnicula*	-	-	-	-	-	-
	*Mountain Tortoiseshell	*Aglais urticae rizana*					1	
	Ladakh Tortoiseshell	*Aglais ladakensis*	-	-	-	-	-	-
	*Indian Tortoiseshell	*Aglais cachmirensis aesis*	1	1	1	1	1	
	Camberwell Beauty	*Nymphalis antiopa yedanula*	-	-	-	-	-	-

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	*Common Jester	*Symbrenthia lilaea khasiana*		1	1			
	Himalayan Jester	*Symbrenthia hypselis cotanda*		1	1	1		
	*Bluetail Jester	*Symbrenthia niphanda niphanda*	1	1				II
	*Danaid Eggfly	*Hypolimnas misippus*	1	1				I
	*Great Eggfly	*Hypolimnas bolina*	1	1				
	*Autumn Leaf	*Doleschallia bisaltide indica*	1	1				II
	Blue Oakleaf	*Kallima horsfieldi*	1	1				
	*Orange Oakleaf	*Kallima inachus inachus*	1	1				
	Marbled Map	*Cyrestis cocles cocles*	-	-	-	-	-	II
	*Common Map	*Cyrestis thyodamas thyodamas*	1	1				
	*Common Maplet	*Chersonesia risa risa*	1	1				
	Chestnut Streaked Sailer	*Neptis jumbah jumbah*	1	1				
	Himalayan Sailer	*Neptis mahendra*	-	-	-	-	-	-
	*Common Sailer	*Neptis hylas varmona*	1	1	1			
	Common Sailer	*Neptis sappho astola*	1	1	1			
	Sullied Sailer	*Neptis soma soma*	1	1	1			II
	Clear Sailer	*Neptis clinia susruta*	1	1				
	Yerburi's Sailer	*Neptis yerburi*		1	1			
	*Broad Banded Sailer	*Neptis sankara amba*	1	1				1
	Dingy Sailer	*Neptis pseudovikasi*	1	1				
	Dingiest Sailer	*Neptis harita harita*		1	1			
	Plain Sailer	*Neptis cartica cartica*	1	1				
	Rich Sailer	*Neptis nashona nashona*	-	-	-	-	-	II
	Yellow Sailer	*Neptis ananta ochracea*	1	1				
	*Small Yellow Sailer	*Neptis miah miah*	1	1				
	Variegated Sailer	*Neptis antilope elba*	-	-	-	-	-	I
	Pale Hockeystick Sailer	*Neptis manasa manasa*	-	-	-	-	-	I
	Hockey Stick Sailer	*Neptis nycteus*	-	-	-	-	-	I

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Broad Stick Sailer	*Neptis narayana nana*		1	1			II
	Great Yellow Sailer	*Neptis radha radha*		1	1			II
	Pale Green Sailer	*Neptis zaida bhutanica*		1				II
	*Yellow Jack Sailer	*Lassipa viraja viraja*	1	1				
	Short Branded Sailer	*Phaedyma columella ophiana*	1	1				
	Common Lascar	*Pantoporia hordonia hordonia*	1	1				
	*Orange Staff Sergeant	*Parathyma cama*	1	1				
	*Colour Sergeant	*Parathyma nefie inara*	1	1				
	*Blackvein Sergeant	*Parathyma ranga ranga*	1	1				
	Studded Sergeant	*Parathyma asura asura*	1	1				
	Common Sergeant	*Parathyma perius*	1	1				
	Staff Sergeant	*Parathyma selenophora selenophora*	1	1				
	Small Staff Sergeant	*Parathyma zeroca*	1	1				
	Hill Sergeant	*Parathyma opalina orientalis*	1	1				
	Bhutan Sergeant	*Parathyma jina jina*	-	-	-	-	-	-
	Commander	*Moduza procris procris*	1	1				
	Commodore	*Limenitis danava*	1	1				
	*Bicolour Commodore	*Limenitis zayla*	1	1				
	Green Commodore	*Limenitis daraxa*	1	1				
	White Commodore	*Limenitis dudu*	1	1				II
	Scarce White Commodore	*Limenitis zulema*	1	1				I
	Clipper	*Parthenos sylvia gambrisius*	1	1				II
	Knight	*Labadea martha martha*	1	1				
	Panther	*Neurosigma doubledayi doubledayi*	1	1				II
	Sergeant Major	*Abrota ganga ganga*	1	1				
	Archduke	*Lexias khasiana*	-	-	-	-	-	-

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	*Grey Count	*Tanaecia lepidea lepidea*	1	1				
	*Common Earl	*Tanaecia julii appiades*	1	1				
	Plain Earl	*Tanaecia jahnu jahnu*	-	-	-	-	-	
	Powdered Baron	*Euthalia kesava arhat*	1	1				
	Grey Baron	*Euthalia anosia saitapherne*	-	-	-	-	-	
	*Blue Baron	*Euthalia telchinia*		1	1			I
	*Common Baron	*Euthalia aconthea suddhodana*	1	1				
	*Streaked Baron	*Euthalia jama jamida*	1	1				
	*White-Edged Blue Baron	*Euthalia phemius*	1	1				
	Gaudy Baron	*Euthalia lubentina indica*	1	1				IV
	French Duke	*Euthalia franciae franciae*	1	1				II
	*Blue Duchess	*Euthalia duda*	1	1				II
	Blue Duke	*Euthalia durga durga*	-	-	-	-	-	I
	Bronze Duke	*Euthalia nara nara*	1	1				II
	*Green Duke	*Euthalia sahadeva sahadeva*	1	1				
	Grand Duke	*Euthalia iva*	-	-	-	-	-	I
	Baronet	*Symphaedra nais*	1	1				
	Cruiser	*Vindula erota erota*	1	1				
	*Red Lacewing	*Cethosia biblis tisamena*	1	1				
	*Leopard Lacewing	*Cethosia cyane*	1	1				
	*Tawny Coster	*Acraea violae*	1	1				
	*Yellow Coster	*Pareba vesta*	1	1				
	*Glassy Tiger	*Parantica aglea melanoides*	1	1	1			
	*Chestnut Tiger	*Parantica sita sita*	1	1	1			
	Chocolate Tiger	*Parantica melaneus platiniston*	1	1				
	*Blue Tiger	*Tirumala limniace*	1	1				

Family	Common Name	Scientific name	Altitude classes (in metres) <900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
		leopardus						
	*Dark Blue Tiger	*Tirumala septentrionis*		1				
	*Common Tiger	*Danaus(Salathura) genutia*	1	1				
	*Plain Tiger	*Danaus (Anosia) chrysippus*	1	1				
	Double Branded Crow	*Euploea sylvester hopei*	1	1				
	*Striped Blue Crow	*Euploea mulciber mulciber*		1	1			
	Blue Spotted Crow	*Euploea midamus rogenhoferi*		1	1			II
	*Blue King Crow	*Euploea klugii klugii*	1	1				
	Magpie Crow	*Euploea radmanthus*	1	1				
	*Srriped Black Crow	*Euploea doubledayi*	1	1				
	Long-Branded Blue Crow	*Euploea algea deione*	1	1				
	*Common Crow	*Euploea core core*	1	1	1			IV
	Common Beak	*Libythia lepita lepita*		1	1			
	*Club Beak	*Libythia myrrha myrrha*		1	1			
Hesperiidae	Branded Orange Awlet	*Bibasis oedipodea athena*	-	-	-	-	-	
	Orange Awlet	*Bibasis jaina jaina*	1	1				
	Plain Orange Awlet	*Bibasis anadi*	-	-	-	-	-	
	Unknown	*Bibasis harisa harisa*	-	-	-	-	-	
	Green Awlet	*Bibasis vasutana*	-	-	-	-	-	
	Small Green Awlet	*Bibasis amara*	-	-	-	-	-	
	Pale Green Awlet	*Bibasis gomata gomata*	-	-	-	-	-	
	Pale Green Awlet	*Bibasis sena sena*	-	-	-	-	-	
	Unknown	*Hasora anura anura*	-	-	-	-	-	
	White Banded Awl	*Hasora taminatus bhavara*	-	-	-	-	-	
	*Common Awl	*Hasora badra badra*	-	-	-	-	-	
	Plain Banded Awl	*Hasora vitta indica*	-	-	-	-	-	IV
	Brown Awl	*Badamia exclamationis*	1	1				

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Branded Awlking	*Choaspes plateni stigmata*	-	-	-	-	-	
	Indian Awlking	*Choaspes benjaminii japonica*	-	-	-	-	-	
	Awlking	*Choaspes xanthopogon*	-	-	-	-	-	
	Awlking	*Choaspes hemixanthus furcata*	-	-	-	-	-	
	Lidderdale's Dawnfly	*Capila lidderdali*	-	-	-	-	-	
	Palestriped Dawnfly	*Capila zennara*	-	-	-	-	-	
	Striped Dawnfly	*Capila jayadeva*	-	-	-	-	-	
	Marbled Flat	*Lobocla liliana liliana*	-	-	-	-	-	
	Bhutan Flat	*Celaenorrhinus flavocincta*	-	-	-	-	-	
	Double Spotted Flat	*Celaenorrhinus pyrrha*	-	-	-	-	-	
	Unknown	*Celaenorrhinus ratna tytleri*	-	-	-	-	-	
	*Multispotted Flat	*Celaenorrhinus pulomaya pulomaya*			1	1		
	Mussouri Pied Flat	*Celaenorrhinus pero lucifera*	-	-	-	-	-	
	Pied Flat	*Celaenorrhinus morena*	-	-	-	-	-	
	De Niceville's Spotted Flat	*Celaenorrhinus plagifera*	-	-	-	-	-	
	Moore's Spotted Flat	*Celaenorrhinus sumitra*	-	-	-	-	-	
	Large Spotted Flat	*Celaenorrhinus patula*	-	-	-	-	-	
	*Common Spotted Flat	*Celaenorrhinus leucocera*	1	1	1			
	Common Spotted Flat	*Celaenorrhinus putra putra*	-	-	-	-	-	
	Himalayan Spotted Flat	*Celaenorrhinus munda munda*	-	-	-	-	-	
	Himalayan Spotted Flat	*Celaenorrhinus munda maculicornis*	-	-	-	-	-	
	Small Banded Flat	*Celaenorrhinus nigricans nigricans*	-	-	-	-	-	

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Scarce Banded Flat	*Celaenorrhinus badia*	-	-	-	-	-	
	Himalayan Yellow Flat	*Celaenorrhinus dhanada dhanada*	-	-	-	-	-	
	Hairy Angle	*Darpa hanria*	-	-	-	-	-	
	Zigzag Flat	*Odina decoratus*	-	-	-	-	-	
	*Fulvous Pied Flat	*Coladenia dan festa*	-	-	-	-	-	
	Fulvous Pied Flat	*Coladenia dan fauta*	-	-	-	-	-	
	Fulvous Pied Flat	*Coladenia dan fabia*	-	-	-	-	-	
	Tricoloured Pied Flat	*Coladenia indrani indrani*	1	1				
	Brown Pied Flat	*Coladenia agni agni*	-	-	-	-	-	
	*Small Common Flat	*Sarangesa dasahara dasahara*	1	1	1			
	Tytler's White Flat	*Satarupa zulla zulla*	-	-	-	-	-	
	Large White Flat	*Satarupa gopala*	-	-	-	-	-	
	Himalayan White Flat	*Seseria dohertyi dohertyi*	-	-	-	-	-	
	Sikkim White Flat	*Seseria sambara sambara*	-	-	-	-	-	
	Olive Flat	*Chamunda chamunda*	-	-	-	-	-	
	White Yellowbreast Flat	*Daimio sinica narada*	-	-	-	-	-	
	*Dusky Yellowbreast Flat	*Daimio phisara phisara*	-	-	-	-	-	
	Unknown	*Tagiades japetus ravi*	-	-	-	-	-	
	Large Snow Flat	*Tagiades gana athos*	-	-	-	-	-	
	Large Snow Flat	*Tagiades parra gala*	-	-	-	-	-	
	*Water Snow Flat	*Tagiades litigiosa litigiosa*	1	1	1			
	Spotted Snow Flat	*Tagiades menaka menaka*	-	-	-	-	-	
	Flat	*Tagiades cohaerens cynthia*	-	-	-	-	-	
	Yellow Flat	*Mooreana trichoneura pralaya*	-	-	-	-	-	
	Tawny Angle	*Ctenoptilum vasava vasava*	1	1				

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Chestnut Angle	*Odontoptilum angulata angulata*	1	1				
	Spotted Angle	*Caprona agama agama*	-	-	-	-	-	
	*Indian Skipper	*Spialia galba*	1	1				
	Unknown	*Carterocephalus avanti avanti*	-	-	-	-	-	
	Forest Hopper	*Astictopterus jama olivascens*	-	-	-	-	-	
	Atkinson's Bob	*Arnetta atkinsoni*	-	-	-	-	-	
	Tiger Hopper	*Ochus subvittatus subradiatus*	1	1				
	Hedge Hopper	*Baracus vittatus septentrionum*	-	-	-	-	-	
	Blue Spotted Scrub Hopper	*Aeromachus kali*	-	-	-	-	-	
	Veined Scrub Hopper	*Aeromachus stigmata stigmata*	-	-	-	-	-	
	*Grey Scrub Hopper	*Aeromachus jhora jhora*	-	-	-	-	-	
	Tufted Ace	*Sebastonyma dolopia*	-	-	-	-	-	
	Grahm's Ace	*Sovia grahami*	-	-	-	-	-	
	Luca's Ace	*Sovia lucasii separata*	-	-	-	-	-	
	Mussoorie Bush Bob	*Pedesta masuriensis masuriensis*	-	-	-	-	-	
	Brown Bush Bob	*Pedesta pandita*	-	-	-	-	-	
	Northern Spotted Ace	*Thoressa astigmata cerata*	-	-	-	-	-	
	Olive Ace	*Thoressa gupta gupta*	-	-	-	-	-	
	Gharwal Ace	*Thoressa aina*	-	-	-	-	-	
	Ba ıded Ace	*Halpe zema zema*	-	-	-	-	-	
	Plain Ace	*Halpe kumara*	-	-	-	-	-	
	Knyvetti's Ace	*Halpe knyvetti*	-	-	-	-	-	
	Sikkim Ace	*Halpe sikkima*	-	-	-	-	-	
	Indian Ace	*Halpe homolea molta*	-	-	-	-	-	II
	Ace	*Halpe acruata*	-	-	-	-	-	

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Light Straw Ace	*Pithauria stramneipennis stramneipennis*	-	-	-	-	-	
	Dark Straw Ace	*Pithauria murdava*	-	-	-	-	-	
	Branded Straw Ace	*Pithauria marsena*	-	-	-	-	-	
	*Chestnut Bob	*Lambrix salsala salsala*	1	1				
	Dark Velvet Bob	*Koruthaialos butleri*	-	-	-	-	-	
	Unknown	*Stimula swinhoei swinhoei*	-	-	-	-	-	
	*Chocolate Demon	*Ancistroides nigrita diocles*	1	1				
	Common Banded Demon	*Notocrypta paralysos asawa*	-	-	-	-	-	
	*Spotted Demon	*Notocrypta fiesthamelii alysos*	1	1	1			
	*Grass Demon	*Udaspes folus*	1	1				
	Forest Bob	*Scobura cephala*	-	-	-	-	-	
	Forest Bob	*Scobura isota*		-	-	-	-	
	Grass Bob	*Suada swerga swerga*		-	-	-	-	
	Indian Palm Bob	*Suastus gremius gremius*	1	1				
	Ceylon Palm Bob	*Suastus minuta aditia*	-	-	-	-	-	
	*Wax Dart	*Cupitha purreea*	-	-	-	-	-	
	Purple And Gold Flitter	*Zographetus satwa*	-	-	-	-	-	
	Purple Spotted Flitter	*Zographetus ogygia ogygia*	-	-	-	-	-	
	*Tree Flitter	*Hyarotis adrastus praba*	1	1				IV
	Spotted Yellow Lancer	*Plastingia noemi*	-	-	-	-	-	
	Giant Red Eye	*Gangara thyrsis thyrsis*	1	1				
	Banded Red Eye	*Gangara lebadea lebadea*	-	-	-	-	-	
	Palm Red Eye	*Erionata torus*	-	-	-	-	-	
	Palm Red Eye	*Erionata thrax thrax*	-	-	-	-	-	
	Red Eye	*Erionata acroleucus apex*	-	-	-	-	-	
	*Common Red Eye	*Matapa aria*	1	1	-	-	-	
	Dark Brand Red Eye	*Matapa druna*	-	-	-	-	-	

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Grey Brand Red Eye	*Matapa cresta*	-	-	-	-	-	
	Black Veined Red Eye	*Matapa sasivarna*	-	-	-	-	-	
	Purple Red Eye	*Matapa purpurascens*	1	1				
	Spotted Red Eye	*Pudicitia pholus*	-	-	-	-	-	
	Green Striped Palmer	*Piradana hyela major*	-	-	-	-	-	
	Nonsuch Palmer	*Cyrina cyrina cyrina*	-	-	-	-	-	
	Sub-Hyaline Darter	*Ochlodes subhyalina pasca*	-	-	-	-	-	
	Assam Darter	*Ochlodes siva siva*	-	-	-	-	-	
	Himalayan Dark Dart	*Taractrocera danna*	-	-	-	-	-	
	Common Grass Dart	*Taractrocera maevius sagara*	-	-	-	-	-	
	Common Dartlet	*Oriens goloides*	-	-	-	-	-	
	*Common Dartlet	*Oriens gola pseudolus*	1	1				
	Branded Dartlet	*Potanthus rectifasciata*	-	-	-	-	-	
	Common Dart	*Potanthus pallida*	-	-	-	-	-	
	*Common Dart	*Potanthus pseudomaesa*	-	-	-	-	-	
	Common Dart	*Potanthus sita*	-	-	-	-	-	
	Chinese Dart	*Potanthus confucius dushta*	-	-	-	-	-	
	Sikkim Dart	*Potanthus mara mara*	-	-	-	-	-	-
	Dart	*Potanthus nesta nesta*	-	-	-	-	-	-
	Dart	*Potanthus pava pava*	-	-	-	-	-	-
	Palm Dart	*Telicota colon colon*	-	-	-	-	-	-
	Dark Palm Dart	*Telicota linna linna*	-	-	-	-	-	-
	Dark Palm Dart	*Telicota ancilla bambusae*	-	-	-	-	-	-
	Dark Palm Dart	*Telicota ohara jix*	-	-	-	-	-	-
	Plain Palm Dart	*Cephrenes chrysozona oceanica*	-	-	-	-	-	-
	Straight Swift	*Parnara guttatus mangala*	-	-	-	-	-	-
	Straight Swift	*Parnara naso bada*	-	-	-	-	-	-

Family	Common Name	Scientific name	Altitude classes (in metres)					
			<900	900 - 1800	1800 - 2800	2800 - 3800	>3800	WPA
	Rice Swift	*Borbo cinnara*	-	-	-	-	-	-
	Beavan's Swift	*Borbo bevani*	-	-	-	-	-	-
	Large Branded Swift	*Pleopidas sinensis*	-	-	-	-	-	-
	Small Branded Swift	*Pleopidas agna agna*	-	-	-	-	-	-
	Small Branded Swift	*Pleopidas thrax masta*	-	-	-	-	-	-
	Large Branded Swift	*Pleopidas subochracea subochracea*	-	-	-	-	-	-
	Small Branded Swift	*Pleopidas mathias mathias*	-	-	-	-	-	-
	Great Swift	*Pleopidas assamensis*	-	-	-	-	-	-
	Swift	*Polytremis lubricans lubricans*	-	-	-	-	-	-
	Himalayan Swift	*Polytremis discreta discreta*	-	-	-	-	-	-
	Yellow Spot Swift	*Polytremis eltola eltola*	-	-	-	-	-	-
	Paint Brush Swift	*Baoris farri farri*	-	-	-	-	-	IV
	Swift	*Baoris pencillata unicolor*	-	-	-	-	-	-
	Figure Of 8 Swift	*Baoris pagana*	-	-	-	-	-	-
	Yellow Fringed Swift	*Caltoris aurociliata*	-	-	-	-	-	-
	Austen's Swift	*Caltoris cahira austeni*	-	-	-	-	-	-
	Swift	*Caltoris confusa*	-	-	-	-	-	-
	*Blank Swift	*Caltoris kumara moorei*	-	-	-	-	-	-
	Purple Swift	*Caltoris tulsi tulsi*	-	-	-	-	-	-
	Tufted Swift	*Caltoris plebeia*	-	-	-	-	-	-
	Unknown	*Caltoris philippina philippina*	-	-	-	-	-	-
	Common Wight	*Iton semamora*	-	-	-	-	-	-

* Recorded by present study.