

# Chapter 1

## 1 Introduction

### 1.1 Background

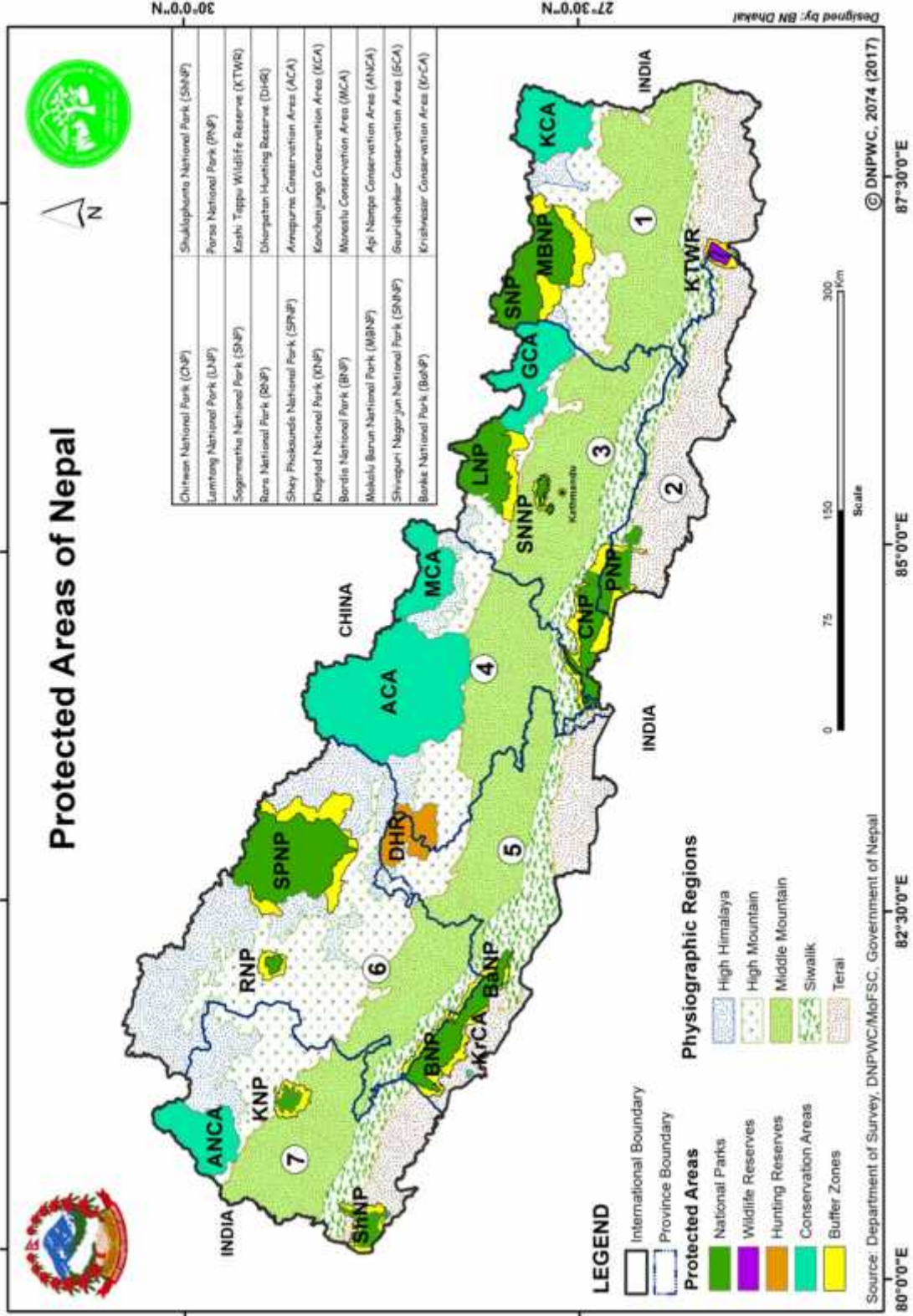
Nepal is renowned for its high diversity of bird species, spectacular mountains and rich culture. It is a landlocked central Himalayan country of South Asia, which is profoundly rich in biodiversity and ecosystem with the natural blessing of diverse topographical design. It lies in the southern slopes of the Himalayas between India and China, which spreads from the wonder of towering Himalayas to eye-catching magnificent mountains to hot and humid plain of terai.

Zoo-geographically, Nepal falls under the Palearctic realm to the north and the Oriental realm to the south. It is situated in between latitudes 26°22' to 30°27' North and longitudes 80°04' to 88°12' East. The total area of Nepal is about 147,181 sq. km. running 885 km. east to west and 145 to 241 km. north to south. Nepal is bounded on the north by Tibet Autonomous Region of China, and on the east by Sikkim and West Bengal of India, and on the south and west by Bihar and Uttar Pradesh of India (DNPWC, 2016).

The altitude increases dramatically from less than 100 meters above sea level in the subtropical terai in the southern zone to the highest point on the earth (8,848 m.) at the southern edge of the Tibetan plateau, all within a very short horizontal range of about 200km in compare to geographical structure of other countries. Nepal is known around the whole world as a country with the highest peak in the world, The Mount Everest.

Generally, Nepal is a mountainous country and is divided into three regions, high mountains, high hills and plain land of terai. Due to its geographical diversity, it has created diversity in ecosystem and climatic variation, where different species of flora and fauna are found. Each region has its typical topography, climate and vegetation. This diversity has helped in overall biodiversity. In each and every ecosystem, there is always a relation between biotic and abiotic factors, which leads some species to flourish, some to extinct and some to categorize as endangered.

Nepal has separated 23.23 percent of total area for national parks, conservation areas, wildlife reserves and hunting reserve as protected land for valuable flora and fauna, which is around 34,185.62 sq. km. (Department of National Parks and Wildlife Conservation, 2012). Majority of the ecosystem are found in Nepal, except desert and ocean. It is recorded that Nepal has a total of 118 types of ecosystem, 75 types of vegetation and 35 types of forests. There are 12 National Parks, 1 Wildlife Reserve, 1 Hunting Reserve, 6 Conservation Areas and 12 Buffer Zones in and around the national parks and wildlife reserves (DNPWC, 2017).



There are numerous species of birds found in wide variety of habitats all around the world. Therefore birds are considered to be one of the most populous organisms. From brightly coloured humming birds to Pheasants, birds are the most beautiful and peculiar creatures found in earth. There are about 9000 species of birds with a tremendous diversity living in the world today. Besides their beautiful feather, their melodious voice and artistic behaviour, birds are important for various aspects. Some of them are used as sensitive indicator of pollution, birds even play great role to control pest etc. (Shrestha, 2000).

Avifauna are highly diverse in Nepal considering the size of the country. Nepal is exceptionally rich for avian fauna with a total of 878 species recorded in just about 200 years of modern ornithological research (DNPWC & Bird Conservation Nepal, 2016). As many as 130 breeding and wintering species (15% of Nepal's birds) have been assessed as nationally threatened of which 38 are endangered, 62 vulnerable and 22 are data deficient (Inskipp et al., 2016). However, according to Bird Life International (2015) 37 species of the total Nepalese birds are listed in IUCN Red List which are considered as globally threatened. Among these, 8 species are critically endangered, 6 endangered and 23 are listed as vulnerable. The majority of Nepal's threatened birds are found in lowlands. Major habitat of birds include the forests, wetlands and grassland (BCN & DNPWC, 2011). According to Grimmett et al. (2000), forests and bushes contribute 77% of Nepalese breeding birds. Many Nepal's resident species (approximately 550 species) among 878 species are seasonal altitudinal migrants, these species breed at higher elevation in mountain region and descend to lower altitude for wintering (Singh et al., 2016).

The nine species of birds that has been protected by National Parks and Wild Life Conservation Act 1973, Government of Nepal shows White Stork (*Ciconia ciconia*),

Black Stork (*Ciconia nigra*), Himalayan Monal (*Lophophorus impejanus*), Satyr Tragopan (*Tragopan satyra*), Cheer Pheasant (*Catreus wallichii*), Bengal Florican (*Houbaropsis bengalensis*), Lesser Florican (*Sypheotides indicia*), Sarus Crane (*Grus antigone*) and Great Hornbill (*Buceros bicornis*) respectively. The status of migratory birds of Nepal includes:

- a. Residents
- b. Summer migrants
- c. Winter migrants
- d. Passage migrants

With the end of the monsoon and the arrival of winter, huge numbers of migratory birds make their way toward Nepal, travelling hundreds of miles from their home regions. Towards the end of monsoon, insects reproduce and serve as food for birds. Migratory birds are important as they eat up the excess insects to keep the environmental balance (Bhushal, 2013).

Varieties of migratory birds come in the lowlands of Himalayan region, mountain and Terai, in their lakes, wetlands and riversides just to tide over the winter season. About 150 species of winter migratory birds come to Nepal from the countries of the North pole viz., Russia, Kirgistan, Turkistan, Uzbekistan, Azarbaizan, China, Mongolia, Eastern Europe, Korea, Siberia and Tibet in search of warmer and pleasant weather every winter. There are about hundred migratory species that transit through Nepal in their long range migrations from countries of the North Pole to Africa, Indonesia and Sri Lanka. Furthermore, in rainy season thousands of birds migrate to Nepal for breeding every year (Bhushal, 2013).

The winter migratory birds come to various wetland areas of Nepal viz., Koshi-Tappu Wildlife Reserve, Suklaphanta National Park, Chitwan National Park, Bishajari lake, Jagadishpur lake, Ghodaghodi lake as well as the Koshi, Gandaki, Karnali, Narayani rivers and their tributaries. The winter migratory birds start coming to Nepal from October to November and by March they return to their home regions. Similarly, the time period from October to March is considered as the season of winter migratory birds (Subedi, 2015). The birds which come to Nepal as winter migrants comprise mostly of Duck species and Raptors, the other species are Thrushes, Flycatchers, Leaf Warblers and Wagtails [Baral and Inskipp (2005), Bhushal (2013)].

Nepal is also one of the best destination for the summer migratory birds due to favourable breeding environment. The summer migratory birds from southern parts of South-East Asia as well as from Africa and Australia come to Nepal from March to May and by the month of September they also return to their native habitats after breeding. A total of 40 migratory birds species visit Nepal every summer for breeding purposes. Different varieties of Cuckoos are among the summer migratory birds which breed during their stay in Nepal. Other summer migrants are Chestnut-headed Bee-eater (*Merops leschenaulti*), Hooded Pitta (*Pitta sordida*), Asian Paradise-flycatcher (*Terpsiphone paradisi*). The main habitats of the summer migratory birds include the forests and adjoining grasslands (Bhushal, 2013).

The above trend shows the migration of birds in Nepal is an annual phenomenon which comprises both winter migrants as well as summer migrants.

These migratory birds come to Nepal either directly or by stopping on the migratory routes. These birds take the help of sun, stars, rivers, physical ranges, magnetic

directions etc. to reach their destinations. Amazingly, there are non-stop travellers who cover the entire journey within two days. They come here via the Kaligandaki valley in the west and the Arun valley in the east. There are some special birds among migratory birds like Bar-headed Goose (*Anser indicus*) which fly over 9 thousand 3 hundred and 65 meters higher than Mt. Everest and come to Nepal as well as in Chitwan National Park in winter season (Hawkes et al., 2011). Likewise, the summer migratory bird Pied Cuckoo (*Clamator jacobinus*) comes to Nepal from African continent by travelling through a distance of around 5000 kilometers. Climate change has forced birds to change their migratory patterns. The destruction of wetlands, pollution of rivers and lakes, use of pesticides in agriculture and depletion of forest has led to dwindling of the bird populations (Bhushal, 2013).

## **1.2 Statement of the Problem**

The researcher has undertaken this research on the basis of hypothesis mentioned on chapter 1.4, believing study on seasonal change of bird diversity has not been carried out for a long time in Chitwan National Park (CNP). Evidently, there have been minor studies that were carried out randomly but not significantly. As the time is passing by, notable changes have occurred within the protected area in terms of climatic changes, human encroachment, and vegetation variation. There have been natural disasters – natural flooding, landslides, civil war-which forced insurgents to take shelter around this park. Besides these problems, human invasion into the park to collect fodders, plants and even animals to meet their daily need is rampant, thus resulting in ecological nuisances to those who take this CNP as their natural habitat.

According to the Shrestha (2000), Some bird species were seen and recorded on specific seasons, which support the idea that CNP is a welcoming in-transit habitat

for those migratory birds who take a short rest to rebuild their fat mass to re-energize or who travel through this area to avoid inverse climatic changes to their natural habitat, however there are no such birds recorded recently. Seasonal changes may be drastically affecting the avifauna of this area in the present context. In each and every biotic and abiotic system, there is always certain threshold which has to be within limits to run the system efficiently.

The researcher believed that to keep the natural homeland of birds as CNP, those problematic areas have to be answered for proper management. Nepal is well known for tourism. Domestic and international tourists are always flooding into this beautiful Himalayan country to witness the magnificent landscape with floral and faunal diversity. And, there is no doubt, bird watching is no exception to help increase country's tourism sector. Currently there is no detailed study carried out in CNP on these mentioned issues.

### **1.3 Objectives**

- ) To assess the seasonal diversity of birds in Chitwan National Park.
- ) To find out bird species richness and distribution in Chitwan National Park.
- ) To estimate the population status of migratory and resident bird species in Chitwan National Park.
- ) Contribution towards the development of conservation plans and future management strategies for protecting birds.

### **1.4 Hypotheses**

Some important hypotheses of the proposed research work are following:

H1 : There is significant difference in seasonal diversity of birds in CNP.

H1 : There is significant difference in distribution pattern of birds in CNP.



H1 : There is significant difference in population density of different birds in CNP.

H1 : There is significant difference in density and diversity of winter and summer visitors in CNP.

## **1.5 Theoretical aspect of the research**

The bird species varies with space and time from micro to macro scale. This is the central ecological question for the ecologist that why and how species are varied with habitats and landscape. The bird species varies with season, vegetation types and other habitat characteristics. Some avian fauna are migratory and some are endemics. This is another ecological question why the qualitative and quantitative variation of avian fauna with local habitats and regional ecological characteristics.

In various subject areas, diversity's concept arises naturally. Diversity can be intuitively related to the application of some quantities into various well-defined categories which may take the form of resources, investment, time, energy, abundance, etc in regards to the problems under study (Patil & Taille, 1979a).

A commonly invoked theory that predicts a positive relationship between species richness and available energy is the Species-energy theory (Brown, 1981; Wright, 1983; Wright et al.,1993). A variety of taxa's species richness has been seen to be increased with a number of resource-based estimates of available energy that includes potential and actual evapotranspiration (Wright, 1983; Currie & Paquin, 1987; Currie, 1991; Francis & Currie, 2003).

Alexander Von Humboldt (1807) suggested the earliest hint of one of ecology's most pervasive rules : larger areas contain more species than do small ones. The Species-

energy relationship rule is viewed as ecology's one of the very general laws by majority of ecologists (E.g. Lawton, 1999; Rosenzweig & Ziv, 1999).

The processes affecting diversity may operate at different spatial scales for different species which is a key issue that complicates the interpretation of species diversity. However, ecologists are likely to oversee them from a human perspective rather than from the perspective of the organism under study (Wiens, 1989b).

The equilibrium theory of island biogeography (e. g. MacArthur & Wilson, 1967) and metapopulation theory (e. g. Hanski & Simberloff, 1997) are two important dispersal-based theories. They rely on the action of organism dispersal, particularly the immigration of individuals to sub-populations. These two theories have been applied to complex landscapes that experienced habitat loss, fragmentation and similar disturbances (Collinge, 1996).

Time minimization is often assumed as the most relevant currency in optimal migration theory. Also, that the traits which amplifies the overall migration speed is favoured by natural selection (Alerstam & Lindstrom, 1990). Derivation of a number of testable predictions for the migration process is allowed by this theory.

Then there is the Homesick theory which suggests that birds return back to their birthplace in spring due to a strong desire driven by home-sickness. Those who are accustomed to endow birds with semi-human attributes; sentimental rather than anatomical, favor this theory. However, this theory suffers from the fact that most birds forsake their homes the moment their nesting duties allow, for this is not expected if they were tremendously affectionate for a particular locality as this theory implies. Similarly, saying that birds have a "desire to disperse" every year in

spring as Dixon suggests in his theory makes this question of what actually causes this dispersal arise.

## **1.6 Contributions of the study**

Study is challenging but result will be welcoming, which contributes the detail information especially in species diversity and ecology of avian fauna in Chitwan National Park. It contributes to manage critical habitat, essential habitat and recovery areas to maintain and enhance the recovery of threatened birds species as well as endangered species, based on information provided at end of this study.

Likewise, It will also contributes to provide timely availability of data, which is very critical to support the bird conservation activities as well as very useful in planning and evaluation of bird conservation strategies. It will contribute to provide educational information on general public, which will be a one of the major factors to restoring bird habitat, cleaning biohazards, and minimizing human disturbances. It will make easier to management to implement conservation measures.

This study also contributes to identify the conservation threats of bird communities in proposed study area such as natural and anthropogenic causes. Furthermore, this study contributes to provide scientific information to the future researchers and will enrich hitherto scanty knowledge of the field. Lastly, it also helps to develop the appropriate conservation policy for avian fauna conservation in Chitwan National Park as well as in Nepal.

# Chapter 2

## 2 Literature Review

Birds are very sensitive to environmental changes and are used as a 'bio-indicator'. They are very important resource in the forest because of their ecological role and recreational values. An important ecological feature of birds mainly concerns to factors that influence their number and their diversity. The abundance of birds numbers and species both depend upon availability of seasonal nature of food resources (Mengesha & Bekele, 2008). The change in diversity of vegetation will alter the composition of bird community in nature (Acevedo & Aide, 2008). A total of 9,930 species of birds are existed worldwide which belong to 204 different families (George, 2010).

Birds are present in different types of habitat. They are among the important groups that play an important role in the ecosystems. They are providing numerous ecological benefits such as, seed dispersal, the pollination of many tropical plant species and the facilitation of forest restoration. They are also important source for pest control through the consumption of insects and small rodents, which can devastate large areas of agricultural products. Although less than 1% of the world's bird species prefer to stay in agricultural areas as their primary habitat, nearly a third of all bird species use such habitats occasionally (Sekercioglu, 2012). Some agro ecosystems can also harbor a substantial portion of the biodiversity found under the original land cover and can buffer and complement protected areas (Curran et al., 2004).

Seasons require contrasting demands on animal species, which must respond with behavioral and physiological adaptations. It also includes shifting resource use or migration to other geographical areas with acceptable or more adequate conditions (Sua'ez-Seoane et al., 2008). These specific responses translate to greater community patterns in accordance with seasonal variation in environmental factors (Laiolo, 2005). Composition and species richness of bird communities is associated with habitat and also abiotic factors such as temperature and precipitation. These are directly related to primary productivity, and it has been studied in both at local and regional scales and at different periods of the year (Honkanen et al., 2010).

During the breeding season, birds restrict their mating to a central place. This is due to saving of time and energy which is imposed by incubation and chick rearing duties. The breeding birds show marked habitat preferences in relation to vegetation structure. The structural complexity of vegetation seems to be the most important element determining species richness and diversity at the local scale (Hinsley et al., 2009). During the winter period, when food resources are much scarcer and weather conditions unpredictable, birds adopt a changing lifestyle. They explored a greater variety of habitats over larger areas to track the spatiotemporal distribution of food availability (Wiktander et al., 2001). To determine bird distribution at local scales, it should be expected that vegetation structure loses importance in winter with respect to the breeding season. The ordered gains and losses of species in assemblage is hypothesized to decrease in periods of high mobility and relaxed habitat preferences, as is the case during winter time (Murgui, 2010).

Wintertime air temperatures in temperate zones of the northern hemisphere are below the thermo neutral zone for small birds. The duration of night time is considerably longer than that of daytime. The wintering birds might respond to spatial variations

in temperature, resulting in higher population observed in warmer areas (Carrascal et al., 2012). The species–energy relationships arise because high-energy areas support more individuals. These larger populations may buffer species from extinction, thus leading to an increase of species richness (Evans et al., 2005). The stressful temperatures do not usually occur in the breeding season, except for sudden frosts and periods of bad weather conditions in early-mid spring that can compromise reproduction success. The temperatures in the seasonal environments of temperate areas rise from winter minimum to high summer temperatures, which can be above the upper critical temperature for small birds. Therefore, it is expected birds that avoid the warmest areas in summer in order to reduce overheating and drought stress. It is supported by recent changes in species and assemblages in response to extreme heat waves (Jiguet et al., 2011).

## **2.1 Birds in world**

Mundy et al. (1992) reported that vultures are the primary consumers of carrion in Asia and Africa. Twenty two species of vultures are found in world. Nine species of vultures have been recorded from South Asia, of which eight are resident and one migratory. Johnsingh and Joshua (1994) found bird species diversity index 3.04 in dry deciduous forest, while 2.83 in secondary vegetation in Mundanthurai Plateau, southern India. Estrada et al. (1997) discussed the distribution of birds in different land use types where they found more species in cultivated land, followed by forests, fences and pasture land.

Chaudhry et al. (1997) studied the avifauna of Cholistan. They identified 58-bird species representing 42 genera, 26 families and 12 orders, including *Chlamydotis*

*undulate*, *Pterocles orientalis*, *Elanus caeruleus*, *Accipiter badius*, *Cursorius coromandilicus*, *Eremopterix alaudipes* and *Lanius excubitor*.

Grimmett et al. (1998) published a very famous book entitled “Birds of the Indian Subcontinent”. All species recorded in the sub-continent upto the end of 1996 have been described in this book. In early 20<sup>th</sup> century, a large number of birds in the subcontinent (and elsewhere) including several species had been collected by Col. Richard Meinertzhagen which had not been recorded by other ornithologists. This book helped observers identifying all of the birds species recorded in the subcontinent. All species are illustrated in colour in their book.

Cueto and de Casenave (2000) found more number of birds in spring (pre-monsoon) than in autumn (post-monsoon) season. The seasonal variation (climate and temperature) has direct influence and effect on the species richness of avian community. The food varies with the seasons ultimately the composition of the birds change accordingly.

Manakadan and Pittie (2001) reported that the Indian subcontinent has 1340 bird species which is over 13% of the world’s birds. Gori et al. (2003) studied the re-colonization of water bird following the wetland and rehabilitation in Hortobagy National Park, Hungary. Azam (2004) studied the avifaunal biodiversity of the National Hingol Park in Pakistan and recorded 105 bird species belonging to 68 genera, 37 families and 14 orders from different habitat types including coast, freshwater wetlands, desert and hills. He noted the abundance of birds belonging to Charadriiformes while larks and shrikes were relatively more numerous in desert areas. Hoopoe was found winter visitor

Green et al. (2004); Shultz et al. (2004) stated that extensive research undertaken within India, Pakistan and Nepal has established that the non steroidal anti inflammatory drug (NSAID) diclofenac is the main, and perhaps the only, cause of the population decline. Laiolo (2005) analyzed birds on mixed forest, pure juniper forest, dwarf rhododendron shrubbery and cultivations land. He found higher diversity of birds in mixed forest whereas terraced cultivation acts as a prime habitat for the wintering birds.

Dinesh et al. (2007) prepared a checklist of 135 birds based on observations from October 2000 to October 2001 in different ecotypes in Karnataka district of India. Prakash et al. (2007) reported that within Nepal, India and Pakistan vulture populations have undergone dramatic declines in numbers since the mid 1990s, declines in excess of 97% for three resident species (White-rumped Vulture *Gyps bengalensis*, Slender-billed Vulture *Gyps tenuirostris* and Indian Vulture *Gyps indicus* ). In India, numbers of white-rumped vultures have declined by 99.9% from 1992 to 2007. Dutta et al. (2008) reported a checklist of 113 species of birds in Assam University, Silchar campus and its adjoining areas is available. They also recorded birds in diverse habitats including tea gardens, grassy areas, jungles, forest, and agricultural lands and near villages.

Hedenstrom (2008) found that breeding, moult and migration are the annual life cycle of many birds. The extent of investment in any one of these time and energy consuming processes may compromise the others. Some core components of optimal migration theory along with some key predictions are reviewed. Analysis of accumulated empirical tests of the departure rule suggests minimization of time is an important aspect of the overall migration strategy, hence giving support to the assumption about time-selected migration. The discussion about how the optimal



policy may be implemented by the bird by applying a set of simple rules is also presented in his work. There is direct relationship between the time constraints on migrants and their body size.

Mc Cain (2009) concluded climate as a key influencing factor for the diversity of birds along elevational gradients. Most of the research concluded that the species richness decreases monotonically (unvarying) with increase in elevation and with humped shaped pattern where the species richness peaked at the elevational range below 2000m. Mahboob and Zaib (2009) studied an avifaunal diversity of Trimmu barrage; district Jhang of Pakistan, on monthly basis for a period of nine months. They recorded a total of 9699 birds 89 species belonging to 68 genera, 39 families and 15 orders. Among them 29 species were migratory and winter visitor, four were migratory but summer breeders, four ordinary migrants and 52 were resident. Passeriformes was the most dominant order represented by 36 species belonging to 18 families. The maximum numbers of bird species were found during midwinter and minimum during summer.

Sarkar et al. (2009) studied on diversity and population status of avifauna of two urban sites in Dhaka, Bangladesh during August 2004 to July 2005. A total of 27 species of birds belonging to 14 families and 8 orders were recorded from two study sites (Sector 7 and 9). Species diversity was higher in Sector 7 than in Sector 9. Regarding the relative abundance, the maximum number of species of birds 11 (44%) was very common, 8 (32%) was fairly common and 6 (24%) was rare in Sector 7. Comparatively, highest number of species of birds 7 (38.9%) was very common, 5 (27.8%) was fairly common and 6 (33.3%) was rare in Sector 9. The result of this study showed that the Sector 7 is suitable habitat for avifauna than Sector 9.

According to the report of Avibase (2010), more than 50 percent of the existing avian species belongs to Passeriformes. The highest density, diversity, richness, abundance were recorded from the forest habitat. The high density, diversity, richness abundance of birds in forest habitat may be associated with the presence of sufficient amount of food, and availability of nesting materials.

Martin et al. (2011) studied about Species Richness and Diversity of Resident and Migratory birds in Remnant Forest Patches in the Florida, USA during March-May 2004 and 2005 and they recorded 68 species of birds. Out of 68 species, 47 species (69%) were migratory species and 21 species (31%) were year-round resident. They further emphasized the necessity of making suitable stopover habitat along migratory routes and also destination habitat near large geographical barriers.

Mahboob et al. (2013) recorded 55 bird species belonging to 42 genera from 28 families representing 13 orders from the area. Among these species 13 bird species were migratory and winter visitor, 5 migratory but summer breeder, 1 ordinary migrant and 36 residents which were found throughout the year. A total of 25,50,219 birds were estimated in the Thal Game Reserve area of Pakistan.

Bibi and Ali (2013) identified avian diversity at Taunsa Barrage Wildlife Sanctuary of Pakistan from 2009 to 2011. The researchers collected the data by direct observation method. In total, 171 species of birds representing 53 families were recorded. Out of 171 species of birds, 42 % were year-round residents, 7 % summer breeders and 38 % were winter visitors and passage migrants. Shannon-Weiner Diversity Index ( $H'$ ) was calculated 3.39 in their report.

Gatesire et al. (2014) conducted a study on bird diversity and distribution in relation to Urban Landscape Types in Northern Rwanda during March 2012 by using point

count method, linear mixed models and Shannon's diversity index analysis. In their report, One Albertine Rift endemic bird species, the Duwenzori Double-Collared Sunbird (*Cinnyris stuhimanni*), was recorded. Similarly, three migratory birds were also found for the first time: the Common Sandpiper (*Actitis hypoleucos*), the Spotted Flycatcher (*Muscicapa striata*), and the Willow Warbler (*Phylloscopus trochilus*).

Pathan et al. (2014) recorded 138 bird species belonging to 13 orders and 48 families during January 2013 to December 2013 in Swat Valley; part of the Federally Administered Tribal Areas (FATA) of the Khyber Pakhtunkhwa province of Pakistan. The Passeriformes was the most dominant order with 31 species mentioned in their report. Most of the recorded avian species were migratory and few were resident.

Koli (2014) recorded 142 species of birds representing 18 orders and 45 families in Todgarh-Raoli Wildlife Sanctuary, Rajasthan, India during January 2013 to December 2013. In his report, Muscicapidae was the largest family with 23 species. The researcher kept the recorded data separately in each survey and later analyzed for relative abundance on the basis of frequency of sightings, according to Mackinnon and Phillipps (1993) method. The author found 99 species of birds were residents, 6 species were winter migrants, 3 species were summer migrants and 14 species were passage migrants.

Singh (2015) studied the seasonal diversity of birds in Solan district of Himachal Pradesh during 2010-2011. He observed 93 species of birds belonging to 9 orders and 26 families during two seasons (summer and winter). The seasonal status of bird species was Summer (57) and Winter (73). In his report, the highest numbers of bird species belong to order Passeriformes and family Muscicapidae. Shah et al. (2016)

studied the diversity of avifauna of Chamba District of Himachal Pradesh with emphasis on Kalatop-Khajjiar Wildlife Sanctuary and its surrounding between 2012 and 2013. They recorded 95 species of birds belonging to 12 orders and 40 families. In their report, 41 species of birds were common followed by occasional (34 species) and rare (20 species). Maximum number of species were resident (83 species) and the rest were 9 winter visitors and 3 summer visitors. They also reported 11 species of new birds for the study area.

Study conducted by Agarnesh Desalgn and C. Subramanian (2015) reported that a total of 89 species of birds were recorded from in Ehiopia which indicates that the area is rich in avian diversity. Majority of the bird species (58 species) belongs to the order Passeriformes. Lepage (2016) reported that Ethiopia harbours 863 species of birds, of which 639 are resident and 224 are regular seasonal migrants, including 176 from the Palearctic and 48 inter-African. He indicated that 19 species are endemic to Ethiopia whereas 31 are globally threatened, 1 introduced species.

Chakdar et al. (2016) conducted a bird survey from February 2011 to June 2011 in Assam University campus, Silchar and found 73 species of birds belonging to 13 orders and 32 families. Girma et al. (2017) found a total of 33 migratory bird species from the southern part of Ethiopia, of which 20 species were northern (Palearctic) migrants while 13 were inter-African migrants. There was a significant difference in the mean abundance of migratory bird species between dry and wet seasons.

## **2.2 Birds in Nepal**

Several ornithologists contributed for the Nepalese ornithology. Hodgson (1846) performed important work on bird of Nepal. He made two extensive collections

comprising 9,512 birds in 20 years periods from 1820 to 1840. Scully (1879) also made good collection of birds which included 2000 different specimens belongs to about 300 different species of birds. Bailey (1938) made an important collection of 381 different bird species during 1935-1938, from Nepal. Ripley (1950) made a wide-ranging collection of birds in the area between far-west parts of Nepal in between 1947-1949. His collection included 1600 specimens representing about 300 species. The latest edition of his classical book 'search for the Spiny Babbler *Turdoides nipalensis*' in 1953 is a marvel of naturalist adventure in Nepal. He was also the scientist who discovered Spiny Babbler (*Turdoides nipalensis*) in Rekha village of Karnali zone in 1950 after a gap of 160 years. Desire Proud published several research papers between 1949-1961 giving observations on birds mainly related to Gandaki-Koshi watershed and Kathmandu.

Biswas (1960) collected 3500 bird specimens including 350 species around Kathmandu valley. Diesselhorst (1968) undertook an ornithological expedition and described distribution, altitude range and breeding places of Nepalese birds. Ali and Ripley (1968-74) have included in greater details latest information about birds in Nepal. Crosin (1974) found several new species of birds through and from the Arun valley of Nepal. Since 1970, several ornithologists and bird watchers have observed and recorded different species of birds in Nepal. Every year a new species is recorded. Kirkpatrick (1973) was the first person to observe a few game birds species in Nepal. Various contributions have been made since then significantly by various authors.

Fleming et al. (1976) produced the first field guide of the birds of Nepal. Many of the facts in guide described about birds of Nepal arising from their own studies of birds in Nepal. The most remarkable work was done by Flemings, the father and son team

who devoted several decades in Nepal. They also authored the field guide to birds of Nepal which was first published in 1976. Many of their collections are at present in Chicago Field Museum of Natural History, USA. Flemmings et al. (1979) were the pioneer ornithologists who described the birds of Nepal. They also described avian fauna of Chitwan National Park. Martens (1980) contributed in greater details to the ornithological studies of Nepal.

Nepali (1984) collected different species of birds from Nepal. His main collection is kept in National History Museum, Kathmandu. Checklist of birds prepared by him gave information about several new species. In 1974, he rediscovered Dunlin (*Calidus alpines*) in Nepal.

A very valuable work on birds of Nepal has been done by Inskipp and Inskipp (1985). They first published a book in 1985 entitled 'A Guide to birds of Nepal'. It was subsequently published in 1991. The main aim of the book was to map and summarize the distribution of birds of Nepal, the information was collected from published literature, museum specimens and unpublished reports and other records received from numerous Ornithologists comprising about 800 references.

Mierow (1988) authored a plentifully illustrated book 'Birds of the Central Himalaya: An Ecological Approach'. This book introduce about the common birds of the Himalayas which is very helpful for both beginners and scientists. Heinen (1987) studied the birds of Koshi Tappu wildlife reserve and Koshi Barage in Eastern part of Nepal. Singh and Roy (1990) studied the systematic of birds colonizing Kavar Lake (Begusarai, Bihar).

Sharma (1994) reported that the application of pesticides on commercial vegetables was 1450g/ha, which is exceptionally high in the Nepalese context. Subba (1994,

1995 and 1997) made checklist of bird of Dharan, Biratnagar and Gajurmukhi VDC, Ilam respectively. Biodiversity profiles project (1995) has given data about birds of Nepal. This project is a scientific milestone in the methodical documentation and presentation of then available information, published as well as field observations, about fauna of Nepal. BPN 1996 recorded numerous fauna of orders including 844 species of birds.

Chaudhary (1996) reported that Koshi Tappu has the largest heronry in Nepal where as many as 25,730 nests belonging to 12 species of medium to large wader. As many as 20 globally threatened bird species have been recorded in the Koshi Tappu and Koshi Barrage area and 11 of these occur regularly. This area is an Important Bird Area especially for some wetland and grassland species, notably Swamp Francolin (*Francolinus gularis*), Lesser Adjutant (*Leptoptilos javanicus*), and Bristled Grassbird (*Chaetornis striatus*). Baral (1995) has highlighted the urgency of surveys and some of the threats to the Bengal Florican (*Houbaropsis bengalensis*). Baral and Upadhyay (1998) studied the status, distribution and habitat preferences of Swamp Francolin (*Francolinus gularis*) in Koshi Tappu National Park and Suklaphanta National Park on several occasions between 1991 and 1995. He estimated the total population of 212 individuals in Nepal.

Dahal (1999) carried out a study on status and conservation of Swamp Francolin (*Francolinus gularis*) in Koshi Tappu Wildlife Reserve in 1999. He observed 80 individuals and recorded 106 call in May and 90 individuals and 122 calls in October-November. Grimmett et al. (2000) wrote a very informative book on birds on Nepal. The author describes all 760 species of birds found in Nepal with brief description of each bird. The ornithologist also described avian fauna of Chitwan National Park. He reported that elevational gradients as a proxy are a powerful tool

to study the responses of biotic communities to different environmental factors. In general, species diversity of birds changes with the elevational gradients. The range of elevational gradients of individual species is explored in the Birds of Nepal.

Shrestha (2000) has also written very colourful book on 'Birds of Nepal' in 2 volumes. That book includes field ecology, natural history and conservation. Some information about Chitwan birds is also included in that book.

Shakya et al. (2000) carried out a survey of Swamp Francolin in March-April 2000. They found 8 birds/ Km<sup>2</sup> at Chitwan, 14.26 birds/ Km<sup>2</sup> at Koshi Tappu and 23 birds/ Km<sup>2</sup> at Sukalphanta Wildlife Reserve. Baral (2000) recorded 461 species of birds representing 58 families in his study in Koshi Tappu Wildlife Reserve. At least 176 species breed in the reserve and 180 species are passage migrant or visitors.

Inskipp and Inskipp (2001) revisit to Nepal's lowland protected areas by the researchers who first surveyed floricans in 1982 further confirmed the degraded quality of grasslands.

Baral (2001) have concluded that the biggest threat to the Bengal Florican in the protected area is inadequate management of grasslands. He has further suggested that there may not be a viable population in Nepal. He also reported that the drastic reduction in the area of lowland grasslands must have directly impacted on populations of birds that utilize this habitat type. Outside protected areas, there are no significant remaining grassland areas that are capable of supporting threatened birds.

Baral (2002) studied the three protected areas in the Terai of Nepal during 2000–2001 to determine the species status and distribution. He found that most sightings were of males in flight, in aerial and ground displays, whereas only three females



were recorded during the survey. Altogether 21–30 birds were recorded from the three protected areas, and total populations of 32–60 individuals were estimated.

Shrestha and Neupane (2002) found that while rice, maize, wheat and mustard were treated one to three times per crop cycle, the cash crops potato, tomato, cabbage, bitter gourd and cucumber were treated two to 15 times. The ornithological survey conducted during 1990s had recorded 194 species of birds from SNP. Later, sightings of 22 additional species of the birds were reported from Sagarmatha National Park and its buffer zone.

Price et al. (2003) had considerable variation in species richness of birds along the Himalaya. Such variation is due to different environmental gradients and isolating factors

Baral and Inskipp (2004) have published about “The State of Nepal’s Birds” which list 861 birds of Nepal. The work was done in collaboration with Bird Conservation Nepal (BCN), DNPWC and IUCN. BCN is the foremost scientific authority providing accurate information on birds and their habitats throughout Nepal. This organization was established in 1982. It works closely in birds and biodiversity conservation throughout the country. Almost all these unprotected grasslands are intensively grazed by domestic livestock all year round and face other human pressures, notably overwhelming disturbance. As a result of serious threats to lowland grasslands that arise chiefly from agriculture, 17 bird species that depend on grasslands were considered at risk nationally, 14% of the total threatened.

Baral et al. (2004) reported that monitoring of vultures in Nepal indicates declines of a similar magnitude with a >90% decrease in numbers up to 2001.

Singh (2004) studied the population status and habitat utilization of Swamp Francolin in Suklaphanta Wildlife Reserve in April-June 2004 and estimated a maximum 46 pairs of birds at Suklaphanta, Jhilmila, Singhpur and Kalikitch grassland of the reserve.

Baral (2005) reported that a large number of bird species (485) has been recorded in the Koshi Tappu and Barrage area. Koshi is by far the most important wetland staging post for migrating waders and waterfowl in Nepal and have been considered one of the most important in Asia.

Baral and Inskipp (2005) in their report stated that it holds the largest population of globally threatened Swamp Francolin (*Francolinus gularis*) in Nepal and also supports a good population of the Bristled Grass Bird. They also mentioned 35 globally threatened birds in RCNP and the globally threatened Indian Spotted Eagle has bred in the park, one of its few known breeding localities in Nepal. The large proportion of 15 out of 22 of Nepal's near-threatened birds has been found in Chitwan. Only two restricted-range species have been recorded and both are rare visitors.

Chhetry DT (2006) studied the diversity of wetlands birds around the koshi barrage areas of Nepal. Koshi Barrage area comprises of a large reservoir, marshland channels, floodplain, reed beds etc. which support fascinating birdlife. During their study altogether 98 species of wetland birds belonging to 60 genera and 18 families were found. Out of these, 41 winter visitors, 4 summer visitors, 14 rare visitors and 39 residents.

Bhujju et al. (2007) reported that as of today, 874 species of birds are reported from Nepal in NBRB 2006. The Mid-hills constitute the greatest ecosystem and species

diversities in Nepal. Nearly 32% of the forests in Nepal are found in the Mid-hills, and the zone includes 52 types of ecosystems. The mid-hills centre harbours the highest number of mammal (55%) and bird species (77%).

Basnet TB (2006) studied the bird diversity in Balewa area of Baglung District from January 2005 to July 2007 in four seasons. He found one hundred and sixty six species of birds. There were five species common, and twelve species fairly common, 34 species occasional and 115 species uncommon. They found a total of 74 species of birds during the first survey in winter, second survey in summer had recorded 98 species, third survey in autumn had recorded 84 species and fourth spring seasonal survey had recorded 96 species of birds.

Koirala et al. (2007) reviewed the occurrence of pesticides in foods in Nepal during 1995- 2004. Among a total of 1,034 samples of different food commodities analysed, 12% of samples were detected with residues of pesticides including malathion (3.9%), BHC (3.1%), methyl parathion (2.8%), DDT (1.8%) and parathion (0.3%). Based on commodity, detection of pesticide residues showed the highest level of contamination in root vegetables (11.9%), followed by leafy vegetables (10.9%).

Surana et al. (2007) stated that avian diversity of Chimdi Lake during rehabilitation stage was studied. 109 species of birds belonging to 34 families were recorded. Maximum 64 species were recorded in March 2004 and 20 species recorded in July 2004. Out of total bird species, 33.94% were migratory, 25.68% were resident, 24.77% were winter visitors and 15.96% were summer visitors. On the basis of abundance, 41.28% were scarce, 22.9 % were occasional, 21.1% were fairly common and 14.6% were common. The lake area was found to be rich in avian diversity although the lake was not fully rehabilitated. Poudyal et al. (2008) gave the most up-

to-date survey data on this species from Chitwan, Bardia and Suklaphanta, the major Nepal strongholds of the species.

MoFSC (2009) reported nine species of vultures in Nepal. Among them six species were resident Bearded Vulture (*Gypaetus barbatus*), Egyptian Vulture (*Neophron percnopterus*), Himalayan Griffon (*Gyps himalayensis*), Red-headed Vulture (*Sarcogyps calvus*), Slender-billed Vulture (*Gyps tenuirostris*), White-rumped Vulture (*Gyps bengalensis*), one was winter migrant Cinereous Vulture (*Aegypius monachus*), Griffon Vulture (*Gyps fulvus*) was a passage migrant and Indian Vulture (*Gyps indicus*) was a vagrant.

DNPWC et al. (2009) indicated that over 90% different species of vulture number decreases from 1995 to 2009 in Nepal. White-rumped Vulture (*Gyps bengalensis*), once the most common vulture occurring up to 1000 m in Nepal has declined by a catastrophic 90 to 95% within the last 15 years.

Acharya et al. (2009) stated that a decrease of 84% of active nests of Himalayan Griffon (*Gyps himalayensis*) was recorded between 2002 and 2005 and was thought highly likely to be due to diclofenac poisoning. The numbers of Bearded Vulture (*Gypaetus barbatus*) recorded per day decreased by 80% between 2002 and 2008 and although the cause is unknown, diclofenac is suspected. Nowadays the entire vulture group in Nepal seems to be facing problems.

Thakuri and Thapa (2009) reported that a total of 27 important Birds Areas (IBAs) had been identified in Nepal. Thirteen IBAs are within protected areas. Dhorpatan Hunting Reserve (DHR) is one of the IBAs. DHR was a habitat of 137 species of birds among which Cheer Pheasant (*Catreus wallichii*) is listed in endangered category of IUCN red data list. In Nepal, growing number of amateur bird watchers

have reported several new species of birds. However, there is need of validation of these species.

Basnet (2010) found higher species richness of birds in lower elevational zone (1400 m.-1700 m.) due to the edge effect. He analyzed the species richness. Composition of breeding birds concluded more species richness can be found in moderately disturbed area than in disturbed one. Also, he argued of having higher alpha diversity in moderately disturbed area but higher beta diversity in the disturbed landscape. However, he observed no marked change in species richness of birds between 1700 m.-2400 m. Bird Life International (2010) informed that of the 35 globally threatened species recorded in Nepal, 15 are wetland birds (43%). In addition, a total of 12 out of 24 near-threatened species (50%) inhabit wetlands, see table 2. Many of the wetland birds found in the country are passage migrants and winter visitors.

Thakuri (2011) reported 201 bird species of Reshunga forest during 20 days survey work covering four seasons. He used Mackinnon and Phillips method for this study. A total 91 Mackinnon's list were prepared during the survey. He prepared 20 lists from autumn season followed by 24 from winter, 26 from spring and 20 from summer season. In his report, highest number of bird species was recorded from spring season with 125 species followed by winter with 115 species, summer with 109 species and least species from autumn with 98 bird species.

BCN and DNPWC (2011) are concentrated on a broad scale of landscape approaches. They have identified the bird's habitat in different land use types like cultivated areas, grasslands, alpine zones, wetlands, bushes or shrubs, open or meadows, different forest type, rocky mountains, ponds, lakes, rivers and streams. They revealed facts about the habitat utilization of nationally threatened bird species

(149). According to the study forest inhabited 79 species (53%), wetlands 40 species (27%), grasslands 23 species (15%), cultivation 12 species (8%), open country 14 species (9%), shrub 7 species (5%), near human habitation 4 species (3%), and semi-desert 1 species (1%) of birds. Few species were found in more than one habitat.

BCN and DNPWC (2009) published an official checklist 'Birds of Nepal' included 863 species of birds belonging to 16 orders and 69 families. In that checklist the most numerous birds come from the order Passeriformes (385 species), Ciconiiformes (163 species) and family Sylviidae (135 species), Muscicapidae (93 species), Corvidae (48 species), Accipitridae (47 species), and Anatidae (33 species) respectively. Later BCN and DNPWC (2012) have published a checklist of 'Birds of Nepal' which mention that there were 871 species of birds representing 16 orders and 61 families in Nepal. In that checklist the most numerous birds come from the order Passeriformes (491 species) and Ciconiiformes (165 species) respectively. Similarly, the largest number of birds belong to family Sylviidae (136 species), Muscicapidae (94 species), Corvidae (49 species), Accipitridae (48 species), and Anatidae (29 species) respectively. Later again after 4 years BCN and DNPWC (2016) published a checklist of 'Birds of Nepal'. It includes 878 species representing 16 orders and 68 families. . In that checklist the most numerous birds come from the order Passeriformes (495 species), Ciconiiformes (164 species) and family Sylviidae (138 species), Muscicapidae (96 species), Corvidae (48 species), Accipitridae (48 species), and Anatidae (34 species) respectively.

BCN (2012) reported that although Nepal covers just 0.1% of the global land mass, nearly 9% of the world's bird species are found here. With the latest record of Ashy minivet (*Pericrocotus divaricatus*) and Indian Vulture (*Gyps indicus*) Nepal's bird diversity has reached 871 species. A total of 29 species recorded in Nepal were

identified as globally threatened by BirdLife International in 1999. Zoogeographically, Nepal falls between two great regions: the Palaearctic in the north and Oriental to the south so Nepal has one of the world's richest avian fauna.

Subedi et al. (2014) published their work and informed that Red-headed Vultures and Egyptian Vultures were abundant in Nepal, but have undergone rapid population decline across their ranges in the recent years. Their study estimated a total of 24 Red-headed Vultures and 241 Egyptian Vultures across these middle mountain region of central west part of Nepal. The bird survey was carried out during November- December, 2015 showed that a total of 86 bird species were recorded from 37 Mackinnon's lists during the field survey. The survey has recorded three new species of birds from the study area viz. Black-necked Grebe (*Podiceps nigricollis*), Maroon-backed Accentor (*Prunella immaculata*) and Tibetan Serin (*Serinus thibetanus*). Thus, there are 219 species of birds belonging to 32 families recorded so far in SNP and its BZ.

Dahal et al. (2014) conducted study in the eastern and central Terai of Nepal between November 2012 and May 2013 by using belt transect measuring 200 m. × 50 m. They recorded 124 species of birds belonging to 28 families across all sites over three seasons. Among all recorded 124 bird species, 68 % were local residents, 16 % winter visitors, 2 % summer visitors and 4 % winter passage migrants. In all three surveys, the most extensive species was the Black-hooded Oriole (*Oriolus xanthornus*), which found at 110 of the 112 survey sites. The Grey-headed canary Flycatcher (*Culicicapa ceylonensis*), Spangled Drongo (*Dicrurus hottentottus*), and Jungle Babbler (*Turdoides striata*) were the next most extensive bird species, each being recorded 80 %, 79 % and 78 % of survey sites, respectively.

Katuwal et al. (2016) studied the seasonal changes of bird diversity in six valleys of the Central Himalayas, Nepal during March 2011 to April 2013. A total of 3,642 individuals of birds belonging to 178 species were recorded in 314 plots during different seasons (mainly pre-monsoon, monsoon, and post-monsoon). They found that resident birds were more species-rich than migratory birds (140 vs. 38 species). In their report, the analysis of feeding guilds showed that a maximum number of species (96 species) were insectivorous, 37 species were herbivorous including frugivorous and 24 species were omnivorous. Inskipp et al. (2016) in The National Red List Series Published by The Zoological Society of London mentioned that till to date, 878 species of bird have been recorded in the country - putting Nepal in the premier league of bird-rich countries. This bird diversity is however under threat, and as the world over, many species are in decline.

OCNP (2016) recorded 86 species of birds belonging to 32 families. Mackinnon's list and direct count methods were used to survey the birds during November 2015 to December 2015. A total of 37 Mackinnon's list were prepared during the field survey. The survey has recorded three new species of birds from the study area viz. Black-necked Grebe (*Podiceps nigricollis*), Maroon-backed Accentor (*Prunella immaculata*) and Tibetan Serin (*Serinus thibetanus*).

Grimmett et al. (2016) has published a book entitled "Birds on Nepal" Revised edition. The main aim of the book was to map and summarize the distribution and status of birds of Nepal. In their book, the species status was mentioned as resident, winter migrant, summer migrant, passage migrant or altitudinal migrant and bird species are illustrated in colour. All species recorded in Nepal upto the end of June 2015 have been described in this book.



Thakuri (2016) recorded 203 bird species belonging to 10 orders and 33 families from only two months, November and June in Panchase Protected Forest located at the junction of three districts, Kaski, Parbat and Syangja of western development region. Survey was carried out on 19-27 November 2014 and 15-22 June 2015 using the Mackinnon's species richness counting method (Mackinnon and Phillips, 1993) as described by Bibby et al. (2000). In his study, during the November and June surveys 152 and 144 bird species were recorded respectively. Likewise, 56 species were recorded only from November and 52 only from June survey. However, only 42 Mackinnon lists were prepared during November in comparison to 55 during June.

Chaudhary and Inskipp (2017) carried out the bird survey in Annapurna Base Camp Trek, Annapurna Conservation area from 30 July to 11 August 2016. The Mackinnon's species richness counting method (Mackinnon and Phillips, 1993) was used as described by Bibby et al. (2000) to estimate species richness in that survey. A total of 42 Mackinnon lists and 174 bird species was recorded including West Himalayan bush Warbler (*Bradypterus kashmirensis*), a new species for Nepal which was probably breeding. A total of 11 nationally threatened species was also recorded in their survey.

### **2.3 Birds in Chitwan National park**

Flemings et al. (1979) were the pioneer ornithologists who described the birds of Nepal. They also described avian fauna of Chitwan National Park. Shrestha (2000) wrote two volumes of birds of Nepal. These books included descriptions of birds in Chitwan National Park.

Inskipp and Inskipp (1991), Baral (2002) reported that Chitwan is the only Nepalese locality where the Slender-billed Babbler (*Turdoides longirostris*) has been recorded and it may support a larger population than any other area in the Indian subcontinent. It is the only Nepal site where Grey-crowned Prinia (*Prinia cinereocapilla*) is common and it may also hold the largest population in the species' range. The globally threatened Indian Spotted Eagle (*Clanga hastata*) has bred in Chitwan National Park, one of its few known breeding localities in Nepal. The large proportion of 15 out of 23 Nepal's near-threatened birds has been found in Chitwan. Half of them are wetland birds. Kashmir Flycatcher (*Ficedula subrubra*) a rare passage migrant to Chitwan, is the only restricted-range species recorded in the park and is also globally threatened. The park has large areas of grasslands as well as dry tropical and subtropical forests. These habitats are known to support significant populations of species characteristic of the Indo-Gangetic Plain, Indo-Malayan Tropical Dry Zone and Sino-Himalayan Subtropical Forest biomes respectively.

Baral (1997) for the first time published a checklist of 'Birds of Chitwan'. It includes 524 birds of different species including residents, migrants and vagrants reported in the national park and its suburbs. These represent a total of 69 bird families.

Baral and Upadhyay (1998) reported 526 bird species representing 69 bird families in the checklist of 'Birds of Chitwan' published by Bird Conservation Nepal and Royal Chitwan National Park. In the checklist the most numerous birds come from the family Sylviidae (45 species), Accipitridae (42 species), Turdidae (35 species) and Anatidae (26 species) respectively. They indicated the threatened status of the birds on national and global level. They also mentioned that two-thirds of Nepal's globally threatened bird species have been recorded in Chitwan.

Baral and Upadhyay (2006) reported 543 species of birds representing 59 bird families of the world in the revised checklist published by BCN and DNPWC. In their checklist, the most numerous birds come from the family Sylviidae (60 species), Muscicapidae (55 species), Accipitridae (44 species), Corvidae (36 species) and Anatidae (25 species) respectively. This revised checklist of Chitwan was aimed at documenting the avifauna of Chitwan, and helping to raise awareness. They found that Chitwan is home to many threatened grassland, wetland and forest birds. There are internationally significant populations of Bengal Florican (*Houbaropsis bengalensis*), Slender-billed Babbler (*Turdoides longirostris*), Grey-crowned Prinia (*Prinia cinereocapilla*), Lesser Adjutant (*Leptoptilos javanicus*), all species considered globally threatened with extinction by the BirdLife International.

BES and DNPWC (2000) published 'Bird Checklist Chitwan' includes 509 species representing 59 bird families. This checklist provided information on abundance and migratory status of each bird species. The checklist also provided brief information on 8 new bird watching sites for exciting birding tours. Later, BES and DNPWC (2013) again published a checklist of 'Birds in Chitwan' that includes 625 species of birds representing 64 families. Special feature of this checklist is inclusion of local status of birds. This checklist mentioned 24 species are globally threatened and 1 endemic.

Ghimire (2009) reported 123 bird species belonging to 15 order and 43 families from two different seasons in Barandabhar Forests, Chitwan. In his report the highest number of bird species i.e. 52 were represented by order Passeriformes along with 14 families.

A brochure was published by Department of National Parks and Wildlife Conservation (2012) which mention the list of some endangered birds including Bengal Florican (*Houbaropsis bengalensis*), Lesser Florican (*Sypheotides indica*), Great Hornbill (*Buceros bicornis*), Black Stork (*Ciconia nigra*) and White Stork (*Ciconia ciconia*) of the area and also mentioned that the Chitwan Valley is home to 546 species of birds.

Khadka (2012) reported 47 water bird species belonging to 11 families in Chitwan National Park. Altogether 12 duck species were observed of which 11 were migratory. Later, Khadka (2013) again reported 47 water bird species belonging to 12 families.

In fairness, it may be added that since 2006, no much data is available except few survey, especially of Chitwan National Park. Therefore, the present investigator undertook this research project to explore recent avian species of the Chitwan National Park with careful validation.

# Chapter 3

## 3 Methodology

Globally, it is recognized that till today insufficient study in birds has been done to establish the species richness and distribution. This is mainly the situation in tropical areas where there is diversity in species and where proper information is required to both figure out change, and act in response to it. The methodologies used in most research are found to be more sophisticated rather than recognizing the potential of simple approaches for primary data collection (Bibby, 2004). In addition, in countries where there are adequate numbers of ornithologists, either professional or unprofessional, most of them do not take part in surveys as others assist them. In Contrary, nations with poorly gifted ornithologists are imperative that all of them should agree to such methodologies that are simple (Bibby, 2004). Hence, in this research, a very straightforward, simple and effective methodology was adopted. However, it was taken into consideration that the methodologies not only fulfill the research purpose, but also match the available levels of skills to overcome logistical and technical difficulties, time constraints, funds, different weather condition and unfamiliar wild habitats.

With these contemplations in mind, this research included both exploratory as well as descriptive designs. Methods included both quantitative and qualitative approach. Quantitative methods were used during data collection, synthesis and analysis. Qualitative method was used during data collection, interpretation and discussion.

Sampling using line transect method was chosen for this study (Bibby et al., 2000). This method was chosen because it is suitable to count birds in open habitat while point counts are applicable for secure forest habitats (Gibbons et al., 1996). Moreover, the method chosen for this study do not entails complex equipments and proficiency to conduct the study. MacKinnon Lists were used to record all the birds seen and heard during auditory and visual recordings (Borg & Gall, 1989).

### **3.1 Research Design**

The research design included both exploratory as well as descriptive designs considering various aspects and inter-relations. Exploratory research aids in making new findings by providing simple methodological limitations. Thus it was used during preliminary study to make posterior hypotheses. Descriptive research is used to find out “what is” as a result describes the features of a population under study. However, it does not describe “why/when/how” the features occurred (Borg & Gall, 1989). Descriptive design was used for parameters like species richness, seasonal diversity, distribution and to estimate the population of migratory and resident bird species in Chitwan National Park. It was also used to note down descriptive notes of physical characteristics of birds during survey for later.

### **3.2 Research Approach and Methods**

To extract information on the bird data, mixed method i.e.; both quantitative and qualitative approach was applied in this research. Quantitative methods were used to collect, synthesis, evaluate and interpret numerical data as it offers scientific approach in the course of handling numbers in research. Qualitative method was used to gather knowledge and information regarding study site (Chitwan National Park),

bird identification, habitat etc during preliminary study. It was also used in the course of literature review, result interpretation and discussion chapter. Books and field guide by Grimmett et al. (1998, 2000, 2003 and 2011) was used to identify birds in the field .

### **3.3 Sampling design and Sampling filters**

#### **3.3.1 Study Area**

The word Chitwan is derived from the word Chitraban of the great Hindu epic Panchatantra. It is believed that the word is the combination of two words Chitra and ban. The word Chitra might have derived from Chittal, which means deer and ban means forest. Therefore, Chitraban means deer forest and it might have become Chitwan later on. Some other scholars opine that the word Chitwan is the combination of two words chit or chita (heart) and wan or ban (jungle). So, Chitwan means Heart of the Jungle.

The Chitwan valley spreads between the foothills of the Mahabharat range in the north and bounded by Siwalik Hills (Churia Range) in the south. Before the unification of Nepal in 1768, Chitwan valley was ruled by Rajas of Tanahu and Makwanpur. Although, there were settlements of indigenous Tharu people, most of it was covered with dense forest, and infested with malaria. Chitwan was incorporated in Nepal in the year 1777. Then, it became the hunting area for the Rana rulers of Nepal and also British royalty since 1870's. In 1911, King George V visited Chitwan and camped at Kasara, now the park headquarter. He bagged 37 tigers, 8 rhino, 4 bears. Similarly, Prince of

Wales (later Edward VIII) visited Chitwan in 1921. His team bagged 18 tigers, 8 rhinos, 2 bears and 2 leopards. These days, the main reason for visiting CNP is not only to view the well known one-horned rhino, tiger, leopard and crocodiles, but birds as well. Chitwan has often been called one of the finest wildlife experiences in Asia because of its easy accessibility from Kathmandu, the capital of Nepal, for viewing of large mammals and birds (BES & DNPWC, 2013).

The study area, Chitwan National Park is the first and oldest national park of Nepal. Chitwan National Park (27° 30'N, 84° 20'E) was established in 1973 with the beginning of Conservation of Biodiversity in Nepal. Chitwan National Park is situated in South-central Nepal, covering an area of 952.63 sq. Km. in the subtropical lowlands of inner terai. It lies between 27°16.56' – 27°42.14' latitudes and 83°50.23' – 84°46.25' longitudes. In altitude it ranges from about 110m (330ft.) in the river valleys to 815m (1,674ft.) in the Churia Hills. In 1957, the area between Tikauli and the Mahabharat range was declared a “rhino sanctuary”, which was the first step towards formal wildlife management in the country. Due to heavy deforestation and rampant poaching, there was a sharp drop in the number of wild animals during the 1950s. Given this alarming situation, a national park to the north of Rapti River and a rhino sanctuary to the south were proposed. In 1963, the area to the south of Rapti was declared a rhino sanctuary and by April 1971, borders of the national park were fixed by a survey team. In 1973, the National Parks and Wildlife Conservation Act was enacted, and Chitwan National Park was declared as the first National Park of Nepal (DNPWC, 2017). Among 27 Important Bird Areas in Nepal, Chitwan National Park is one of the most renowned areas for the birds.

In 1977, the promulgated boundaries were increased from 540 sq. km. to 932 sq. km. In 1977, a buffer zone of 766.1 sq. km. was added to the north and west of the



Narayani-Rapti river system, and between south-eastern boundary of the park and the international border to India (DNPWC, 2014). Recognizing its outstanding universal value of unique ecosystems of international significance, UNESCO declared the park a World Heritage Site in 1984 and is also identified as an important bird area (IBA) by Bird Life International. In 1996, an area of 750 sq. km. surrounding the park was declared as a buffer zone, which consists of forests and private lands. According to 17 October 2016 Gazette of Nepal, the area of Chitwan National Park and its buffer zone has become 952.63 sq. Km. and 729.37 sq. Km. respectively. Bishajari and associated lakes in the buffer zone of the Chitwan National Park were declared as a wetlands of international importance under the Ramsar Convention in 2003 (DNPWC, 2017). The area is situated in the southern part of Chitwan district, and it shares eastern boundary with Parsa National Park and southern boundary with Balmiki Tiger Reserve of India. The CNP has a variety of ecosystems, including the Churia hills, ox-bow lakes and the flood plains of Rapti, Reu and Narayani rivers. The Churia hills rise slowly towards the east from 150m to more than 800m. The western portion of the CNP comprises lower but more rugged Someshwor hills. Following the river systems, the park has a unique relation between upstream forest conservation and downstream wildlife conservation. The park's headquarters is in Kasara. Close-by the gharial and turtle conservation breeding centers have been established. In 2008, the DNPWC in collaboration with NTNC, BCN, RSPB and ZSL has established a vulture conservation and breeding centre in Kasara of CNP aiming at holding up to 25 pairs of each of the two Gyps vultures species now critically endangered in Nepal – the White-rumped Vulture (*Gyps bengalensis*) and the Slender-billed vulture (*Gyps tenuirostris*) (GoN/MoFSC, 2014).

Extended in four districts of Central Terai, this national park includes area of Chitwan 74%, Parsa 15%, Makwanpur 7% and Nawalparasi 4%. It is bordered by Parsa Wildlife Reserve (499 sq.km.) on the eastern side and on all other sides rivers make natural boundary for the park (DNPWC, 2017).

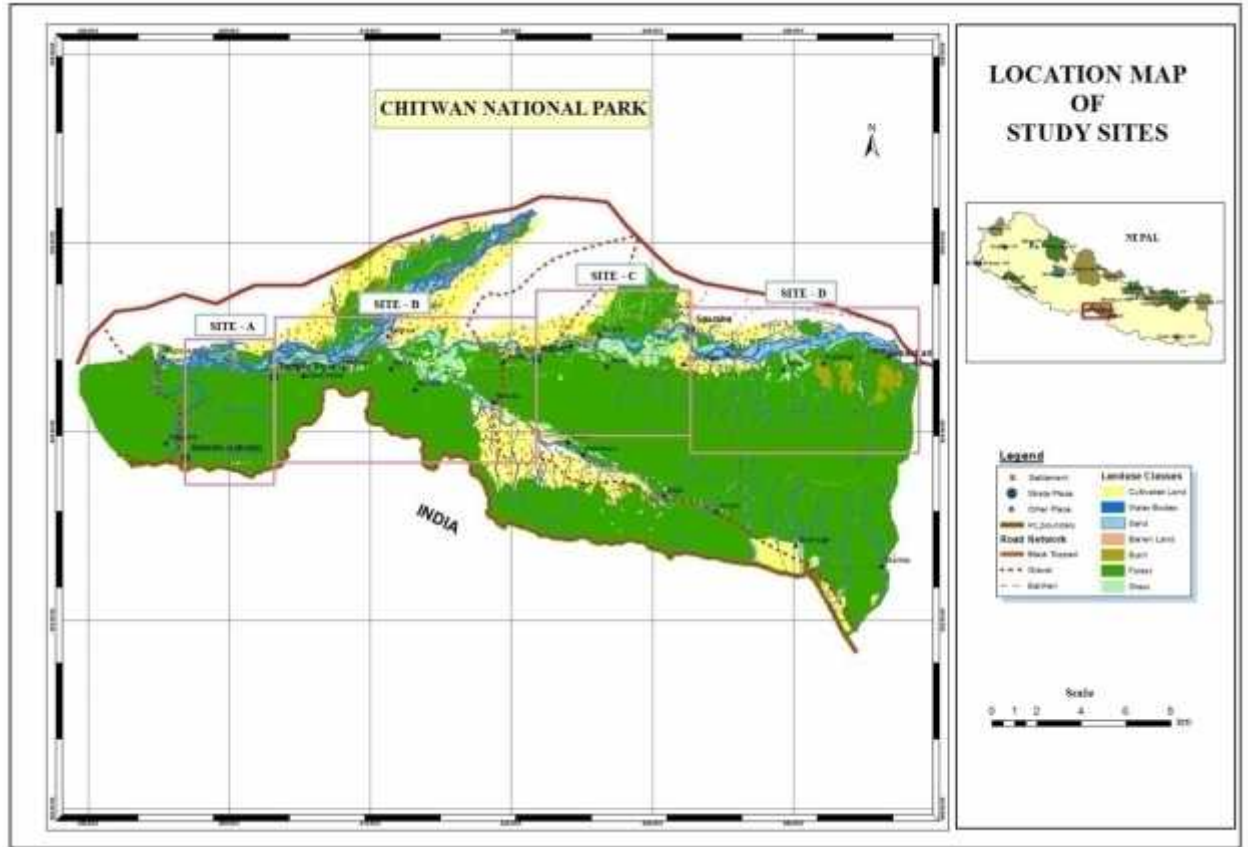
The Chitwan National Park has many lakes. Major lakes are Tamor Tal, Lami Tal, Garud Tal and Devi Tal. The CNP is home to more than 68 species of mammals, 55 species of amphibians and reptiles, 546 species of birds and 120 species of fish. The endangered fauna found in the CNP include the One-horned Rhinoceros (*Rhinoceros unicornis*), Gaur Bison (*Bos gaurus*), Royal Bengal Tiger (*Panthera tigris tigris*), Asian Elephant (*Elephas maximus*), Four-horned Antelope (*Tetracerus quadricornis*), Pangolin (*Manis crassicaudata*), Golden Monitor Lizard (*Varanus flavescens*), Asiatic Rock Python (*Python molurus*), Bengal Florican (*Houbaropsis bengalensis*), Lesser Florican (*Sypheotides indica*), Giant Hornbill (*Buceros bicornis*), Black Stork (*Ciconia nigra*) and White Stork (*Ciconia ciconia*) (DNPWC, 2017).

In the winter season of Chitwan National Park, local villagers are allowed to cut thatch in the park, which gives visitors better views of the wildlife. Also, between September to November and February to April, migratory birds join the residential ones and create spectacular bird watching opportunities. While the monsoon rains bring lush vegetation, most trees flower in late winter. The Palash tree (*Butea monosperma*), known as the “flame of the forest”, and Silk cotton tree or Ceiba tree (*Ceiba pentandra*) have spectacular crimson flowers, which are visible miles away (DNPWC, 2017).

The entry points for the tourists to enter the CNP are:

- a. Ghatgain via Patihani
- b. Bhimle via Meghauri
- c. Khagendramalli via Bhandara
- d. Sauraha via Tandi (Ratna Nagar)
- e. Laukhani via Pragatinagar
- f. Amaltari via Danda
- g. Sunachuri
- h. Bankatta via Madi
- i. Kasara via Jagatpur
- j. Kujauli via Rajahar

Chitwan National Park is the third destination of tourists in Nepal. Since its establishment in fiscal year 2014/015, the number of tourists who visited the national park are 25,57,054. Over one lakh tourists per year visit to Chitwan National Park to see its pristine habitats, birds and other wildlife. According to OCNP (2015) in fiscal year 2014/015, the number of tourists who visited the national park are 1,19,398 foreigners, 17,891 SAARC countries and 40,968 Nepalese. The total tourists who visited the National Park are 1,78,257 in fiscal year 2014/015. The percentage of visitors who visited the CNP are 67% foreigners, 10% SAARC countries and 23% Nepalese in same fiscal year.. In the fiscal year 2014/015, the maximum number of tourists (1,32,415) who entered the national park are from Sauraha while least number of tourists (221) are from Kujauli. During the same fiscal year, the tourists who entered CNP are maximum (25,781) in the month of October-November while they are minimum (1,592) in the month of June-July (OCNP, 2016).



**Figure 1: Location Map of CNP**

### 3.3.2 Study Site

Preliminary observations of the study site were carried out before the actual study and the study site of Chitwan National Park was selected.

For conducting surveys, Chitwan National Park was divided into four sites after final consultation with the local field guides. Division of study area into different site was based upon vegetation types and habitats. The Chitwan National Park consists of tropical and sub-tropical forests with mostly Sal (*Shorea robusta*) forests. Sal forest covers 70% of the park, tall grasslands 15% and remaining by riverine and other forest types. The surveys were carried out in four sites in Chitwan National Park, during different seasons of the year 2013-2014 using the line transect method.

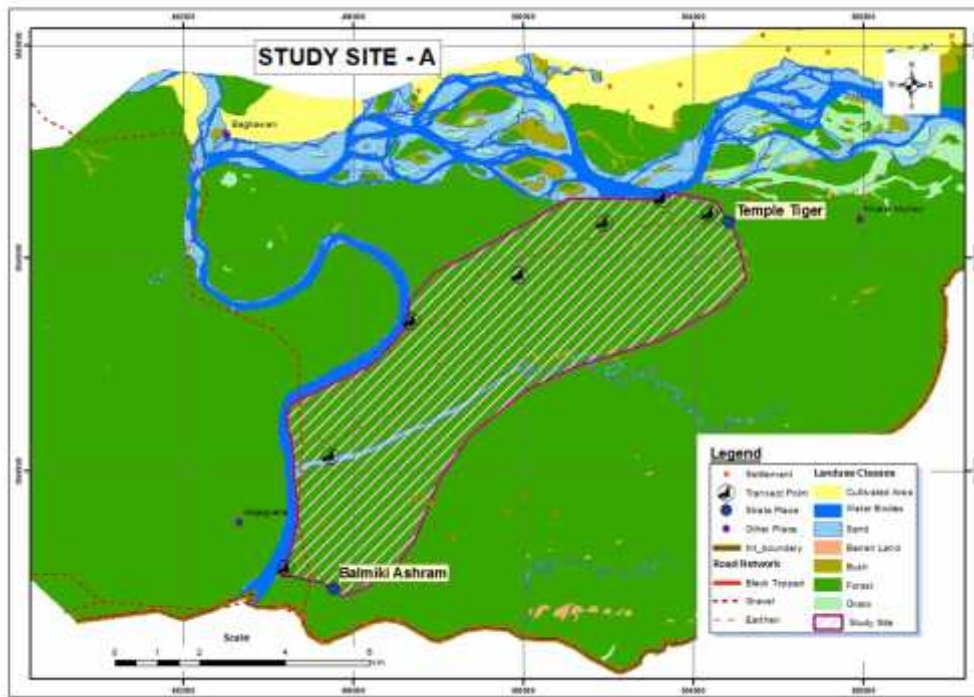


Figure 2 : Site A (Balmiki Ashram to Temple Tiger)

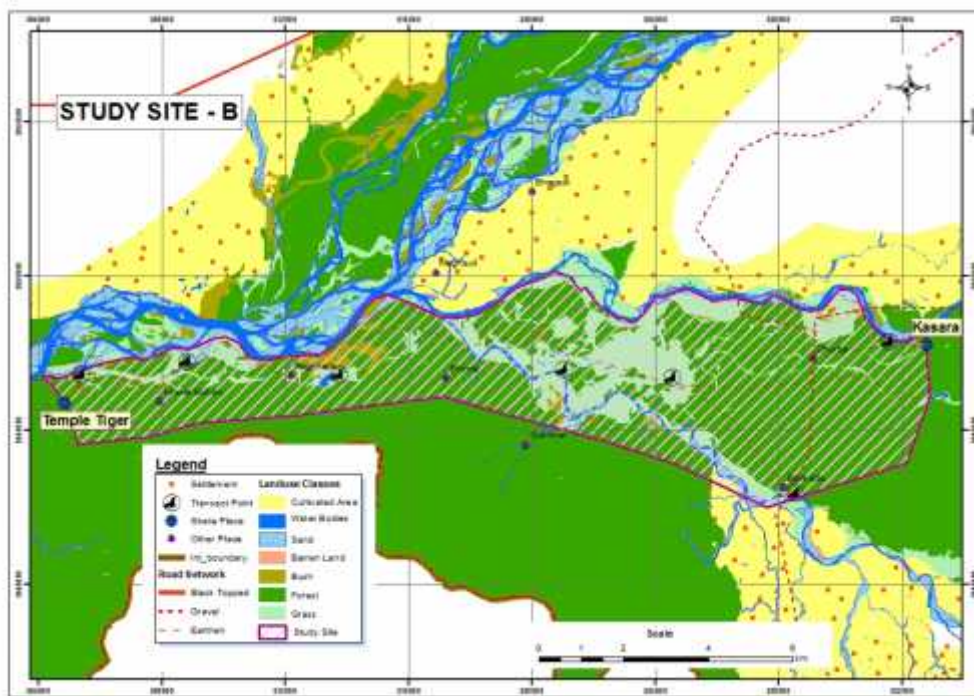


Figure 3 : Site B (Temple Tiger to Kasara)

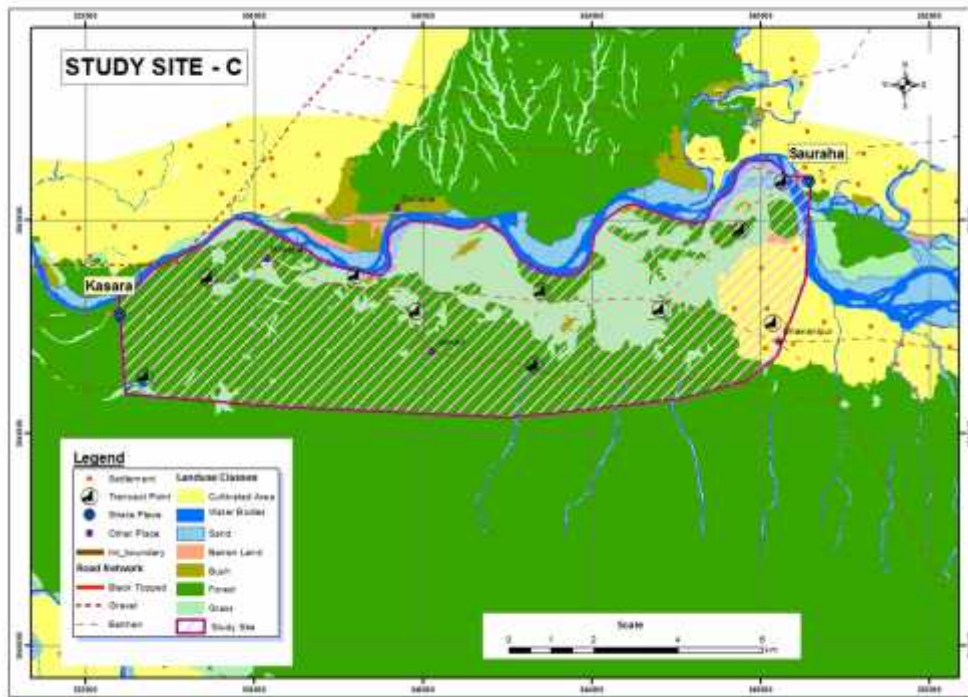


Figure 4 : Site C (Kasara to Sauraha)

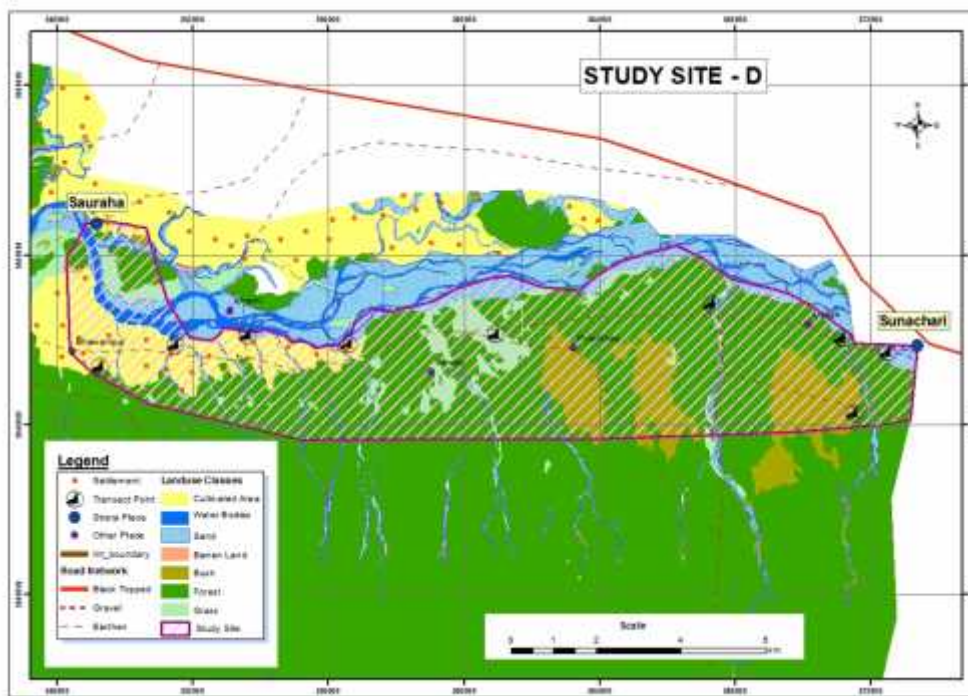


Figure 5 : Site D (Sauraha to Sunachari)



**Table 1: GPS Location of Study Area**

S.No.	Location	Elevation (m)	Latitude	Longitude
1	Balmiki Ashram	125	27°32'29.5"	84°11'24.8"
2	Temple Tiger	129	27°32'09.1"	84°04'42.2"
3	Baghmara	131	27°33'15.2"	84°09'47.1"
4	Bhimle	131	27°33'09.1"	84°12'20.8"
5	Dhurche	142	27°32'53.6"	84°17'30.9"
6	Kasara	159	27°32'59.4"	84°19'48.0"
7	Ghatgai	180	27°32'09.5"	84°08'45.6"
8	Dumaria	210	27°32'09.6"	84°09'39.5"
9	Jarneli	215	27°32'09.6"	84°23'28.7"
10	Bhawanipur	195	27°31'40.5"	84°23'14.6"
11	Sauraha	140	27°32'06.0"	84°15'57.8"
12	Amrite	141	27°32'46.8"	84°17'31.8"
13	Pyaridhap	233	27°32'43.6"	84°42'32.5"
14	Liglige	224	27°33'25.1"	84°40'59.8"
15	Sunachari	230	27°33'30.5"	84°40'62.8"
16	Lami Tal	123	27°32'59.0"	84°09'07.1"
17	Muna Tal	135	27°33'04.4"	84°10'07.1"

### 3.3.3 Climatic Features of Study Area

As Chitwan is a tropical region, it has a tropical climate in general. Distinctly, Chitwan has two types of climate, summer and winter. Summer extends from April/May to October. The temperature rises up to a maximum of 32° to 41°C in summer. Winter extends from November to April and the temperature ranges are between 22° to 36°C maximum and 7°C minimum. Summer is hot and humid. The monsoon occurs from June/July to September/October with plenty of rainfall, and is considered as unpleasant time. Chitwan gets average 2,600mm of rainfall per year,

90% of which falls in the monsoon season. Relative humidity is extremely high during November to February mostly in the morning and it is lowest in April. Winter is cold in the mornings and evenings but the days are warm and pleasant. January is the coldest month. Dew fall during December and January nights is common and it drips off the trees and in the morning and is often mistaken for rain (DHM /GoN).

**Table 2: Metrological data for 2013 and 2014**

	2013			2014		
	Temp. Max.	Temp. Min.	Rainfall	Temp. Max.	Temp. Min.	Rainfall
Month	(°C)	(°C)	(mm)	(°C)	(°C)	(mm)
January	21.4	1.7	9.6	22.6	9.5	9.2
February	26.6	4.5	0	22.9	10.1	20.7
March	32.1	8.1	29.5	31.1	12.9	10.2
April	34.4	12.4	74.5	36.8	16.6	3.9
May	35.3	22.1	375.9	37.2	21.6	106.4
June	34.2	24.9	667.5	35.5	24.7	389.5
July	34.3	25.9	430.1	33.6	25.8	428
August	33.9	25.8	181.1	33	25.3	795.7
September	33.7	26.2	199.3	32.6	24.5	205.6
October	30.6	21.9	158.8	31.9	19.6	85
November	27.5	12.8	1.6	28.6	14.1	0
December	23.5	9.6	0	22.5	10.3	9.5

Source: DHM/ GoN



### 3.3.4 Flora and Fauna of Chitwan National Park

Vegetation of Chitwan National Park can be classified into three main types. Sal (*Shorea robusta*) forest occupies the seventy percent of the park. Sal comes in pure stand or in association with other trees such as *Terminalia alata*, *Adina cordifolia*, *Terminalia belerica*, *Terminalia chebula*, *Holrrhena antidysenterica*, *Schleichera trijuga* etc. in the higher elevation carry an interesting mixture of *Shorea robusta* and *Pinus roxburghii*. Many shrubs, creeper ferns, grasses grow among and under the Sal-forest.

The riverine forest occupies an area of about 7% along the Narayani, Rapti and Reu rivers and their islands. It is mainly dominated by Simal (*Bombax ceiba*) and grassland. Many other species of Sisau (*Dalbergia sissoo*), *Ficus* spp., *Zizyphus* spp., Papri (*Holoptelia integrifolia*), Malata (*Macaranga postulate*), Bhellar (*Trewia nudiflora*), Sindhure (*Mallotus philippinensis*), Palas (*Butea monosperma*), *Bahunia* spp., Kyamuno (*Careya arborea*) and Lazzawati (*Mimosa pudica*) are the most common tree species.

Mitho Nim-Indian curry Leaf Tree (*Murraya koenigii*), Guyallo (*Callicarpa macrophylla*), Rajbeli (*Clerodendron viscosum*) and Dhusure (*Colebrookea oppositifolia*) are smaller shrubs. *Acacia conicinna*, *Bridelia stipularia*, *Stiipharia japonica* and *Tinospora sinensis* (Guruj) are various types of climbers in the riverine forest.

Grassland occurs in alluvial flood plains cover 20% of the park area that support luxuriant growth of grasses interspersed with patches of riverine forest. Elephant grass called *Saccharum ravennae* (renowned for its immense height and can grow upto 8 meter in height), Kans (*Saccharum spontaneum*), *Saccharum bengalensis*,

*Saccharum arundinaceum*, *Arundo donax*, Khar (*Cymbopogon flexuosa*), *Narenga porphyrocoma*, *Themeda* spp., Narkat (*Phragmites karka*), *Imperata cylindrica*, Pater (*Typha angustifolia*), Guyallo (*Callicarpa macrophylla*) and Ank (*Calotropis gigantean*) are the main species of grassland. Most of the grassland extends along the rivers mainly on both new and old floodplains. Titepati (*Artemisia indica*), Amliso (*Thysanolaena maxima*), Bayar (*Zizyphus mauritiana*) and Jangali Bayar (*Zizyphus rugosa*) are the main species of shrubs.

Birds are an important component of biodiversity. Birds are involved in many ecosystem functions through their roles as scavengers, pollinators and seed dispersers and in pest control. A total of 878 species of birds has been recorded in Nepal (BCN and DNPWC, 2016). Out of them, about 546 species [Baral and Upadhyay (2006); Giri and Chaudhary (2008); Giri and Chaudhary (2010); Giri and Chaudhary (2011)] has been reported from Chitwan National Park and its surroundings. About two-third of globally threatened bird species have been recorded in Chitwan (Baral & Upadhyay, 2006). The park is home to many threatened, grassland, wetland and forest birds. This place is especially important for several grassland species including Bengal Florican (*Houbaropsis bengalensis*), Grey-crowned Prinia (*Prinia cinereocapilla*), Slender-billed Babbler (*Turdoides longirostris*) and also Lesser Adjutant (*Leptoptilos javanicus*), all species considered globally threatened with extinction by the Bird Life International (Baral and Upadhyay, 2006). The protected birds found in the CNP include Black Stork (*Ciconia nigra*), White Stork (*Ciconia ciconia*), Sarus Crane (*Grus antigone*), Bengal Florican (*Houbaropsis bengalensi*), Lesser Florican (*Syphoetides indica*), and Great Hornbill (*Buceros bicornis*) (DNPWC, 2017).

Chitwan National Park is the only locality in Nepal where Slender-billed Babbler (*Turdoides longirostris*) has been found. The site supports a larger population than any other area in Indian sub-continent. CNP is the only site in Nepal where Grey-Crowned Prinia (*Prinia cinereocapilla*) is common. The area also holds largest population in species range. The park is one of the few known breeding sites of the globally threatened Spotted Eagle (*Aquila hastata*), Indian Pea-fowl (*Pavo cristatus*) and Red Junglefowl (*Gallus gallus*) scratch their living on the forest floor (Baral & Inskipp, 2005).

In winter season, majority of birds from high altitude of Nepal, Tibet, Mongolia, Europe and Siberia visit the National Park to cross over the winter times. Similarly, in summer season, birds from South India, Philippines, Myanmar etc visit for breeding (OCNP, 2016).

As soon as winter visitors have left in spring, the summer visitors arrive from southern latitudes. The calls of cuckoos herald the start of spring. The colorful Bengal pittas and several sunbird species are common breeding visitors during monsoon. Among the many flycatcher species the Asian Paradise-flycatcher (*Terpsiphone paradisi*) with his long undulating tail in flight is a spectacular sight (Bhushal, 2013).

Vulture Conservation and Breeding Centre was established in 2008 at Kasara in CNP aiming to ensure long term survival of two species of Gyps vultures – Slender-billed Vulture (*Gyps tenuirostris*) and White-rumped Vulture (*Gyps bengalensis*) (OCNP, 2016).

### 3.3.5 Timetable

Surveys were made from November 2013 to August 2014, covering all four seasons as follows: autumn season (September, October and November), winter season (December, January and February), spring (March, April and May) and summer (June, July and August).

**Table 3: Itinerary of bird survey**

Visit	Date	Route
November, I Visit (Autumn season)	3 Nov 2013 to 6 Nov 2013	Balmiki Ashram - Temple Tiger
	7 Nov 2013 to 10 Nov 2013	Temple Tiger – Baghmara – Bhimle-Dhurche-Kasara
	11 Nov 2013 to 14 Nov 2013	Kasara – Ghatgai – Dumaria – Jarneli – Bhawanipur – Sauraha
	15 Nov 2013 to 18 Nov 2013	Sauraha – Icharni – Amrite – Pyaridhap – Liglige – Sunachari
February, II Visit (Winter season)	5 Feb 2014 to 8 Feb 2014	Balmiki Ashram - Temple Tiger
	9 Feb 2014 to 12 Feb 2014	Temple Tiger – Baghmara – Bhimle-Dhurche-Kasara
	13 Feb 2014 to 16 Feb 2014	Kasara – Ghatgai – Dumaria – Jarneli – Bhawanipur – Sauraha
	17 Feb 2014 to 20 Feb 2014	Sauraha – Icharni – Amrite

	2014	– Pyaridhap – Liglige – Sunachari
March, III Visit (Spring season)	15 Mar 2014 to 18 Mar 2014	Balmiki Ashram - Temple Tiger
	19 Mar 2014 to 22 Mar 2014	Temple Tiger – Baghmara – Bhimle-Dhurche-Kasara
	23 Mar 2014 to 26 Mar 2014	Kasara – Ghatgai – Dumaria – Jarneli – Bhawanipur – Sauraha
	27 Mar 2014 to 30 Mar 2014	Sauraha – Icharni –Amrite – Pyaridhap – Liglige – Sunachari
June, IV Visit (Summer season)	10 Jun 2014 to 13 Jun 2014	Balmiki Ashram - Temple Tiger
	14 Jun 2014 to 17 Jun 2014	Temple Tiger – Baghmara – Bhimle-Dhurche-Kasara
	18 Jun 2014 to 21 Jun 2014	Kasara – Ghatgai – Dumaria – Jarneli – Bhawanipur – Sauraha
	22 Jun 2014 to 25 Jun 2014	Sauraha – Icharni –Amrite – Pyaridhap – Liglige – Sunachari

### **3.4 Types of data sources**

Secondary data were procured from various published and unpublished existing sources to attain initial awareness into the research problem. Books and field guide by Grimmett et al. (1998, 2000, 2003 and 2011) was used to identify birds during data collection. Primary data were collected during survey on seasonal basis for seasonal diversity, distribution pattern of birds and population density of migratory and resident bird species in Chitwan National Park.

### **3.5 Research Equipments**

Observations during field surveys were done with 10x50 Super Zenith prismatic field binocular for the visual identification of bird species and photographs/ videos were recorded using a Canon powershot 5×40 HS. In addition, Field guide Birds of Nepal (Grimmett et al., 1998, Grimmett et al., 2000, Fleming et al., 1984) and Birds of the Indian Subcontinent 2011 by Grimmett, Inskipp and Inskipp were used as field guides to identify the birds in the field. Samsung mobile with voice recording app was used to record unidentified vocalizations of individual bird and mixed species groups for later identification and also to complement visual observations (Parker, 1991). The Red Data Book of Birds of Nepal (Inskipp et al., 2016) was followed to name the birds. Other materials used during survey was GPS, some lens tissue to wipe the binocular lens, pencil and eraser, field data sheets to record bird survey data and a large clear plastic bag to safeguard data sheets from water.

### **3.6 Ethical Considerations during the study**

The researcher thoroughly reviewed various ethical guidelines published by international organisations before commencing this ornithological research. Prior to conducting the research, the researcher attained permits for this research from the Mewar University, Rajasthan, India. To conduct field survey, prior consent was obtained from the Chitwan National Park committee assuring that this research is purely based on observational data which will not include any method that requires bird handling. The researcher was also diligent about evaluating the possible adverse impacts of survey during data collection with the aim of eradicating or reducing those impacts to the maximum extent. To achieve those aims, the researcher strived to collect various scientific published information which were then reviewed to select best survey method reliable with the purpose of this research.

The researcher advocates the application of Replacement, Reduction and Refinement (the 3Rs) at all stages during any research. As this research includes birds during survey, animal ethical considerations such as the wellbeing of animals used for scientific purposes were followed. All possible steps were taken all the times during the survey to safeguard the wellbeing of birds (National Health and Medical Research Council, 2013). Measures were taken to avoid or minimize harm to the birds, including pain, suffering and distress. This research did not involve any invasive procedure. The chosen data collection method was purely observational and acoustic with no animal welfare issues involved.

The birds were not captured or handled during the entire data collection period. Mist nets were not used during the course of assessing the seasonal diversity of birds, species richness and distribution in CNP or during estimating the bird population to

avoid any stress and harm to the birds. Moreover, it do not counterpart the simplicity of other assessment techniques. For instance, point counts and line transects are said to be far more effective at sampling entire populations as compared to mist net trapping (Estades et al., 2006). It has also been shown that mist netting is high labour intensive and low time efficient (Herzog et al., 2002).

During the course of data collection, bright coloured dress was avoided as it may threaten the birds. All required proper equipments mentioned above were carried along in a shoulder bag to facilitate data collection. Before starting the survey, field guides were consulted regarding the information on birds breeding and feeding time. Close-range bird watching were avoided during birds breeding and feeding time. Such close inspections by humans may develop aggressive or disturbed bird behavior such as loud frequent calls or anxious flight. Besides, in extreme cases, too close to a bird's nesting site may disturb or threaten the bird and they may enduringly leave the site forever. While walking in a line transect whilst surveying, cautiousness was to walk slowly and quietly along tracks and through the habitat as some birds have a habit to nest on the ground or in dense shrubs very adjacent to the ground. Thus wherever feasible, care was taken whilst surveying to cause only negligible disturbance to habitats. For bird species identification, chasing the overflying birds were avoided.



## **3.7 Data Collection**

### **3.7.1 Bird surveys**

Sampling using line transect method was used for this study (Bibby et al., 2004). This method was chosen because it is suitable to count birds in large open habitat while point counts are applicable for secure forest habitats (Gibbons et al., 1996). Moreover, line transect method tends to be more efficient as it records more birds per unit time Yallop et al. (2003). This survey technique involves the spectator to record all the birds seen on either side of the itinerary while walking slowly along the transect.

Surveys were carried out at four different sites in Chitwan National Park (Balmiki Ashram to Temple Tiger, Temple Tiger to Kasara, Kasara to Sauraha and Sauraha to Sunachari, referred to as sites 1, 2, 3 and 4 respectively) during four different seasons (Autumn, Winter, Spring and Summer) of the year 2013-2014. A Geographic Positioning System (GPS) was used during demarcating the study sites with certain marks at each site. Each transect length was determined as one kilometer at one time and transects placed 100m apart at each site. Even though during preliminary survey in this research, the effects of time of day on bird detection were not assessed; a number of other researchers have stated that the peak activity in most bird species are observed more in the morning (2-3 h after sunrise) and in the evening (2-3 h before sunset) [Bried et al., 2011; Kessler and Milne, 1982]. Pizo et al. (1997) stated that usually birds have a tendency to avoid noontime heat and therefore may have low detection rate. Therefore, time of observation of birds commenced within 3 hours after sunrise and 3 hours before sunset depending on seasons. Audio recordings were performed because vocalizations are generally much more recurrent than visuals

contacts, particularly in dense forest habitat (Rosenstock, 1996). However, recordings of vocalisations were not started before 6:00 a.m. in the morning to avoid any bias due to peak vocal activity and bird songs in early morning (Bibby et al., 1985).

At each site, birds were surveyed twice daily; once in the morning and another in the late afternoon. On each four visit, each site was surveyed for four consecutive days during four seasons. This plan of bird survey facilitate us to record winter visitor and summer visitor bird species. Observations were done with a pair of 10x50 super Zenith prismatic field binocular for the visual identification of bird species along with field guides. Audio recording was done to record unidentified vocalizations of individual birds and mixed species groups for later identification and also to complement visual observations (Parker, 1991). Each 1 km. distance in each transects was covered either by walking slowly along the roads or paths wherever possible or by elephant ride without making any noise or disturbances to their habitat. The speed of movement was governed by the level of bird activity, the time required to observe mixed species groups and to record high vocal calls in the mornings. To avoid any possible observational biasness, all surveys were done by the same spectator during good weather condition. Help from bird watchers were also attained for observation conformations. All birds that were seen, heard and in flight were counted and recorded in the list. Further details on the methodology of survey listings are mentioned below in the Mackinnon's listing method.

### **3.7.2 Mackinnon's listing method**

It is a quantitative approach to evaluating audio-visual survey data (Poulsen et al., 1997). All birds seen and heard were recorded to estimate species richness, seasonal diversity and distribution by using the Mackinnon's counting method, as described by Bibby et al. (2000). During the observations, each new bird species encountered were grouped into consecutive lists of 20 species. Then a second subsequent list was used to assemble another 20 species encountered, also including species from the previous list if encountered again. Likewise, third, fourth, fifth and so on lists were used for recording the species in that particular site. However throughout listing, caution was taken so that no same species was repeated in the same list. Each list included 20 different bird species. After completing all the recordings for the site, a final consecutive species total was achieved from mining the number of species in second list that were not listed in first and so on during all the recorded data for that site. Similarly, the other three sites were also surveyed separately in the same manner during all four visits in different seasons.

A species richness curve was then generated by plotting the collective total of those species not listed on any preceding list to the total number of species. This species accumulation curve also gives insight of species diversity measure.

MacKinnon's list data from each survey was also used to analyse relative abundance of a species. This was done on the basis of frequency of occurrence, i.e., the repeated number of time same species appears in consequent lists.

Relative abundance = Frequency of occurrence in lists

The species were categorized as very common (VC) – sighted more than 10 times, Common (C) – sighted 7-9 times, Uncommon (UC) – sighted 3-6 times, and Occasional (OC) – sighted once or twice as followed by McKinnon and Philips (1993).

The residential status of the birds was worked out, and different status categories were used; resident, winter migrants, and summer migrants were assigned strictly with reference to the study area on the basis of the presence or absence method (Thakur et al., 2010). Moreover, the feeding guilds of the birds (e.g. as omnivorous, carnivorous, insectivorous, frugivorous and herbivorous) were assigned as described by Ali and Ripley (2007). The International Union for the Conservation of Nature (IUCN) status was also used to compare the local status with the global status of avian fauna.

### **3.7.3 Direct Observation Method**

This method was used as secondary method to estimate bird population in selected study sites. The method involves direct counting of each species encountered during sites survey on a daily basis and listing their names and numbers in a record book. Direct counting confirmed the entry of those bird species which were not listed during McKinnon's method. For those species that fly long distances or have immense habitat ranges, the total number encountered in one day was listed as one and expected as their population. Whereas, for the species that makes unclear calls in a group, the number was listed as one for each recording. For other species the total population was obtained from adding the number from each site.

### **3.8 Data Analysis**

The data were interpreted both in tables or charts and in text. The qualitative data were evaluated and defined in script whereas quantitative data were explored in graphs and charts and then described in text.

Field data were analysed using MS Excel 2013 and ArcView GIS 3.3. MS Excel was used for quantitative analysis of survey data such as adding and calculating lists and plotting graphic representations of data such as graphs and bar diagrams. ArcView GIS was used for plotting maps.

#### **3.8.1 McKinnon's list data**

Bird diversity and species richness was represented through diversity curve and species richness curve respectively, prepared from the McKinnon's list data from all four visits. Distribution of bird species in four different sites was shown in table calculated from the number of list taken in each site. Relative abundance of bird species was calculated by dividing the frequency of occurrence of a species by the total abundance of all species collective and was represented through Bar Chart (Bibby et al., 1992).

#### **3.8.2 Shanon Wiener Diversity Index:**

Shanon Wiener Diversity Index (Shannon & Weaver, 1949) was used to calculate seasonal bird diversity, bird diversity in four different sites and species evenness.

Shannon-Weiner diversity Index 'H' was calculated using the formula:

$$H = - \sum (P_i * \ln P_i)$$

Where,

S = Number of species or species richness

$P_i$  = Number of individuals of species/ total number of individuals (n/N)

n= number of one particular species

N= Total number of individuals

ln = Natural log

= Sum

Evenness (E) was calculated using the formula:

$$E = (H/H_{max})$$

Where,

$H_{max}$  = Maximum diversity possible

H value would be high if the species are uniformly distributed in the group.

Therefore, the higher value of H represents more diverse communities.

### **3.8.3 Oneway ANOVA**

Order diversity and species diversity were analysed using Oneway ANOVA (SPSS Program)

# Chapter 4

## 4 Results

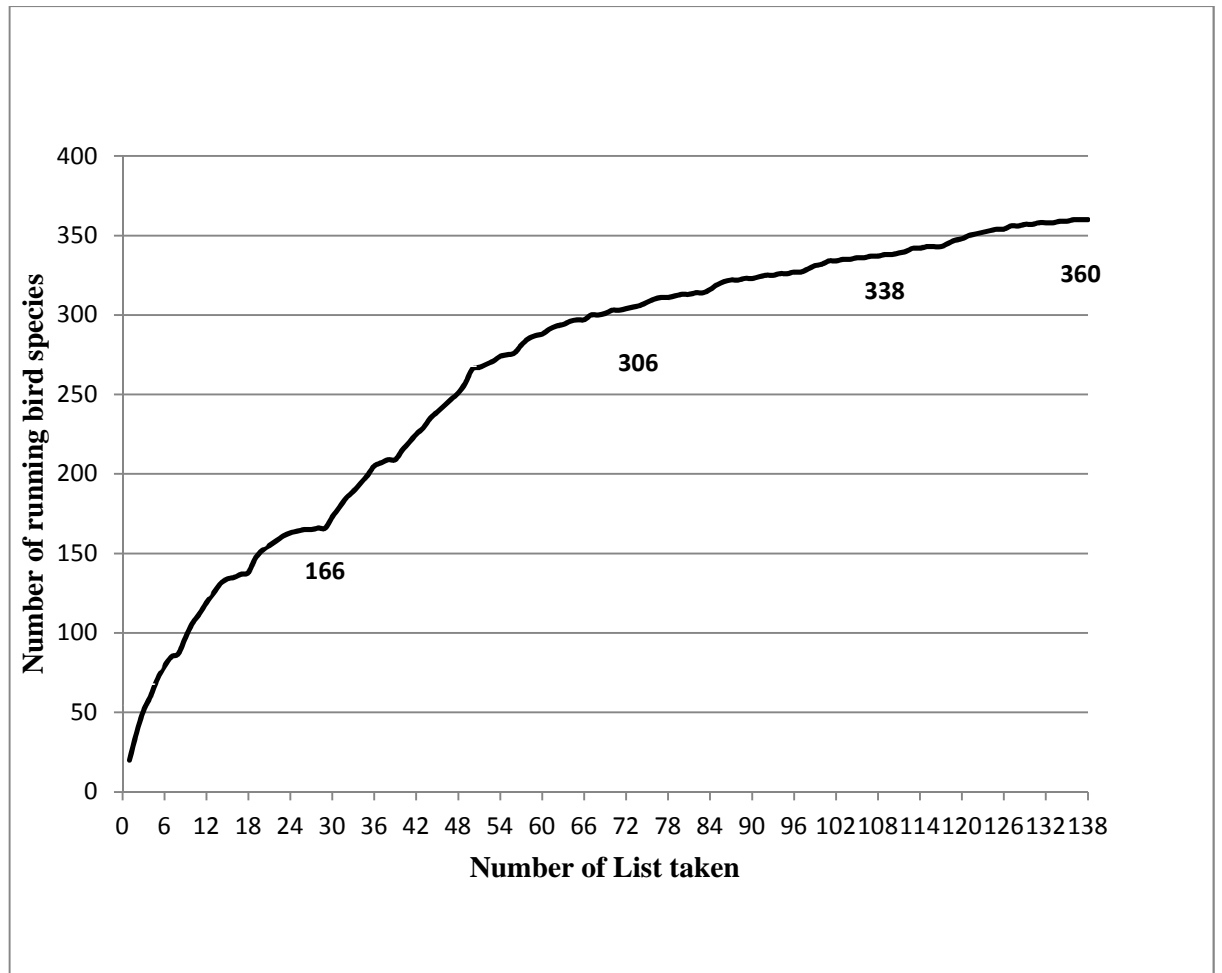
### 4.1 Bird Diversity

A total of 378 species of birds belonging to 15 orders and 55 families were recorded during 64 days survey work covering four seasons. The total number of species found in 15 orders were (Annex-I) : Galliformes (4) 1.05%, Anseriformes (13) 3.43%, Piciformes (15) 3.96%, Bucerotiformes (2) 0.52%, Upupiformes (1) 0.26%, Trogoniformes (1) 0.26%, Coraciformes (11) 2.91%, Cuculiformes (13) 3.43%, Psittaciformes (5) 1.32%, Apodiformes (7) 1.85%, Strigiformes (10) 2.64%, Columbiformes (11) 2.91%, Gruiformes (12) 3.17%, Ciconiiformes (88) 23.28%, Passeriformes (185) 48.94%. Similarly, the total number of species found in 55 families were (Annex-I) : Phasianidae (4) 1.05%, Dendrocygnidae (1) 0.26%, Anatidae (12) 3.17%, Picidae (12) 3.17%, Megalaimidae (3) 0.79%, Bucerotidae (2) 0.52%, Upupidae (1) 0.26%, Trogonidae (1) 0.26%, Coraciidae (2) 0.52%, Alcedinidae (1) 0.26%, Halcyonidae (3) 0.79%, Cerylidae (1) 0.26%, Meropidae (4) 1.05%, Cuculidae (11) 2.91%, Centropodidae (2) 0.52%, Psittacidae (5) 1.32%, Apodidae (6) 1.58%, Hemiprocnidae (1) 0.26%, Strigidae (5) 1.32%, Caprimulgidae (4) 1.05%, Columbidae (11) 2.91%, Otididae (1) 0.26%, Gruidae (2) 0.52%, Rallidae (9) 2.38%, Scolopacidae (15) 3.96%, Jacanidae (2) 0.52%, Burhinidae (1) 0.26%, Charadriidae (7) 1.85%, Glareolidae (1) 0.26%, Laridae (4) 1.05%, Accipitridae (28) 7.40%, Falconidae (6) 1.58%, Podicipedidae (2) 0.52%, Anhingidae (1) 0.26%,

Phalacrocoracidae (2) 0.52%, Ardeidae (13) 3.43%, Threskiornithidae (2) 0.52%, Ciconiidae (5) 1.32%, Pittidae (2) 0.52%, Irenidae (2) 0.52%, Laniidae (5) 1.32%, Corvidae (29) 7.67%, Muscicapidae (35) 9.25%, Sturnidae (5) 1.32%, Sittidae (3) 0.79%, Paridae (2) 0.52%, Hirundinidae (3) 0.79%, Pyconotidae (6) 1.58%, Cisticolidae (10) 2.64%, Zosteropidae (1) 0.26%, Sylviidae (49) 12.96%, Alaudidae (4) 1.05%, Nectariniidae (6) 1.58%, Passeridae (20) 5.29% and Fringillidae (3) 0.79%. The survey covered almost all types of habitats using four different routes in different section of the national park. A total 138 Mackinnon's lists were prepared resulting in the recording of 360 bird species. Great Hornbill (*Buceros bicornis*), Ruddy Kingfisher (*Halcyon coromanda*), Oriental Cuckoo (*Cuculus orientalis*), Slaty-legged Crake (*Rallina eurizonoides*), Mottled Wood Owl (*Strix ocellata*), Egyptian Vulture (*Neophron percnopterus*), White-rumped Vulture (*Gyps bengalensis*), Red-headed Vulture (*Sarcogyps calvus*), Purple Heron (*Ardea purpurea*), Black Bittern (*Dupetor flavicollis*), Large-Woodshrike (*Tephrodornis gularis*), Isabelline Wheater (*Oenanthe isabellina*), Red-throated Flycatcher (*Ficedula parva*), Kashmir Flycatcher (*Ficedula subrubra*), Ashy Prinia (*Prinia socialis*), Hoary Throated Barwing (*Actinodura nipalensis*), Nepal wren Babbler (*Pnoepyga pusilla*), Chestnut-headed Tesia (*Tesia castaneocoronata*) were observed but not during the compilation of the Mackinnon's lists.



A total of 166 species of birds were recorded during the first visit, 140 species were added from the second visit, 32 from the third and 22 species from the fourth visit.



**Figure 6 : Bird species richness curve**

Great Slaty Woodpecker (*Mulleripicus pulverulentus*), Bengal Florican (*Houbaropsis bengalensis*), White-rumped Vulture (*Gyps bengalensis*), Egyptian Vulture (*Neophron percnopterus*), Red-headed Vulture (*Sarcogyps calvus*), Lesser Adjutant (*Leptoptilos javanicus*), Kashmir Flycatcher (*Ficedula subrubra*), Grey-crowned Prinia (*Prinia cinereocapilla*), Bristled Grassbird (*Chaetornis striatus*) and Yellow-breasted Bunting (*Emberiza aureola*) are the recorded globally threatened

birds listed in IUCN Red List under Critically Endangered to Near Threatened Category. Spiny Babbler (*Turdoides nipalensis*), the only one endemic bird to Nepal, was also recorded in Chitwan National Park.

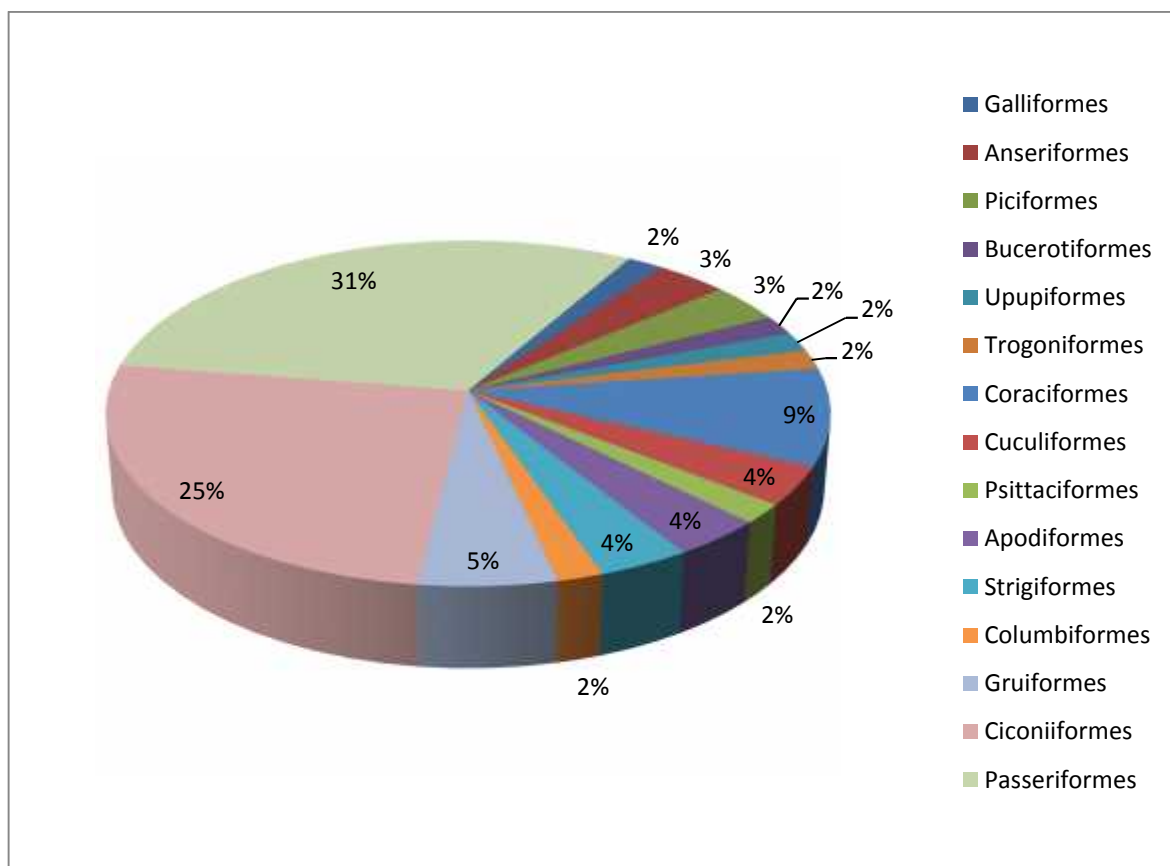
The most common species were Lesser Whistling Duck (*Dendrocygna javanica*), Crested Treeswift (*Hemiprocne coronata*), Slaty-headed Parakeet (*Psittacula himalayana*), Rock Pigeon (*Columba livia*), Large-billed Crow (*Corvus macrorhynchos*), House Crow (*Corvus splendens*), Blue Whistling Thrush (*Myophonus caeruleus*), Black Bulbul (*Hypsipetes leucocephalus*), Himalayan Bulbul (*Pycnonotus leucogenys*), Oriental White-eye (*Zosterops palpebrosus*), Puff-throated Babbler (*Pellomeum ruficeps*), Eurasian Tree Sparrow (*Passer montanus*), Paddyfield Pipit (*Anthus rufulus*) and Scaly-breasted Munia (*Lonchura punctulata*). These were recorded throughout the season with high relative abundance and number (Appendix I).

Other birds with high populations were Bar-headed Goose (*Anser indicus*), Ruddy Shelduck (*Tadorna ferruginea*), Common Merganser (*Mergus merganser*), Gadwall (*Anas strepera*), Mallard (*Anas platyrhynchos*), Common Greenshank (*Tringa nebularis*), Temminck's Stint (*Calidris temminckii*), Great Cormorant (*Phalacrocorax carbo*), Black Stork (*Ciconia nigra*), Grey-hooded Warbler (*Seicercus xanthoschistos*) and Common Rosefinch (*Carpodacus erythrinus*) due to their conducive habitats in Chitwan National Park, though, these birds were not seen in all visits (Appendix I).

Kashmir Flycatcher (*Ficedula subrubra*), Nepal Wren Babbler (*Phoebastria immaculata*), Ashy Minivet (*Pericrocotus divaricus*), Hoary Throated Barwing (*Actinodura nipalensis*), Mottled Wood Owl (*Strix ocellata*), Greater White Fronted

Goose (*Anser albifrons*), Isabelline Wheater (*Oenanthe isabellina*) were recorded after 10 to 15 years in Chitwan National Park.

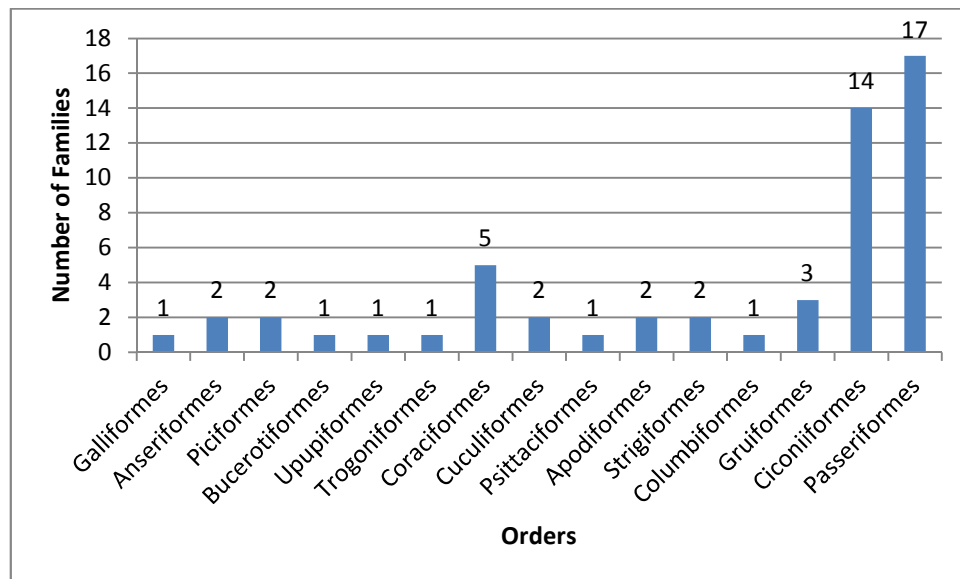
Out of 15 orders of bird species, maximum number of species of birds seen belong to order Passeriformes (185) 48.94% followed by Ciconiiformes (88) 23.28% and least number (1) 0.26% in orders Upupiformes and Trogoniformes respectively.



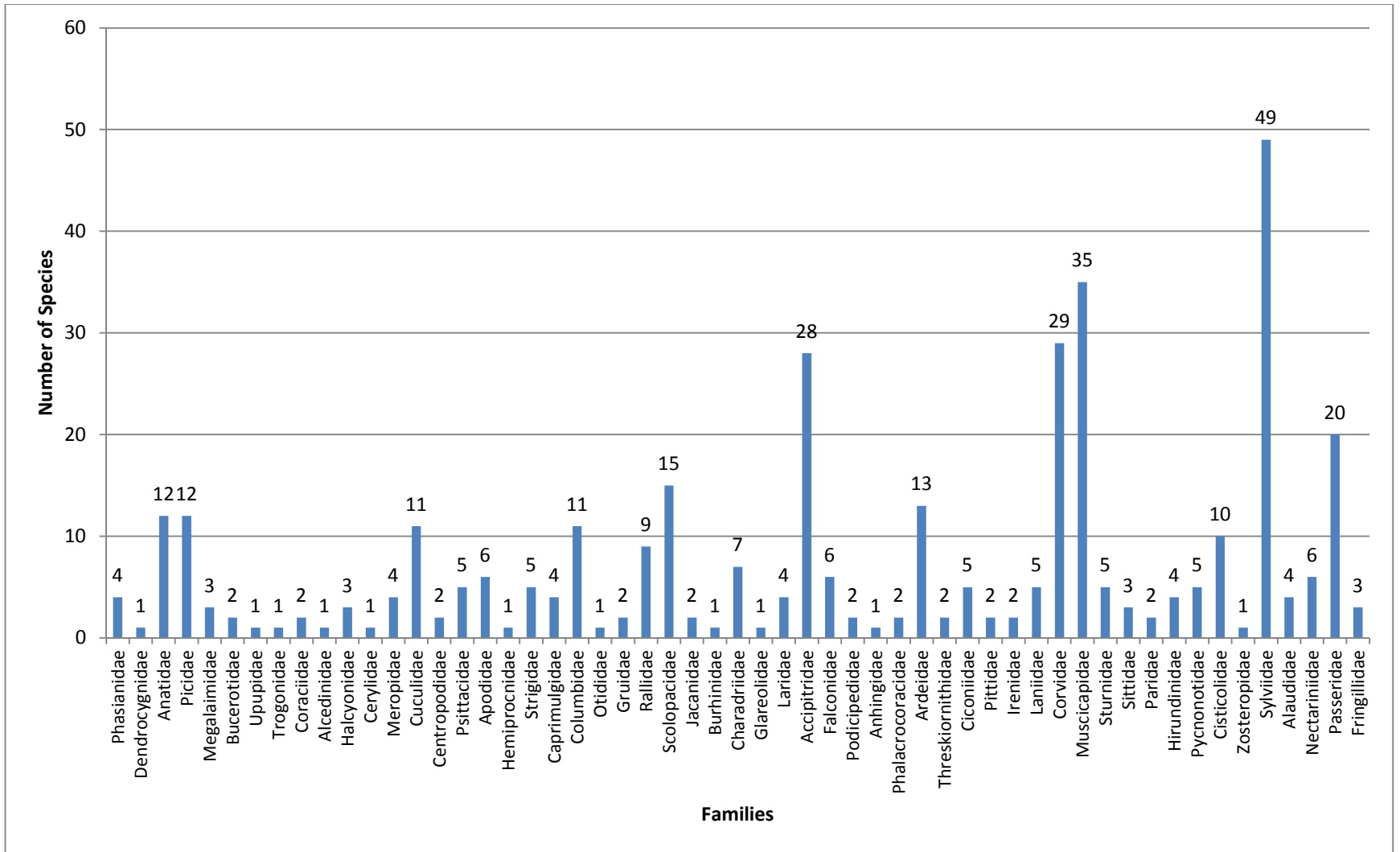
**Figure 7 : Order-wise distribution of bird species in Chitwan National Park**

The highest number of species were found in family Sylviidae (49) 12.96% followed by Muscicapidae (35) 9.25%, Corvidae (29) 7.67% and Accipitridae (28) 7.40% and least number (1) 0.26% in other 11 families. Birds of family Sylviidae are seen in maximum number because these birds are short-distance flyers and they are forest-dwellers. Since in Chitwan national Park, there is 70% domination of Sal (*Shorea robusta*) forest, the birds of family Sylviidae was seen more in number.

The order Passeriformes was found dominant having 17 families followed by orders Ciconiiformes (14), Coraciiformes (5), Gruiformes (3), Anseriformes, Piciformes, Cuculiformes, Apodiformes, Strigiformes each with 2 families and remaining Galliformes, Bucerotiformes, Upupiformes, Trogoniformes, Psittaciformes and Columbiformes with 1 family each.

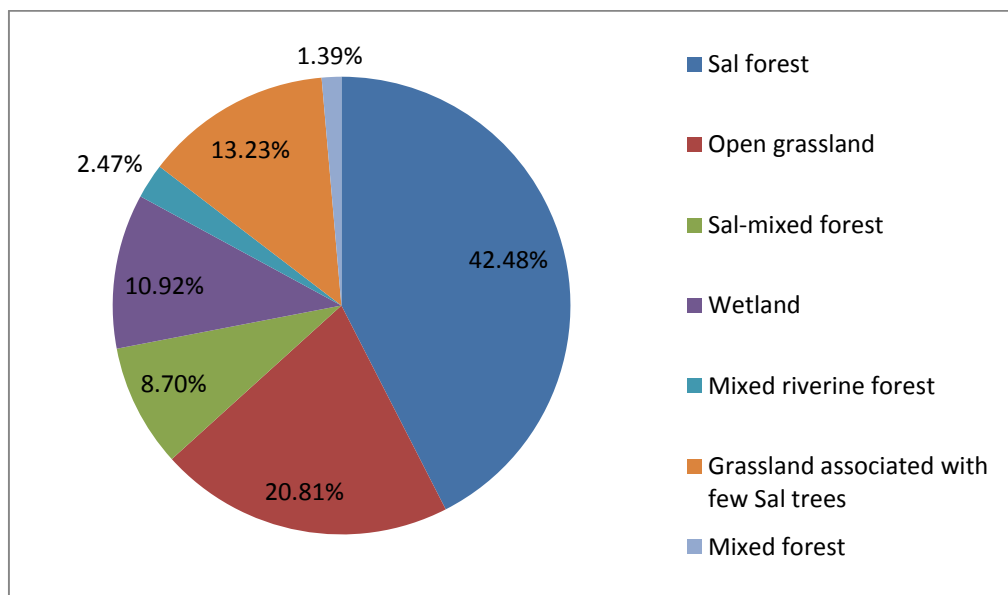


**Figure 8: Order-wise distribution of families in Chitwan National Park**



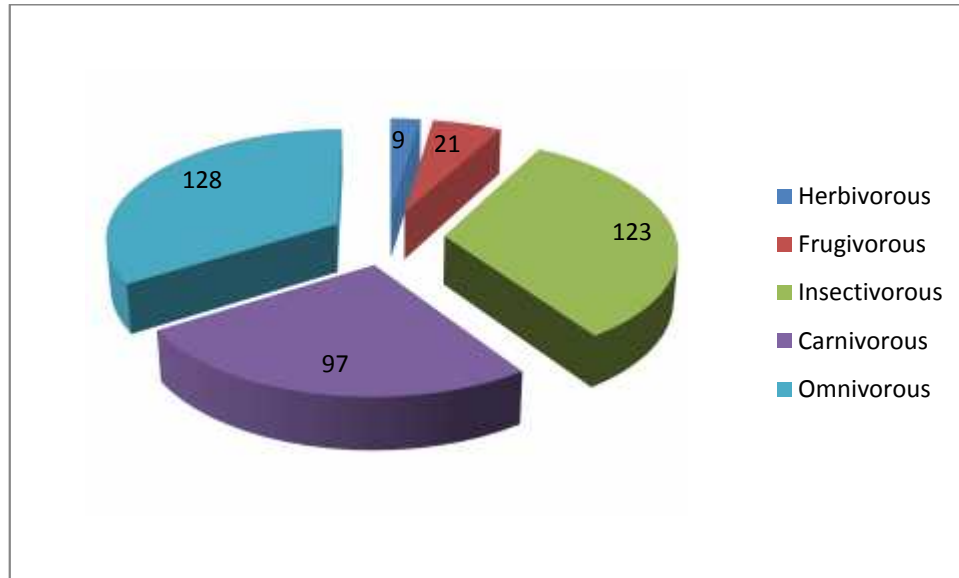
**Figure 9 : Family wise distribution of bird species in Chitwan National Park**

Bird population also showed a great fluctuation within the habitat type. Major seven habitat types were found on the line transect laid down in the Chitwan National Park. Most of the species (42.48%) were recorded from Sal (*Shorea robusta*) forest followed by open grassland (20.81%), Sal -mixed forest (8.70%), wetland (10.92%), mixed riverine forest (2.47%), grassland associated with few Sal trees (13.23%) and mixed forest (1.39%)



**Figure 10 : Habitat wise distribution of birds in Chitwan National Park**

The analysis of feeding habits showed that a maximum number of species (128 species) were omnivorous, followed by insectivorous (123 species), carnivorous (97 species), frugivorous (21 species) and herbivorous (9 species) respectively.



**Figure 11 : Feeding Guild**

A total 28 plant species belonging to 18 families were found in wetlands of Chitwan National Park during study period.

**Table 4: Checklist of Aquatic Floras**

S.No.	Scientific name	Common name	Family
1	<i>Typha capensis</i>	Padare	Typhaceae
2	<i>Typha angustifolia</i>	Padare	Typhaceae
3	<i>Schoenoplectus paludicola</i>	Mauth	Cyperaceae
4	<i>Schoenoplectus brachyceras</i>	Sano Pani Fuli	Cyperaceae
5	<i>Phragmites australis</i>	Thulo Narkat	Poaceae
6.	<i>Cyperus sexangularis</i>	Pani Mauth	Cyperaceae

7	<i>Cyperus eragrostis</i>	Pani Gudh Mauth	Cyperaceae
8	<i>Cyperus dives</i>	Pani Mauth	Cyperaceae
9	<i>Carex austro Africana</i>	Sarpa Makai Parako Lamo Ghonga	Cyperaceae
10.	<i>Pentederia cordata</i>	Besarko Pat Jastai	Pontederiaceae
11	<i>Plantago longissima</i>	Dadiban Parako	Plantaginaceae
12	<i>Marsilla spp.</i>	Charpaatee	
13	<i>Limosella maior</i>	Bangalaa Paat	Scrophulariaceae
14	<i>Floscopa glomerata</i>	Ban Pyaag Jastai	Commelinaceae
15	<i>Cyclosorus interruptus</i>	Raanisinka Jastai	Pteridophyta
16	<i>Potamogeton crispus</i>	Phulunga Jhaar	Potamogetonaceae
17	<i>Egeria densa</i>		Hydrocharitaceae
18	<i>Trapa natans</i>	Singada	Lythraceae
19	<i>Nymphoides thumbergiana</i>	Bangalaa Paat Kamal	Menyanthaceae
20	<i>Nymphoides species</i>	Baadee Hariya Kamal	Menyanthaceae
21	<i>Nymphoides Mexicana</i>	Seeta Ful Aarka Kamal	Menyanthaceae
22	<i>Nymphoides nouchalia</i>		Menyanthaceae
23	<i>Hydrocleyes nymphoides</i>	Kamal Para Dekhenee	Alismataceae
24	<i>Spiraea bella</i>	Seeto Khareto	Rosaceae
25	<i>Hymenodictyon excelsum</i>	Seeto Kath	Rubiaceae
26	<i>Myrsine capitellata</i>	Seeto Kath	Myrsinaceae
27	<i>Nymphae esculenta</i>	Seeto Kamal	Nymphoeaceae
28	<i>Cyperus niveus</i>	Seeto Mauth	Cyperaceae

A total of 36 species of birds belonging to 3 orders and 10 families were recorded in the wetlands of Chitwan National Parks during study period of different seasons.



**Table 5 : Checklist of wetland birds**

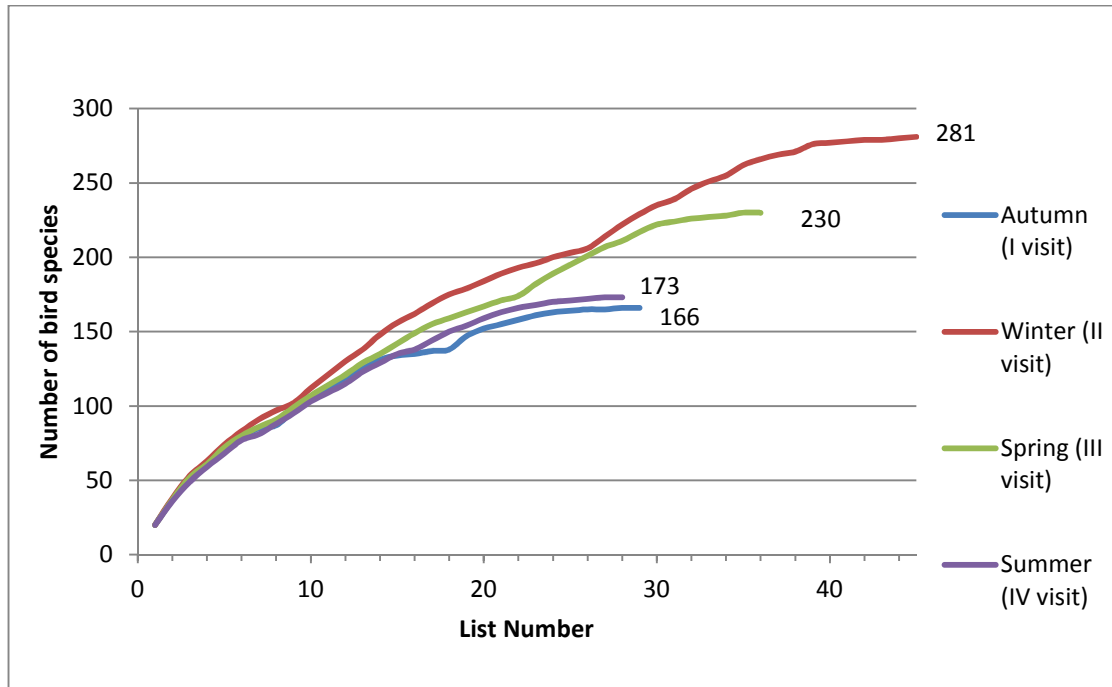
S.No.	Order/Family	Scientific name	Common name
	<b>ANSERIFORMES</b>		
1.	Dendrocygnidae	<i>Dendrocygna javanica</i>	Lesser Whistling Duck
2.	Anatidae	<i>Anser indicus</i>	Bar-headed Goose
3.	Anatidae	<i>Anser anser</i>	Greylag Goose
4.	Anatidae	<i>Tadorna ferruginea</i>	Ruddy Shelduck
5.	Anatidae	<i>Tadorna tadorna</i>	Common Shelduck
6.	Anatidae	<i>Anas strepera</i>	Gadwall
7.	Anatidae	<i>Anas platyrhynchos</i>	Mallard
8.	Anatidae	<i>Poecilorhyncha</i>	Spot-billed Duck
9.	Anatidae	<i>Anas acuta</i>	Northern Pintail
10.	Anatidae	<i>Anas penelope</i>	Eurasian Wigeon
	<b>GRUIFORMES</b>		
11.	Rallidae	<i>Amaurornis akool</i>	Brown Crake
12.	Rallidae	<i>Amaurornis phoenicurus</i>	White-breasted Waterhen
13.	Rallidae	<i>Porzana fusca</i>	Ruddy-breasted Crake
14.	Rallidae	<i>Porphyrio porphyrio</i>	Purple Swamphen
15.	Rallidae	<i>Gallinula chloropus</i>	Common Moorhen
16.	Rallidae	<i>Fulica atra</i>	Common Coot
	<b>CICONIIFORMES</b>		
17.	Scolopacidae	<i>Tringa nebularia</i>	Common Greenshank
18.	Scolopacidae	<i>Calidris temminckii</i>	Temminck's Stint
19.	Accipitridae	<i>Pandion haliaetus</i>	Osprey
20.	Accipitridae	<i>Ichthyophaga ichthyaetus</i>	Grey-headed Fish Eagle
21.	Podicipedidae	<i>Podiceps cristatus</i>	Great Crested Grebe
22.	Anhingidae	<i>Anhinga melanogaster</i>	Oriental Darter
23.	Ardeidae	<i>Egretta garzetta</i>	Little Egret
24.	Ardeidae	<i>Ardea cinerea</i>	Grey Heron
25.	Ardeidae	<i>Ardea purpurea</i>	Purple Heron
26.	Ardeidae	<i>Nycticorax nycticorax</i>	Black-crowned Night Heron
27.	Ardeidae	<i>Ardeola grayii</i>	Indian Pond Heron
28.	Ardeidae	<i>Casmerodius albus</i>	Great Egret
29.	Ardeidae	<i>Mesophoyx intermedia</i>	Intermediate Egret
30.	Ardeidae	<i>Bubulcus ibis</i>	Cattle Egret
31.	Ardeidae	<i>Butorides striatus</i>	Little Heron

32.	Threskiornithidae	<i>Pseudibis papillosa</i>	Black Ibis
33.	Ciconidae	<i>Anastomus oscitans</i>	Asian Openbill
34.	Ciconidae	<i>Ciconia nigra</i>	Black Stork
35.	Ciconidae	<i>Ciconia episcopus</i>	Woolly-necked Stork
36.	Ciconidae	<i>Leptoptilos javanicus</i>	Lesser Adjutant

## 4.2 Seasonal Bird Species Richness

Species richness curve resulted from Mackinnon's list shows that highest number of birds species were recorded from winter season with 281 (74.33%) species followed by spring with 230 (60.84%) species, summer with 173 (45.76%) species and least species from autumn season with 166 (43.91%) birds species. Thus winter season was found dominant for bird diversity than other seasons (autumn, spring and winter).

From autumn visit 29 lists were prepared followed by 45 from winter, 35 from spring and 26 from summer visit.



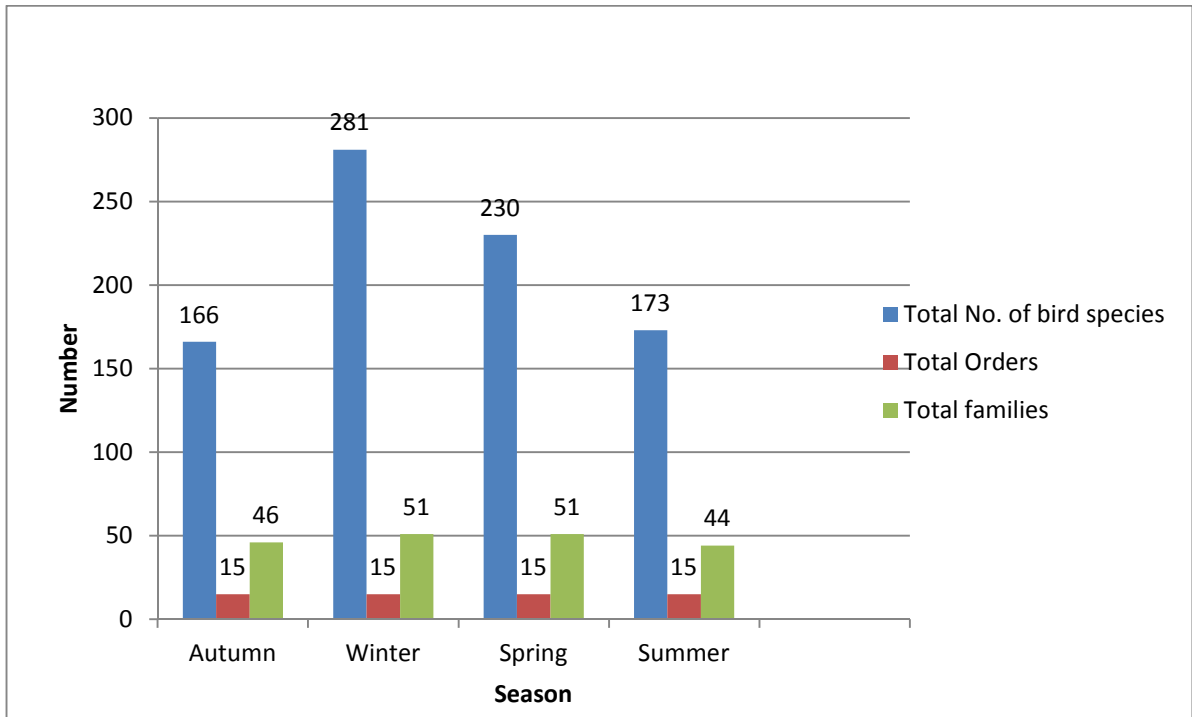
**Figure 12 : Comparative species richness curve**

The bird Ruddy Kingfisher (*Halcyon coromanda*), Hoary Throated Barwing (*Actinodura nipalensis*), Large-Woodshrike (*Tephrodornis gularis*), Mottled Wood Owl (*Strix ocellata*), and Isabelline Wheater (*Oenanthe isabellina*) were recorded only from one visit which were not included in Mackinnon's list. Including these five birds, the species diversity of 1<sup>st</sup> visit (Autumn season) results to 171 species. Adding Egyptian Vulture (*Neophron percnopterus*), White-rumped Vulture (*Gyps bengalensis*), Red-headed Vulture (*Sarcogyps calvus*), Greater White Fronted Goose (*Anser albifrons*) and Kashmir Flycatcher (*Ficedula subrubra*) results 286 bird species in winter visit.

Similarly, adding Great Hornbill (*Buceros bicornis*), Purple Heron (*Ardea purpurea*), Black Bittern (*Dupetor falvicollis*) and Ashy Prinia (*Prinia socialis*) results 234 bird species in spring season (third visit)

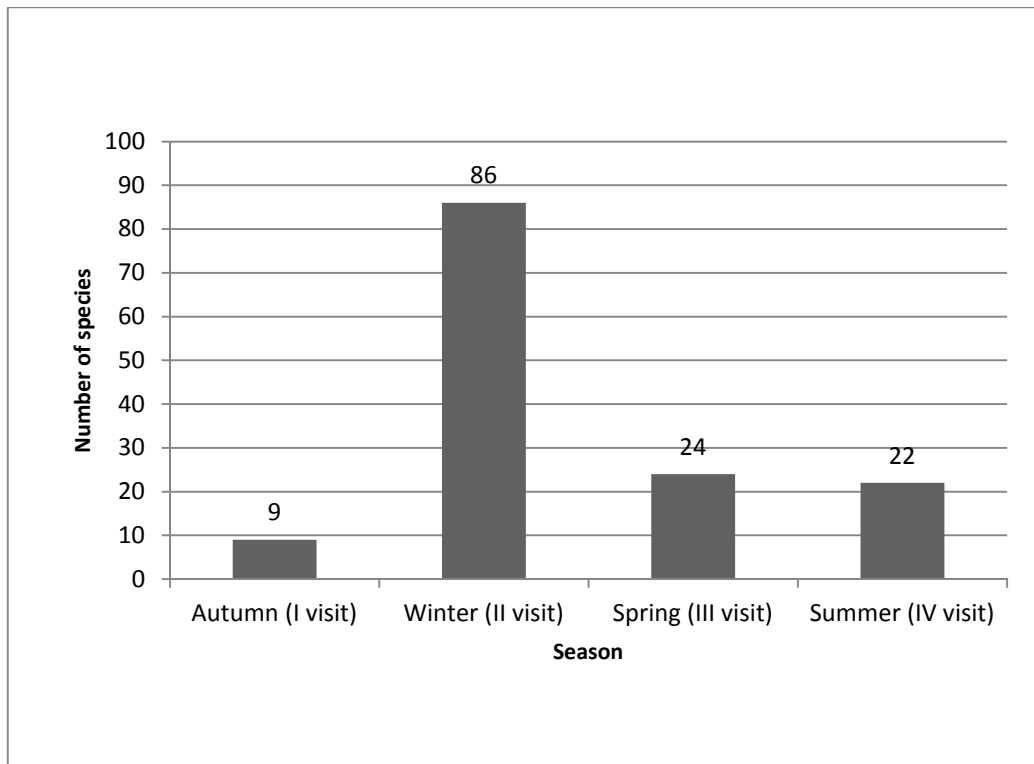
Likewise, Oriental Cuckoo (*Cuculus orientalis*), Slaty-legged Crake (*Rallina eurizonoides*), Red-throated Flycatcher (*Ficedula albicilla*) and Chestnut-headed Tesia (*Tesia castaneocoronata*) totals 177 bird species from summer visit. The following nine birds; Black-napped Monarch (*Hypothymis azurea*), Great Bittern (*Botaurus stellaris*), Scaly Thrush (*Zoothera dauma*), Sultan Tit (*Melanochlora sultanea*), Graceful Prinia (*Prinia gracilis*), Striated Grassbird (*Megalurus palustris*), Thick-billed Flowerpecker (*Dicaeum agile*), White-browed Wagtail (*Motacilla maderaspatensis*) and Indian Silverbill (*Euodice malabarica*) were seen on only first visit.

The total number of species recorded were 166 belonging to 15 orders and 46 families in autumn season. Similarly, in spring season, a total of 230 species of birds representing 15 orders and 51 families were recorded. Likewise, in winter season, the total number of species of birds recorded were 281 belonging to 15 orders under 51 families. In summer season, 173 total number of species were found, belonging to 15 orders and 44 families.



**Figure 13 : Seasonal status of bird species in Chitwan National Park**

Highest number of species i.e. 86 were only seen during second visit. Most of them were altitudinal migrant and winter visitors. Likewise, 24 types of species of birds were recorded only during third visit i.e. spring season. Both late winter and early summer migrant birds were recorded during this visit including Spiny Babbler (*Turdoides nipalensis*) (Appendix I). Similarly, 22 species of birds were recorded only during summer i.e. fourth visit. The lowest number of species i.e. 9 were recorded only from first visit.



**Figure 14 : Number of bird species recorded only in each season**

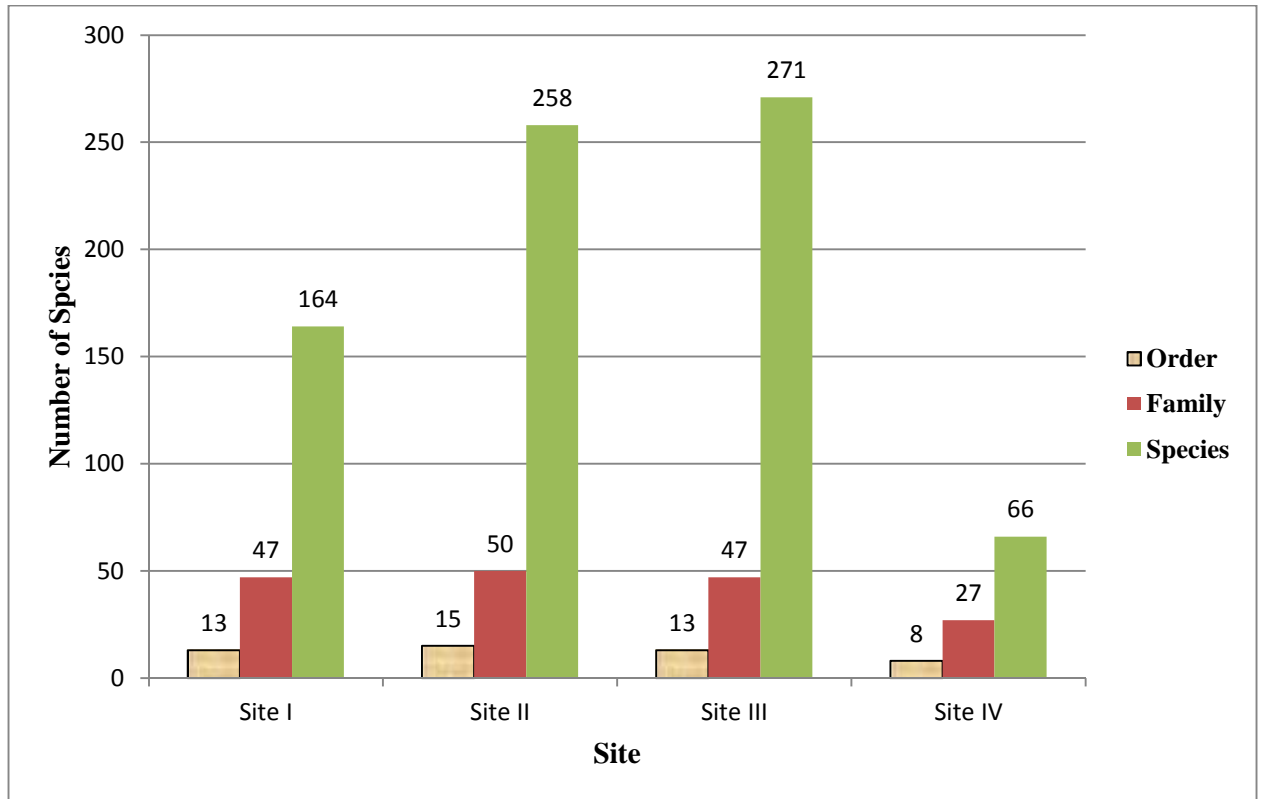
### 4.3 Distribution of birds in four different sites

Analysing the Mackinnon's lists the table below shows that site number 3 seems richest in bird diversity while site number 4 seems lowest. From site 1, total 34 lists were prepared, likewise 51 lists were from site 2, 45 lists from site 3 and 8 from site 4.

**Table 6 : Number of Mackinnon's list and bird species**

Number of list taken/Number of bird species					
Site	I visit (Autumn)	II visit (Winter)	III visit (Spring)	IV visit (Summer)	Total
1	8/79	10/99	9/89	7/58	34/164
2	10/100	17/182	14/142	10/109	51/258
3	9/83	16/168	11/121	9/85	45/271
4	2/23	2/25	2/23	2/24	8/66

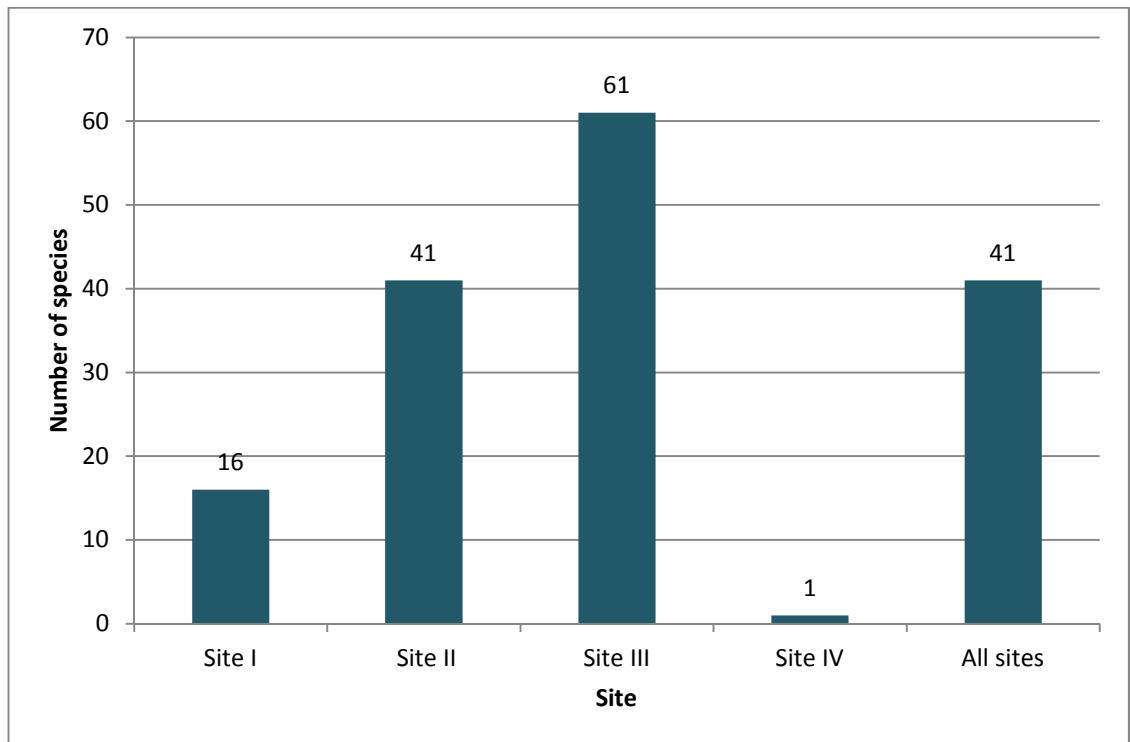
In site I of study area, 13 orders, 47 families and 164 (43.38%) species of birds were recorded. Similarly, in site II, there were 15 orders, 50 families and 258 (68.25%) species, in site III 13 orders, 47 families and 271 (71.69%) species and in site IV 8 orders, 27 families and 66 (17.46%) species of birds were recorded.



**Figure 15 : Site-wise distribution of bird species in Chitwan National Park**

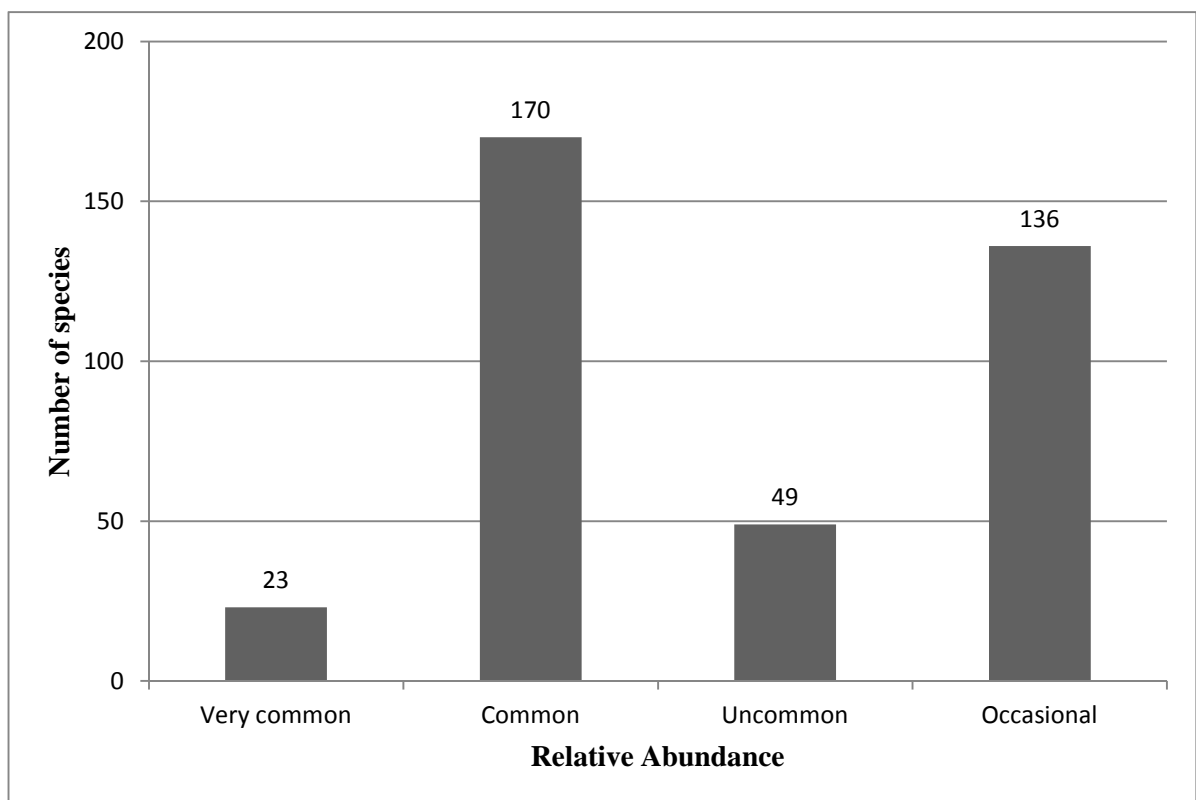


The highest number of species of birds i.e.; 61 were only seen in site 3 during all four season. Likewise, 41 species of birds were recorded only in site 2 and 16 species of birds were recorded only in site 1. The lowest number of bird species i.e.; 1 was recorded only in site 4 during all four season. The 41 species of birds listed in Appendix I were recorded from all four sites during all four season.



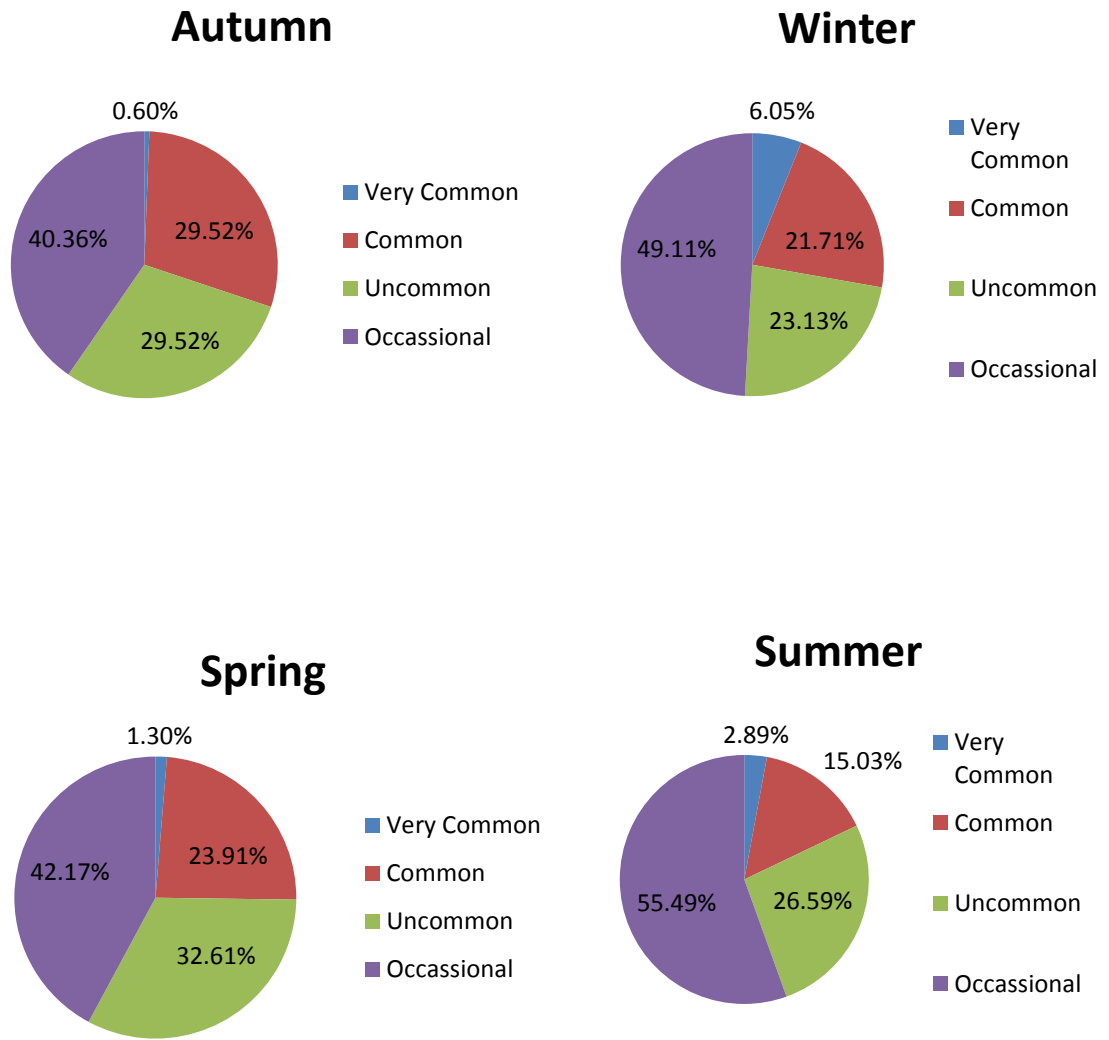
**Figure 16 : Bird species composition in four sites in Chitwan National Park**

From McKinnon's and Philips method, the data were also analysed for relative abundance on the basis of frequency of sightings. The data analysed as shown below in fig. 17, the very common bird species were 23, common were 170, uncommon were 49 and occasional were 136. The highest number of species were found in common followed by occasional, uncommon and very common. The detail abundance of species of birds are in Appendix I.



**Figure 17 : Relative Abundance of bird species in Chitwan National Park**

In autumn season, the highest number of species were found in occasional 67 (40.36 %) followed by uncommon 49 (29.52%), common 49 (29.52%) and very common 1 (0.60%). Similarly, in winter season, the highest number of species of birds were found in occasional 138 (49.11%) followed by uncommon 65 (23.13%), common 61 (21.71%) and very common 17 (6.05%). Likewise, in spring season, the highest number of species of birds were found in occasional 97 (42.17%) followed by uncommon 75 (32.61%), common 55 (23.91%) and very common 3 (1.30%). In summer season, the highest number of species were found in occasional 96 (55.49%) followed by uncommon 46 (26.59 %), common 26 (15.03%) and very common 5 (2.89%).



**Figure 18 : Comparison of relative abundance of bird species among four seasons**

#### 4.4 Population status of Resident and Migratory birds in Chitwan National Park

The analysis of data on residential status revealed that out of 378 species, 217 were resident, whereas the remaining 161 species showed seasonal. Total number of resident birds were 217 belonging to 15 orders and 46 families. Migratory birds were of winter visitors, summer visitors and passage visitors. Winter visitors were 121 species belonging to 7 orders and 22 families. Summer visitors were 26 species belonging to 7 orders and 12 families and passage visitors were 14 species belonging to 3 orders and 12 families. Detailed population and status of each encountered birds are mentioned in Appendix I & II.

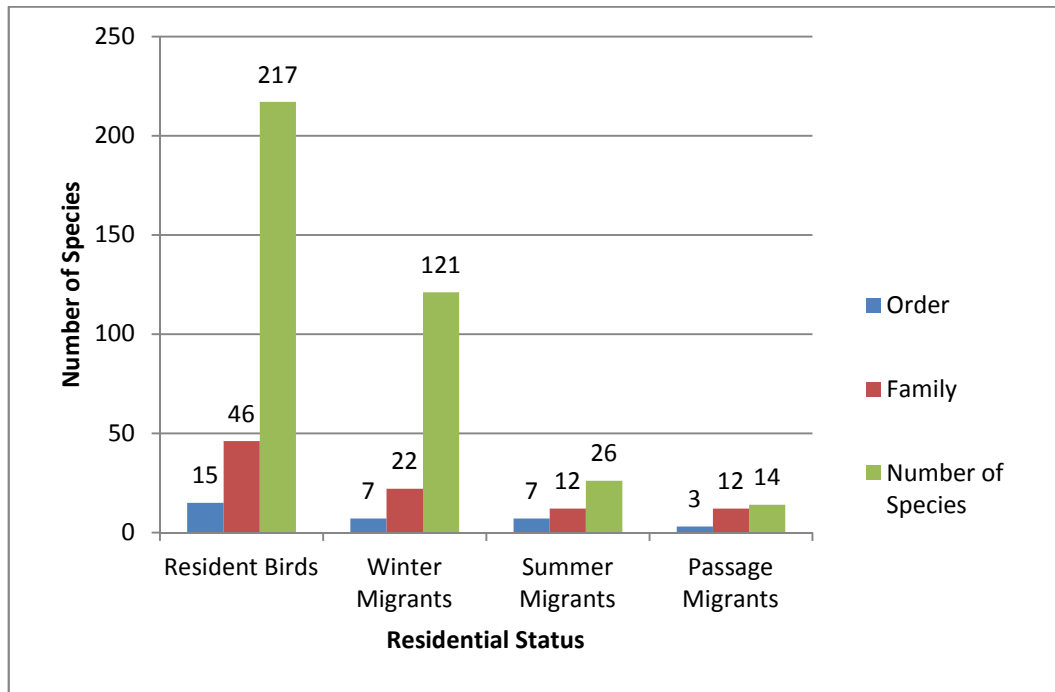


Figure 19 : Population of resident and migratory birds

## 4.5 Data Analysis

### 4.5.1 Diversity of birds in different season

Shanon Wiener Diversity Index was used to calculate seasonal bird diversity, bird diversity in four different sites and species evenness.

The value of H is highest (4.497) in winter season as compared to other seasons. Hence, winter season is more diverse for species richness. Whereas, the value of E is highest (0.850) in summer season in comparison to any other seasons, hence bird species are evenly distributed in summer. The details are given in Appendix IV.

**Table 7 : Shanon - Weiner Diversity Index for four seasons**

Season	S	N	$\pi(n/N)$	$\ln(\pi)$	$[\pi*\ln(\pi)]$	H	$H_{max}$	Evenness
Autumn	166	1509	1	-964.728	-4.228	4.228	5.117	0.826
Winter	281	3816	1	-1838.39	-4.497	4.497	5.638	0.797
Spring	230	2154	1	-1411.63	-4.477	4.477	5.442	0.822
Summer	173	1248	1	-1008.48	-4.382	4.382	5.153	0.850

### 4.5.2 Diversity of birds in four sites

The value of H is highest (1.631) in site 2, hence it is more diverse. The value of E is highest (0.728) in site 4, hence in site 4 species are evenly distributed. The details are given in Appendix V.

**Table 8 : Shanon- Weiner Diversity Index for four sites**

Season	S	N	pi(n/N)	ln(pi)	[pi*ln(pi)]	H	H <sub>max</sub>	Evenness
Site 1	13	164	0.836	-47.817	-1.395	1.395	2.564	0.544
Site 2	15	258	0.993	-57.01	-1.631	1.631	2.708	0.602
Site 3	13	271	0.993	-47.002	-1.547	1.547	2.564	0.603
Site 4	8	66	0.996	-20.988	-1.514	1.514	2.079	0.728

### 4.5.3 Order diversity

In total, 15 orders were recorded. The mean number of orders  $3.49 \pm 4.7$ , range 1-17 was recorded. In site-1; 13 out of 15 orders (mean= $3.62 \pm 4.7$ , range 1-15), in site-2; 15 orders (mean= $3.33 \pm 4.8$ , range 1-17), site-3; 13 out of 15 orders (mean= $3.62 \pm 4.9$ , range 1-17) and in site-4, 8 out of 15 orders (mean= $3.38 \pm 3.6$ , range 1-11) were recorded. The highest number of families in site 2 (n=15) and site 3 (n=13) were recorded (Figure 20). The number of orders is not statistically significant different in four sites (Oneway ANOVA,  $F= 0.013$ ,  $df = 3$ ,  $Sig = 0.998$ , Figure 18, Appendix-VI). In site-1, Upupiformes and Psittaciformes, site-3, Piciformes and Bucerotiformes, and site-4, Anseriformes, Bucerotiformes, Trogoniformes, Apodiformes, Strigiformes, Gruiformes, and Upupiformes were not observed.

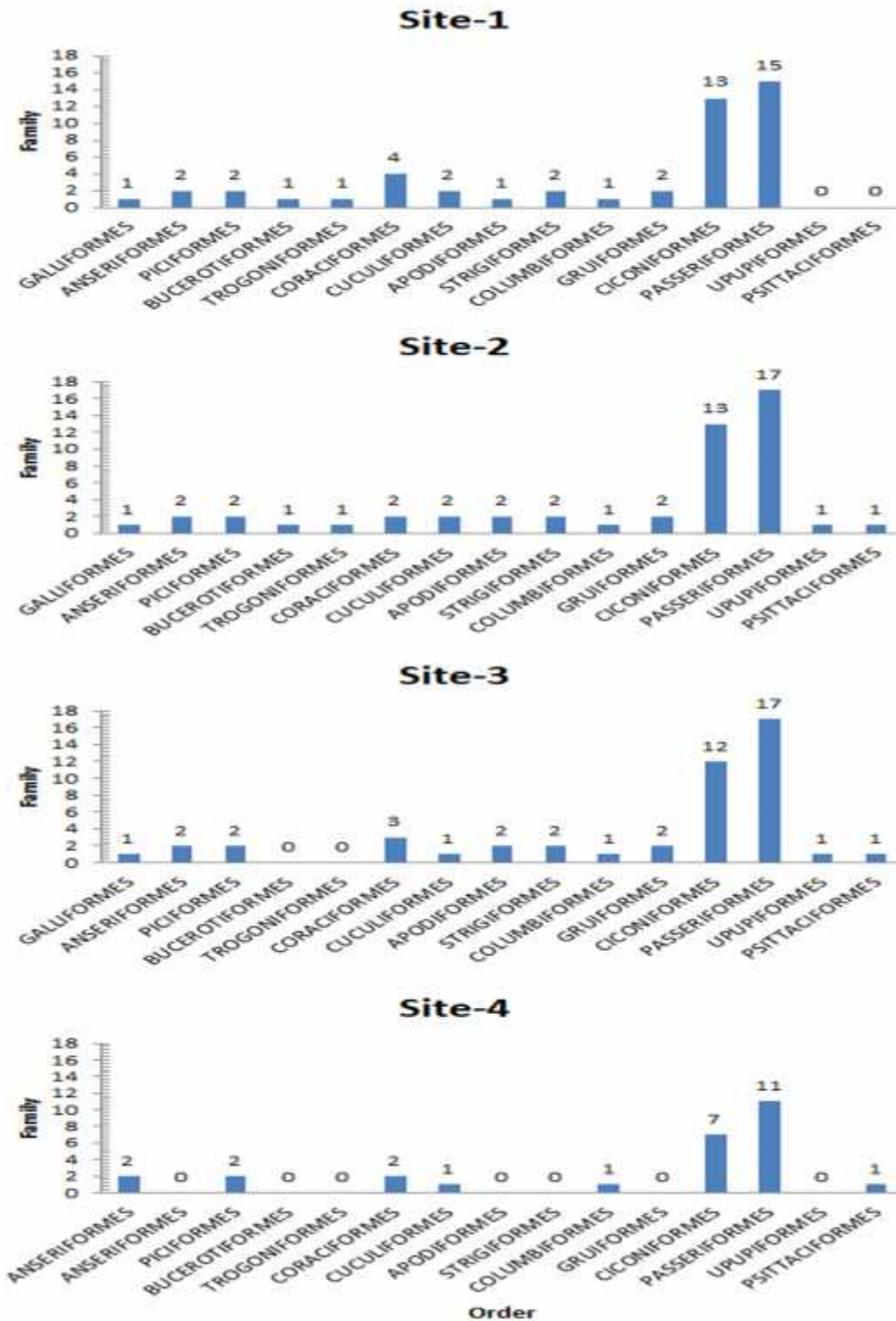
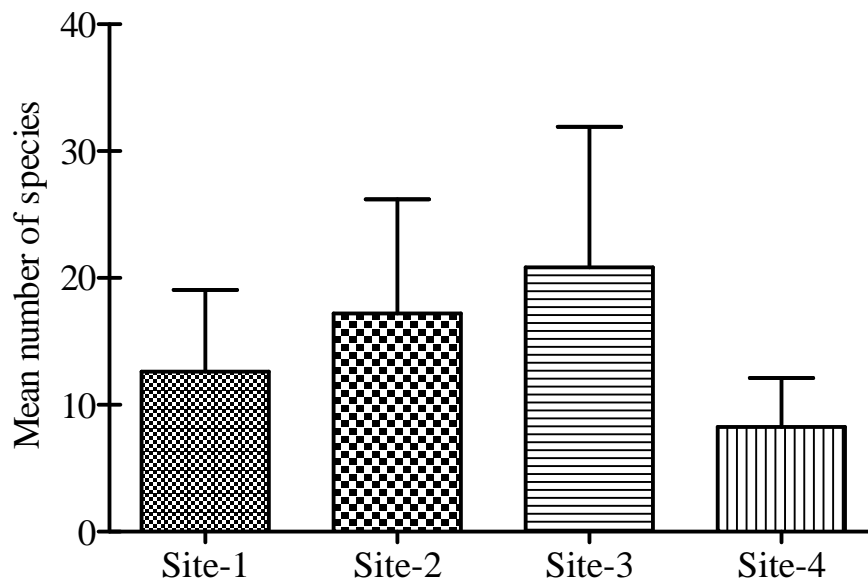


Figure 20 : Number of family and order recorded at four sites



#### 4.5.4 Species diversity

Mean number of species in four sites were recorded. The highest number of species was recorded in site-3 (20.85<sup>1</sup> 39.91; range 1-144; N=13), whereas the lowest number of species was recorded in site-4 (8.25<sup>1</sup> 10.93; range 2-34; N= 8). *Turkey Post Hoc Test* showed that there is no statistical significant different in the number of species in four sites (Oneway ANOVA; F =0.299; df = 3; Sig= 0.824, Figure 21 – Appendix-VI).



**Figure 21 : Mean number of species in four sites**



**Photograph 1: Ruddy Shelduck (*Tadorna ferruginea*) and Bar-headed Goose (*Anser indicus*)**



**Photograph 2: Oriental Pied Hornbill (*Anthracoceros albirostris*)**



**Photograph 3: Asian-paradise Flycatcher (*Terpsiphone paradisi*)**



**Photograph 4: Egyptian Vulture (*Neophron percnopterus*)**





**Photograph 5: Asian Openbill (*Anastomus oscitans*)**



**Photograph 6: Stork-billed Kingfisher (*Halcyon capensis*)**



**Photograph 7: Chestnut-headed Bee-eater (*Merops leschenaulti*)**



**Photograph 8: Red Avadavat (*Amandava amandava*)**





**Photograph 9: Common Iora (*Aegithina tiphia*)**



**Photograph 10: Orange-headed Thrush (*Zosterops citrine*)**

# Chapter 5

## 5 Discussion

Nepal is rich in biodiversity. So far, 878 species of birds have been recorded in Nepal, which are about 8% of the total bird species found worldwide. Chitwan National Park is home to more than 6% of the world's bird species.

Baral (1997) for the first time published a checklist of 'Birds of Chitwan'. It includes 524 birds of different species including residents, migrants and vagrants. These represents a total of 69 bird families. First Edition included 401 species of birds in the checklist of 'Chitwan Birds' published by Bird Education Society, Chitwan, year of publication (?). Second Edition included 509 species of birds representing 59 families in the checklist of 'Birds of Chitwan' published by Bird Education Society, Chitwan in 2000. Third Edition included 625 species of birds belonging to 64 families in the checklist of 'Chitwan Birds' published by Bird Education Society and Department of National Parks & Wildlife Conservation in 2013. In this checklist, the most numerous bird species come from the family Sylviidae (87 species), Muscicapidae (69 species), Accipitridae (45 species), Corvidae (40 species) and Anatidae (26 species) respectively.

Baral and Upadhyay authored a checklist of 'Birds of Chitwan' published by the Royal Chitwan National Park and Bird Conservation Nepal in 1998. It mentions 526 species of birds belonging to 69 bird families.

The checklist prepared by Baral and Upadhyay in 2006 mention 543 species of birds representing 59 bird families of the world which is published by Department of National Parks & Wildlife Conservation and Bird Conservation Nepal. In their checklist, the most numerous birds come from the family Sylviidae (60 species), Muscicapidae (55 species), Accipitridae (44 species), Corvidae (36 species) and Anatidae (25 species) respectively.

However, the present researcher has also deeply and thoroughly observed 378 species of birds representing 15 orders and 55 families during 2013-2014 covering all seasons duration of the research period. In this study, the most numerous species of birds come from the family Sylviidae (50 species), Muscicapidae (36 species), Accipitridae (27 species), Corvidae (29 species) and Anatidae (12 species). The old checklist of species of birds included the Chitwan district and buffer zone. Special feature of this study is field knowledge and available information status of each bird species recorded in Chitwan National Park. In fairness, it may be stated that whole Chitwan district is not covered but focus is on the park.

Of the 878 species of birds recorded in Nepal, about 37 species are listed in IUCN Red List of Globally Threatened Birds according to Bird Life International (2015), among these 8 species are Critically Endangered, 6 Endangered and 23 are listed in Vulnerable categories, 167 species have been assessed as Nationally Threatened. and 62 Near threatened bird species [BCN and DNPWC (2011), BCN and DNPWC (2016), and Inskipp et. al., 2016). However, during this study only 10 species of birds of prey identified as Globally Threatened, 33 species of Nationally Threatened (6 are Critically Endangered, 8 species are Endangered and 19 species are Vulnerable) and 35 Near



Threatened species were recorded. The altitudinal distribution of globally threatened birds in Nepal and availability of habitat shows very few globally threatened bird species can be expected at the Chitwan National Park (BCN & DNPWC, 2011).

Baral and Inskipp (2005) reported 35 globally threatened birds (Vulnerable-14, Near Threatened-15, Endangered-3, Critically Endangered- 2, and Vagrant-1). However, this study noted only 10 globally threatened birds (among these 3 species are Critically Endangered, 2 Endangered and 5 are Vulnerable) on computation, the difference is 25 in number. Following globally threatened birds have not been observed at the site besides best efforts: Swamp Francolin (*Francolinus gularis*), Cheer Pheasant (*Catreus wallichii*), Bayer's Pochard (*Aythya baeri*), Sarus Crane (*Grus antigone*), Lesser Florican (*Sypheotides indicus*), Wood Snipe (*Gallinago nemoricola*), Black-billed Tern (*Sterna acuticauda*), Indian Skimmer (*Rynchops albicollis*), Pallas's Fish Eagle (*Haliaeetus leucoryphus*), Slender-billed Vulture (*Gyps tenuirostris*), Long-billed Vulture (*Gyps indicus*), Indian Spotted Eagle (*Aquila hastate*), Greater Spotted Eagle (*Aquila clanga*), Imperial Eagle (*Aquila heliaca*), Greater Adjutant (*Leptoptilos dubius*), Asian Wollyneck (*Ciconia episcopus*), Saker Falcon (*Falco cherrug*), Hodgson's Bushchat (*Saxicola insignis*), Jerdon's Babbler (*Chrysomma altirostre*), Slender-billed Babbler (*Turdoides longirostris*), Finn's Weaver (*Ploceus megarhynchus*), Pink-headed Duck (*Rhodonessa caryophyllacea*), Black-breasted Parrotbill (*Paradoxornis flavirostris*), White-bellied Heron (*Ardea insignis*), Black-necked Crane (*Grus nigricollis*), Rufous-necked Hornbill (*Acerous nipalensis*) and Long-tailed Duck (*Clangula hyemalis*).

The highest number of species were recorded from the second visit (winter season) i.e. 281 followed by 230, 173 and 166 from third visit (spring season), fourth visit (summer season) and first visit (autumn season) respectively. Comparatively Ruddy Shelduck (*Tadorna ferruginea*) was the most abundant species with the total count 378 because they feed on algae which are widely available at Shingle banks of Rapti and Narayani rivers where water flow is slow. They also remain in pair within the flocks (Khadka, 2012 & 2013). The same species also recorded highest in 2012 with count 5,549 in Narayani and Rapti rivers of Chitwan (Khadka, 2013).

From 1st visit 28 list were prepared followed by 45 from 2nd, 36 from 3rd and 27 from 4th visit. It is assumed that highest number of birds from 2nd visit (winter season) may be due to the augmentation of winter migratory birds including altitudinal migrant birds in comparison to summer visitor.

The number of birds from 1st visit (autumn season) were recorded lowest. This could be due to the seasonal impact as in winter migratory birds may have left the study site and likewise summer visitor had not arrived yet.

The number of birds were recorded in fourth visit (summer season) was also low because birds migrate in higher altitude in summer season for breeding; 36% of Nepal's breeding birds are altitudinal migrants (Inskipp, 1989). The variation in number of bird species and list taken from each visit was due to familiarity with birding route, number of survey hour and existed weather conditions.

The present investigator's contribution is for new information on avifauna of Chitwan National Park. In fairness, it may be mentioned that regular monitoring scheme of birds in key sites and main site of Chitwan National Park is very important.

The present investigator (2013 -2014) carried out the survey in the following sites of Chitwan National Park.

1. Balmiki Ashram to Temple Tiger
2. Temple Tiger to Kasara
3. Kasara to Sauraha
4. Sauraha to Sunachari

Considering the status of the study site following important features are noted by the present investigator:

- a. Balmiki Ashram to Temple Tiger (Site-I) - Total number of birds observed 164 (43.38%).
- b. Temple Tiger to Kasara (Site- II) – Total number of birds observed 258 (68.25%).
- c. Kasara to Sauraha (Site-III) - Total number of birds observed 271 (71.69%).
- d. Sauraha to Sunachari (Site-IV) - Total number of birds observed 66 (17.46%).

Site 2 and 3 seems rich in bird diversity with 50 and 45 lists and 258 & 271 species of birds respectively. The reason for higher bird concentration in these areas were due to the less disturbances by human activities compared to other parts, these areas are easily accessible to observe by ornithologists, as there is dense forest, presence of many

tributaries confluence, many smaller feeder stream in the main river as single bed, algae entangled in stone/boulder where a variety of aquatic – invertebrates and small fish that hide under boulder. Other reasons could be sandy bank, shaded forest areas where river flow slows and flooded trees in water.

Mainly fish eating species were sighted at river confluences and shaded forest areas. The higher concentration of fishes at confluences between the river mainstreams and various tributaries and creeks, may be a factor influencing the distribution of water birds in such areas. During the hot season, the water of shaded forest areas is cooler and during winter the water is warmer than that of main rivers. Such areas may assist with thermoregulation for Gharial (*Gavialis gangeticus*) and Marsh Muggers (*Crocodylus palustris*) as well as fish at different times of the year (Khadka, 2012). Fish are also abundant so that fish eating birds are more concentrated in these areas.

Devi Tal, Muda Tal, Kamal Tal, Lami Tal, Nand Bhauju Tal and Tamor Tal are the 5 lakes situated between Temple Tiger to Kasara (Site- II). Lami Tal and Tamor Tal are near the park head quarter at Kasara. Tamor Tal is in the southern part of Kasara in the sal forest and Lami Tal is in the riverine belt of Rapti which is in the eastern part of Kasara, near Ghatgain. Lami Tal has good marshy lakes than Tamor Tal. Lesser Whistling-duck (*Dendrocygna javanica*), Common Moorhen (*Gallinula chloropus*), Bronge-winged Jacana (*Metopidius indicus*) were commonly found at Lami Tal.

Between Kasara to Sauraha (Site-III) Nandani Tal and Patana Tal are situated. Nandani Tal is a lake surrounded by Sal-forests. Several species of Eagles are found in this area because they require both forests and wetlands as they breed in forests close to rivers or

lakes. Common Kingfisher (*Alcedo atthis*), Brown Hawk Owl (*Ninox scutulata*), & different species of woodpecker, flycatchers, minivet, different types of pigeons, barbets & cuckoo shrikes were observed.

Patana tal is good habitat for many wetland birds such as Black-tailed Godwit (*Limosa limosa*), River Lapwing (*Vanellus duvaucelli*), Pied Avocet (*Recurvirostra avosetta*), Whimbrel (*Numenius phaeopus*), Eurasian Curlew (*Numenius arquata*), Grey Bushchat (*Saxicola ferrea*) and many species of Ducks, Geese, Storks and Snipes, many wetland depended birds were sighted in this lake.

Site 2 and 3 have different habitats like riverine forest, grassland, marshland and Sal (*Shorea robusta*) forest. The high proportion of 77% of Nepal's breeding birds utilizes forest or shrub (Inskipp, 1989) bird community of Chitwan National Park is also dominated by forest birds. Red-headed Trogon (*Harpactes erythrocephalus*), White-tailed Stonechat (*Saxicola leucura*), Chestnut-capped Babbler (*Timalia pileata*), Rufous-Woodpecker (*Celeus brachyurus*), Laughingthrushes, Streaked Spiderhunter (*Arachnothera magna*), Ruddy Kingfisher (*Halcyon coromanda*) which breeds in this areas, and Sultan Tit (*Melanochlora sultanea*) were commonly seen during the monsoon.

Site 2 and 3 have good security arrangement therefore, human intervention is very low as a result no heavy fishing & other illegal activities takes place.

Site I (Balmiki Ashram to Temple Tiger) included 33 lists with only 164 species of birds. Black Bulbul (*Hypsipetes leucocephalus*), Large-billed Crow (*Corvus macrorhynchos*), Blue Whistling Thrush (*Myophonus caeruleus*), Paddyfield Pipit

(*Anthus rufulus*), were seen from Trail 1 with high number of individuals in comparison to other sites. This site touches the border of India and due to the open border situation between India and Nepal, hunters and trappers movement are not properly controlled and thus illegal trade of birds happens in that site. Galliformes (pheasants, partridges and francolins) are popular targets for hunters and trappers in some parts of Nepal resulting in much reduced populations, even in protected areas, for example in Chitwan National Park (Inskipp et al., 2008). Nepal is often a safe market for illegal bird traders. Several nationally threatened bird species including Cheer Pheasant (*Catreus wallichii*), and owls have been found to be traded (Thapa & Thakuri, 2009). A wide- ranging owl trade, mainly of Rock Eagle Owl (*Bubo benghalensis*) takes place in Nepal from where the birds are illegally exported to India, Bangladesh, China, and the Middle East (Acharya & Ghimirey, 2009). Some birds are hunted for traditional medicine. For example, the oil from the casque and the beak of the nationally threatened Great Hornbill (*Buceros bicornis*) is much valued (Flemming et al., 1984). Moreover, wetland condition in this site is also not appropriate for water birds. These two reasons justify the lower presence of birds in this trail.

In site IV from Sauraha to Sunachari, only 66 species of birds were recorded because there is low presence of park security as a result there is maximum human intervention in form of silting and collection of sand & stone pebbles are rampant. Overgrazing by domestic livestock, fodder collection, fish poisoning, fishing through electric shocks by battery and other illegal activities have increased in that area (Khadka, 2012). These practices results in the reduction of number of fishes which in turn has decreased the number of birds that depend on fish as food. Also this site has low density of sal-forest,

riverine forest and grassland forest. Moreover, there is no Tal in this site and this site is short and steep seems poor in bird diversity with only 2 list.

The number of birds sighted was highest in site II in comparison to other sites during this study. Similarly, the lowest number was in site IV. However, the result of statistical analysis indicated that there was no significant difference in the number of birds in all four respective sites. This clearly indicates that the probability of increasing the number of birds in site IV is high if considerable efforts are applied for improving the ecological conditions favourable to the birds at this site. For instance, low presence of park security as a result sand and gravel mining of river beds, grazing, fish poisoning, environmental nuisance, loss of forests and other anthropogenic activities (e.g. washing, bathing, spread of charcoal from funeral pyres, litter associated with funerals) should be controlled in order to achieve the above mentioned outcome. This also indicates that the study sites are equally important for bird watching and protection of birds.

Ten species of Woodpeckers were recorded occupying mostly Sal-forest, Sal and grassland and Sal mix forest. They included Grey capped pygmy Woodpecker (*Dendrocopos canicapillus*), Fulvous breasted Woodpecker (*Dendrocopos macei*), Rufous Woodpecker (*Celeus brachyurus*), Lesser Yellownape (*Picus chlorolophus*), Streak-throated Woodpecker (*Picus xanthopygaeus*), Grey-headed Woodpecker (*Picus canus*), Himalayan Flameback (*Dinopium shoroii*), Black-rumped Flameback (*Dinopium benghalense*), Greater Flameback (*Chrysocolaptes lucidus*) and Great Slaty Woodpecker (*Mulleripicus pulverulentus*). Woodpeckers are known to be the good indicators of forest biodiversity. Similarly, five species of Parakeet such as Alexandrine parakeet (*Psittacula eupatria*), Rose-ringed Parakeet (*Psittacula krameri*), Slaty headed Parakeet

(*Psittacula himalayana*), Plum-headed Parakeet (*Psittacula cyanocephala*), Red-breasted Parakeet (*Psittacula alexandri*) were noticed utilizing mostly Sal (*Shorea robusta*) forest. Their population was remarkably high in Spring.

Baral and Upadhyaya (2006) mentioned 31 summer visitors, 209 winter visitors and 22 passage visitors in their checklist of 'Birds of Chitwan'. Likewise, Bird Education Society and Department of National Parks and Wildlife Conservation (BES & DNPWC, 2013) have also listed 53 summer visitors, 168 winter visitors and 13 passage visitors. While the result of this research showed 26 were summer migrants belonging to 12 families, 121 were winter migrants belonging to 22 families, and 14 were passage migrants belonging to 12 families. Ruddy Shelduck (*Tadorna ferruginea*), Bar-headed Goose (*Anser indicus*), Common Merganser (*Mergus merganser*), Gadwall (*Anas strepera*), Common Moorhen (*Gallinula chloropus*) and Temminck's Stint (*Calidris temminckii*) were the most dominant winter visitors. Similarly, Chestnut-headed Bee-eater (*Merops leschenaulti*), Indian Cuckoo (*Cuculus micropterus*), Drongo Cuckoo (*Surniculus lugubris*), Asian Koel (*Eudynamis scolopacea*), Hooded Pitta (*Pitta sordid*), Ashy Drongo (*Dicrurus leucophaeus*) and Asian Paradise-flycatcher (*Terpsiphone paradisi*) were the most dominant summer visitors. It is quite plausible that the earlier authors covered birds not only of Chitwan National Park but also in the adjacent areas i.e. district and buffer zone.

In the winter season, majority of the birds from high altitude of Nepal, Tibet, Mongolia, Europe and Siberia visit the National Park to cross over the winter times. Similarly, in summer season, birds from South India, Philippines, Myanmar etc visit for breeding (OCNP, 2016).



This study noted that in Chitwan National Park, birds migrate also from Sri-Lanka, South-East Asia, Mongolia, Eastern Europe and Africa to avoid seasonal changes and for breeding.

As mentioned, in the checklists provided by various authors following birds have not been observed during this study even after careful and minute observations.

**Summer Birds:** Painted stork (*Mycteria leucocephala*), Lesser Florican (*Sypheotides indica*), Indian Skimmer (*Rynchops albicollis*), Sarus Crane (*Grus antigone*), Black Baza (*Aviceda leuphotes*).

**Winter Birds:** Falcated Duck (*Anas falcate*), Barred Cuckoo Dove (*Macropygia unchall*), Curlew Sandpiper (*Calidris ferruginea*), Ruff (*Philomachus pugnax*), Ibisbill (*Ibidorhyncha struthersii*), Pacific Golden Plover (*Pluvialis fulva*), Grey Plover (*Pluvialis squatarola*), Yellow-legged Gull-Caspian Gull (*Larus cachinnans*), Pallid Harrier (*Circus macrourus*), Lesser Kestrel (*Falco naumanni*), Laggar Falcon (*Falco jugger*), Black-necked Stork (*Ephippiorhynchus asiaticus*), Southern Grey Shrike (*Lanius meridionalia*), White-browed Shortwing (*Brachypteryx Montana*), Snowy-browed Flycatcher (*Ficedula hyperythra*), Common Starling (*Sturnus vulgaris*), Pygmy Wren Babbler (*Pnoepyga pusilla*), Fire-breasted Flower-pecker (*Dicaeum igniperctus*).

**Passage Migrants:** Bean Goose (*Anser fabalis*), Sanderling (*Calidris alba*), Dunlin (*Calidris alpina*).

The population of migratory birds is decreasing due to habitat loss, use of pesticides, use of chemicals in water, deforestation and encroachment, eutrophication, illegal hunting,

illegal trapping, illegal trade, climate change, industrialization, urbanization, mass tourist activities in park and disturbance in migratory corridor.

This study also showed that the breeding potentiality of birds is decreasing due to change in grass cutting season in the Chitwan National Park. Earlier it was in the month of January while now a days it is shifted to February and March which are the breeding season of birds. It effects badly on the behaviour of birds.

Regarding the migratory birds, the present study has been carried out in Chitwan National Park because in recent years a little or no work has been done especially on status of migratory bird species in the area.

In terms of the resident birds, a total of 217 species of birds belonging to 15 orders and 46 families were recorded at the Chitwan National Park. Baral and Upadhyay (2006) recorded 251 resident species belonging to 54 families whereas according to BES and DNPWC (2013), 231 resident species of birds belonging to 57 families were recorded in the Chitwan area. Although the comparison with earlier studies implies a notable decrease in the bird population, it is not entirely true. It is because of the fact that these earlier studies covered the entire Chitwan including the Chitwan National Park, buffer zones and surrounding areas. But, this research strictly focused on the Chitwan National Park only. Also, effective comparison couldn't be made with earlier works as these works did not record the orders of the birds under study.

However, it is true that the population of resident birds is declining here. The declines can be traced to a variety of factors, depending on a bird's particular habitat. The anthropogenic causes most frequently cited in the research are agriculture, climate

change, development and energy, and invasive species. Excessive pesticides use in agriculture, global warming, rapid urbanization, increased noise pollution and deforestation are the major threats to the birds.

Apart from the temporal, spatial and human induced factors, this decline might also be due to various diseases in the birds. As diagnostics among birds is not popular here, it is very necessary to conduct tests like malaria test and blood sample test in order to be sure about such suspected diseases.

Seven species of birds which were recorded after 10 to 15 years in Chitwan National Park are as follows:

1. Kashmir Flycatcher ( *Ficedula subrubra* )
2. Nepal Wren Babbler ( *Phoebastria immaculata* )
3. Ashy Minivet ( *Pericrocotus divaricus* )
4. Hoary Throated Barwing ( *Actinodura nipalensis* )
5. Mottled Wood Owl ( *Strix ocellata* )
6. Greater White Fronted Goose ( *Anser albifrons* )
7. Isabelline Wheater ( *Oenanthe isabellina* )

Kashmir Flycatcher (*Ficedula subrubra*) recorded in Hotel Royal Park, Sauraha on 12 February 2013. Kashmir Flycatcher (*Ficedula subrubra*) observed in Parsa District, Thori area in 2000 (Bird Education Society, 2013). This bird comes in spring season for breeding from South to North about 2135m (Inskipp et al. 2000). Nepal Wren Babbler (*Phoebastria immaculata*) was observed in Kasara on 20 March 2013. Likewise, a pair of Ashy Minivet (*Pericrocotus divaricus*) was observed in Chitwan Gaida Lodge, Sauraha

on 22 March 2013. Isabelline Wheater (*Oenanthe isabellina*) was seen in Temple Tiger area of CNP on 11 June. Mottled Wood Owl (*Strix ocellata*) was observed in Jarneli area between Kasara to Sauraha on 25 March 2013. Similarly, Greater White Fronted Goose (*Anser albifrons*) was recorded in Narayani river of Sauraha on 7 February 2014.

Baral and Upadhyay (2006) reported 88 Very Common, 98 Common, 103 Occasional and 204 Uncommon species of birds in his checklist of Birds of Chitwan. Similarly, Fairly Common 84, Common 209, Uncommon 51 and Rare 215 species reported in Chitwan Bird Checklist (BES and DNPWC, 2013). However, this result showed that 23 Very Common, 170 Common, 49 Uncommon and 136 Occasional species of birds in Chitwan National Park.

Six species of Vultures were recorded in the Chitwan National Park during this study. These are Cinereous Vulture (*Aegypius monachus*), Egyptian Vulture (*Neophron percnopterus*), White-rumped Vulture (*Gyps bengalensis*), Red-headed Vulture (*Sarcogyps calvus*), Eurasian Griffon (*Gyps fulvus*), and Himalayan Griffon (*Gyps himalayensis*). Among these White-rumped Vulture (*Gyps bengalensis*) and Red-headed Vulture have been listed as “Critically Endangered” and Egyptian Vulture (*Neophron percnopterus*) “Endangered” Globally Threatened birds (IUCN 2014).

Vultures death on a massive scale has been attributed to the “Diclofenac Sodium”, an antibiotic that was used as a pain killer to treat sick livestock. Vultures fed carcasses of both domesticated and wild animals and due to the toxic effects of this medicine died due to their kidney failure. Much of this diclofenac is bought an Indian markets near the border with Chitwan District and is being imported by many small distributors,

veterinarians and livestock owners (OCNP, 2015). Currently, diclofenac misuse in Nepal is poor, but it still poses a threat to our vultures.

Adverse cutting of Simal tree (*Bombax ceiba*) has led to habitat destruction of vultures and many species of birds. This act is further favoured when Ministry of Forest and Soil Conservation stopped the ban against cutting of Simal (*Bombax ceiba*). Simal (*Bombax ceiba*) is limited to Buffer Zone and National Park of Chitwan (OCNP, 2015). Private sectors started taking permission from Ministry of Forest to cut these trees in their areas and habitat of vultures is in threat. More specifically, adverse deforestation in the districts of Terai region has consequently degraded many Simal (*Bombax ceiba*). According to Ministry of Forest and Soil Conservation, cutting of these trees has direct effects in vultures as vultures prefer to build their habitat in tall trees.

For conservation of Vultures, Vulture Conservation and Breeding Center was established at Kasara (Park headquarter) of Chitwan National Park in 2008 by DNPWC, support from NTNC, BCN, RSPB and ZSL (GoN/MoFSC, 2015).

Flora and fauna are two very important aspects of any eco-system, representing the indigenous plants and animal world respectively in certain geographical region and their relationship is fascinating to observe and study. Plants and animals evolved together, it is not surprising that there are many complex plants and animals relationship precisely exist. Chitwan National Park has a particularly rich and precious flora and fauna, which indigenous animal and plants are valued highly throughout the world. There are more than 2000 species of flora and fauna found in this Park, where man and nature are seen to exist in harmony.

Chitwan National Park has been classified into three main vegetation types. Sal (*Shorea robusta*) forest occupies the seventy percent of the park. Sal comes in pure stand or in association with other trees such as *Terminalia alata*, *Adina cordifolia*, *Terminalia belerica*, *Terminalia chebula*, *Holrrhena antidysenterica*, *Schleichera trijuga* etc. in the higher elevation carry an interesting mixture of *Shorea robusta* and *Pinus roxburghii*. Many shrubs, creeper ferns, grasses grow among and under the Sal-forest.

The riverine forest occupies an area of about 7 percent along the Narayani, Rapti and Reu rivers and their island. It is mainly dominated by Simal (*Bombax ceiba*) and grassland. Many other species of Sisau (*Dalbergia sissoo*), *Ficus* sps., *Zizyphus* sps., Papri (*Holoptelia integrifolia*), Malata (*Macaranga postulate*), Bhellar (*Trewia nudiflora*), Sindhure (*Mallotus philippinesis*), Palas (*Butea monosperma*), Bahunia sps., Kyamuno (*Careya arborea*) and Lazzawati (*Mimosa pudica*) are the most common tree species.

Mitho Nim-Indian curry Leaf Tree (*Murraya koenigii*), Guyallo (*Callicarpa macrophylla*), Rajbeli (*Clerodendron viscosum*) and Dhusure (*Colebrookea oppositifolia*) are smaller shrubs. *Acacia conicina*, *Bridelia stipularia*, *Stiipharia japonica* and *Tinospora sinensis* (Guruj) are various types of climbers in the riverine forest.

Grassland occurs in alluvial flood plains cover 20 percent of the park area that support luxuriant growth of grasses interspersed with patches of riverine forest. Elephant grass called *Saccharum ravennae* (renowned for its immense height and can grow upto 8 meter in height), Kans (*Saccharum spontaneum*), *Saccharum bengalensis*, *Saccharum*

*arundinaceum*, *Arundo donax*, Khar (*Cympopogon flexuosa*), *Narenga porphyrocoma*, *Themeda spp.*, Narkat (*Phragmitis karka*), *Imperata cylindrica*, Pater (*Typha angustifolia*), Guyallo (*Callicarpa macrophylla*) and Ank (*Calotropis gigantean*) are the main species of grassland. Most of the grassland extends along the rivers mainly on both new and old floodplains. Titepati (*Artemisia indica*), Amliso (*Thysanolaena maxima*), Bayer (*Zizyphus mauritiana*) and Jangali Bayar (*Zizyphus rugosa*) are the main species of shrubs.

Due to the wide range of vegetation types, Chitwan National Park is favoured by more than 700 species of wildlife and not yet fully surveyed number of butterfly, moth and insect species. The Narayani-Rapti river system, their small tributaries and myriads of oxbow lakes is habitat for 113 recorded species of fish and Marsh Mugger (*Crocodylus palustris*). 68 mammal species were recorded along with one of the major attraction of tourism “the king of the jungle” the Royal Bengal Tiger (*Panthera tigris*) and Greater One- horned Rhino (*Rhinoceros unicornis*). Besides these animal species, every year dedicated bird watchers and conservationists survey bird species and according to the data published in 2006, 543 bird species were recorded. During the study period, 378 bird species were recorded, representing 15 orders and 55 families during 64 days of survey work covering all four season. Among those 378 bird species, total number of resident birds were 217 belonging to 15 orders and 46 families. 161 bird species were recorded as migratory birds during the different season.

Great Hornbill (*Buceros bicornis*), Mottled Wood Owl (*Strix ocellata*), white-rumped vulture (*Gyps bengalensis*), Red-headed vulture (*Sarcogyps calvus*), Oriental Cuckoo (*Cuculus saturatua*), Slaty-legged Crake (*Rallina eurizonoides*), Ruddy Kingfisher

(*Halcyon coromanda*), Purple Heron (*Ardea purpurea*), Kashmir Flycatcher (*Ficedula subrubra*), Hoary Throated Barwing (*Actinodura nipalensis*), Bar-headed Goose (*Anser indicus*), Black Bulbul (*Hypsipetes leucocephalus*), Large-billed Crow (*Corvus macrorhynchos*), House Crow (*Corvus splendens*), Himalayan Bulbul (*Pycnonotus leucogenys*), Black Stork (*Ciconia nigra*), Common Merganser (*Mergus merganser*), Sultan Tit (*Melanochlora sultanea*), and Common Rosefinch (*Carpodacus erythrinus*) were the few renowned bird species recorded out of these 378 bird species.

Generally, there are 5 types of feeding habits performed by different kinds of bird species in Chitwan National Park. They are Herbivorous, Carnivorous, Frugivorous, Insectivorous and Omnivorous. Out of these 5 feeding habits, most of the bird species preferred omnivorous and insectivorous types of feeding habits, which is heavily dependent on fruits and berries, grains, flower-nectar, insects and grubs, spiders, small animals such as baby mice, frogs, lizards, small birds and crabs. Flowering period of many plant species attract a large number of birds species. Being a frugivorous and herbivorous, their relationship with flora of given geographical region is directly related to their daily life style.

As mention above, Chitwan National Park has a variety of vegetation type, densely populated with avifauna, which enhances the life expectancy of birds by providing natural habitat and food for many of them. Birds perform an essential service to plants in return by carrying seed away from the parent plants to other locations as seed dispersal, which help to germinate them in sufficient light and water. There is no doubt that some relationships are beneficial to both parties. Some birds are important for perpetuating plants for pollination, where they carry the pollen from one flower to the stigma, or



female reproductive organ of another, which results in fertilization and ultimately, the formation of seeds. Being an insectivorous, some of the birds eat insect, which help plant to grow and prevent from diseases.

Because of mutualism, they are inter related and their population may varied on their availability of benefits. Some of the birds like Sunbirds, Flowerpecker, Crows, Treepies, Magpies, Doves, Pigeons, Cuckoos, Koel, Hornbills, Barbets, Pheasant, Parakeets, Munias, Sparrows, Buntings, and Finches were recorded and they are categorized as a frugivorous, which feeds on fruits as well as juices from flowers and could be seen all over the Chitwan National Park, and can be a good seed carrier and pollinator to germinate the seeds in wide range of National Park. In return, Fruit trees like Simal (*Bombax ceiba*), Bayer (*Zizyphus jujube*), Sami (*Ficus semicarpifolea*), Bel (*Aegle marmelos*), Amala (*Embllica officinalis*), Harro (*Terminalia chebula*), Chutro (*Barberry sps.*), Barro (*Terminalia bellirica*), Jamun (*Syzigium cumini*), Kimbhu (*Moous alba*), Maawa (*Ficus jamboni*), Papaya (*Carica papaya*), Mango (*Mangifera indica*), Guava (*Psidium guava*), Pipal (*Ficus relegiosa*), Wild Banana (*Musa paradisica*), Badhar (*Terminalia sp.*), Thakal (*Phoenix dactylifera*), Imili (*Tamarindus indica*), Kharbuja (*Grewia helicterifolia*), Khaniyo (*Wendlandia puberula*), Kafal (*Myrica nagi*), Nemaro (*Ficus glomerulata*), Wheat (*Triticum aestivum*), Bar (*Ficus benghalensis*), Mahuwa (*Madhuca indica*) may provide food and shelter to those birds mention above.

Many birds like Storks, Vultures, Parakeets, Warblers can be seen in riverine forest but very few in number. The riverine forest occupies only seven percent of Chitwan National Park, so there are high probabilities that there will not be sufficient food and shelter for those very rare and few birds. Asian Paradise Flycatcher (*Terpsiphone*

*paradisi*) is summer migratory bird and White-browed Wagtail (*Motacilla maderaspatensis*) is common resident bird of Chitwan National Park whose preferable habitats are riverine forest.

More than 70 % of the grassland birds have been sighted in Themeda dominated habitat and rests were sighted in *Narenga porphyrocoma*, *Imperata cylindrica* and other grass species with scattered clumps of Themeda. Grey -breasted Prinia (*Prinia hodgsonii*), White-tailed Stonechat (*Saxicola leucura*), Grey-crowned Prinia (*Prinia cinereocapilla*) and Chestnut- capped Babbler (*Timalia pileata*) are the grassland birds which strongly associated with *Themeda arundinacea* grass species. They use the grassland as a shelter so their number may fluctuate depending on their food availability. The grassland is one of the best staging ground for winter migratory birds and is a breeding ground for summer visitors in Chitwan National Park.

Some birds like Great Hornbill (*Buceros bicornis*), Vultures, Jungle Owlet (*Glaucidium radiatum*) mostly arboreal prefer tall trees like Saj (*Crocodile barks*) and Sal (*Bombax ceiba*) as their shelter, where they built their nest.

Abundance of vegetation and survival rate of animal species like birds are correlated depending on their inter productivity and activities. Besides these very important dependent factors, there are other biological factors, which will be a major role to enhance the survival rate of flora and fauna of Chitwan National Park.

The rapidly changing environmental conditions caused by climate, natural disaster and human interference make plant species more vulnerable to diseases and pests, which might lead them to extinction. Climate change and disturbance by human encroachment

and some of the unavoidable natural disaster is upsetting the ecosystem balance of Chitwan National Park and seriously endanger the survival of many plant and animal species like birds.

Activities by local communities have been identified as threats to birds. Such activities are over-fishing, human disturbance, illegal hunting and fuel-wood collection. Use of pesticide also effect birds indirectly. In Chitwan all major rivers viz., the Narayani, Rapti and Reu are polluted by the industrial waste. Human population has also affected the birds. People collect thatching grass and forest product. However, in the park entrance fees for local use in community development projects is useful and successful. Park and people project known as participatory conservation programme which is funded by the UNDP, works to generate income and small scale improvements in communities.

Some future management strategies are noted by the present investigator, viz., fishing ban, ban on grass-cutting during breeding season, pollution of wetland should be stopped, urbanization also must be stopped in the park.

In conclusion, it may be said that about biodiversity of avian fauna of Chitwan National Park that there is a need to have continuous monitoring so as to know the dynamics of the avian fauna and also there is immediate need to conserve avian diversity by protecting natural habitat of the area. Human activity in the park also deserve special reach.

This deep research study is after about 10 years of insurgency in Nepal. During which almost no research work was carried out either by local or foreign ornithologists in Chitwan National Park. Only checklist was compiled.

# Chapter 6

## 6 Conclusion

### 6.1 Conclusion

Clearly based on hypothesis, which states that there is significant difference in seasonal diversity, distribution pattern, and population density of different birds in CNP. It also states that there is significant difference in density and diversity of winter and summer visitors in CNP. To support the hypothesis, half of the decade long research had conducted to justified it.

During study period, 378 species of different birds of different order and families had recorded. Passeriformes presented the highest number (248 species) of observed birds. During this period, 281 species of birds were recorded in the winter season, 230 species in the spring, 173 species in the summer and 166 species in the autumn season. Regarding the relative abundance, 23 species were very common, 170 species common, 49 species uncommon and 136 species occasional respectively.

To provide an authentic support to the research, frequent field visits had made to designated sites to record the bird species. 86 species of birds were recorded in winter season during the second visit of field trip, 24 species were observed in spring season of third visit, 22 species were seen in summer season from fourth visit.

During the study period, Slaty-headed Parakeet (*Psittacula himalyana*), Large-billed Crow (*Corvus macrorhynchus*), Black Bulbul (*Hypsipetes leucocephalus*), Himalayan Bulbul (*Pycnonotus leucogenys*), Oriental White-eye (*Zosterops palpebrosus*) were recorded the most in autumn season. Similarly Ruddy Shelduck (*Tadorna ferruginea*), Bar-headed Goose (*Anser indicus*), Common Merganser (*Mergus merganser*), Gadwall (*Anas strepera*), Common Moorhen (*Gallinula chloropus*), Temminck's Stint (*Calidris temminckii*) were recorded in winter season. Lesser Whistling-duck (*Dendrocygna javanica*), Indian Cuckoo (*Cuculus micropterus*), Drongo Cuckoo (*Surniculus lugubris*), were seen during the summer season.

While 298 Slaty-headed Parakeet (*Psittacula himalayana*) were recorded in spring season, which is the highest by number in all season. 186 Slaty-headed Parakeet (*Psittacula himalayana*) were recorded in autumn season and 78 Slaty-headed Parakeet (*Psittacula himalayana*) were recorded in summer season, which is comparatively the lowest by number in all season. Similarly, 126 Black Bulbul (*Hypsipetes leucocephalus*), were observed during the autumn season, while 76 were seen only in summer season.

During the study period, seven bird species which were seen after long time as well as 10 Globally Threatened species were recorded. There were six species of vultures which were also recorded. This study recorded 217 resident types, 121 winter visitors and 26 summer visitors. In Chitwan National Park, winter visitors outnumber the summer visitors. A few passage visitors were also observed. Regarding the feeding habits of recorded birds, maximum numbers of species were omnivorous (128 species) and minimum numbers were herbivorous (9 species). According to the IUCN status, 295

species, which is the highest by number are placed in the Least Concern category, while 5 species are placed in the Data Deficient category, which is the lowest by number

Study area was divided into 4 sites to determine the population density of different bird species and during this study period, site 2 (Temple tiger to Kasara) and site 3 (Kasara to Sauraha) were found mostly preferred by bird species and densely populated by bird species. Whereas site 4 was least preferred by bird species resulting in the lowest population among these sites.

In conclusion, there is significant difference in seasonal diversity, distribution pattern and population density of different birds in CNP. There is also significant difference in density and diversity of winter and summer visitors in CNP.

## **6.2 Recommendations**

Considering the importance of Chitwan National Park in South Central Nepal covering an area of 932 sq. Km. in the subtropical lowland of inner terai, some suggestions are noteworthy:

- ) Cutting of Simal (*Bombax ceiba*) tree, which is the natural habitat to Vultures and other big species of birds should be strictly banned in the vicinity of Chitwan National Park.
- ) Education and awareness activities should be given to protected area managers, bird watchers, ornithologists, tourist guides, tourists, wildlife lodge managers, and other relevant stakeholders.
- ) Cleaning of lakes should be done according to migratory pattern of birds.

- ) Using harmful pesticides within CNP should be monitored regularly to control the biological damage done by those chemicals, which might be one of the major factors to alter the habitat of bird species. Alternatives, such as biological control is highly recommended.
- ) Diversity of the fruiting plants for example Simal (*Bombax ceiba*), Jamuna (*Eugenia jambolana*), Bayer (*Zigyphus mauritiana*) should be properly maintained.
- ) Education and awareness program should be run in regular basis to update the condition of bird species and their habitats.
- ) Relationship of fishes and birds deserve special studies on long term. This is very important as many water birds visit the park depend on fishes for their food.
- ) Fishing permit in the park should be stopped.
- ) Mass tourist activities should be limited in certain number to avoid human nuisance.
- ) The grass-cutting should not be allowed during breeding season of birds.
- ) It is highly recommended to create an artificial bird nests as a temporary shelter or habitat to lure the migratory birds as well as local birds, which lost their natural habitat due to ecological nuisance.

These suggestions are important and significant as they will also help in formulation of appropriate policies for solving management problems of Chitwan National Park and adjacent area of district and buffer zone.

## References

- Acevedo, M. A., & Aide, T. M. (2008). Bird community dynamics and habitat associations in Karst, mangrove and Pterocarpus forest fragments in an urban zone in Puerto Rico. *Caribbean Journal of Science*, 44(3), 402–416.
- Acharya, R. & Ghimire, B. (2009). Owl Conservation Camps in Chitwan District of Nepal. Report submitted to World Owl Trust and The Global Owl Project. Unpublished report.
- Acharya, R., Cuthbert, R., Baral, H. S., & Shah, K. B. (2009). Rapid population declines of Himalayan Griffon Gyps himalayensis in Upper Mustang, Nepal. *Bird Conservation International*, 19(1), 99–107.
- Alerstam T., & Lindström Å. (1990) *Optimal Bird Migration: The Relative Importance of Time, Energy, and Safety*. In: Gwinner E. (eds) *Bird Migration*. Springer, Berlin, Heidelberg, 331-351.
- Ali, S. and Riplet, D. (1968-74). *Handbook of the birds of India and Pakistan* (10 vols). Bombay. Oxford University Press.
- Ali, S. and Riplet, D. (2007). *Handbook of the birds of India and Pakistan*). Bombay. Bombay Natural History Society and Oxford University Press.
- Avibase (2010). Bird Checklist of the World Ethiopia. Downloaded from <http://www.bsc.eco.org>.
- Azam, M.M. (2004). Avifaunal Diversity of Hingol National Park. *Records, Zoological Survey of Pakistan*, 15, 7-15.



- Bailey, F. M. (1938.) Register of bird specimens collected in Nepal 1935 – 38, and presented to the British Museum (Natural History). Unpublished. 40.
- Baral, H. S. (2005) *Avian fauna in High Altitude Lakes of Nepal Himalaya*. *High Altitude Wetlands of Nepal: views and reviews on conservation (ed)*, Bishnu Bhandari. The proceedings of the National Workshop on High Altitude Wetlands of Nepal, Kathmandu, 53-58.
- Baral, H. S. (2002). Impact of climate change on Nepal's birds. *Danphe*, 11(4), 6.
- Baral, H. S. & Inskipp, C. (2004) *The State of Nepal's Birds 2004*. Kathmandu: Bird Conservation of Nepal, Department of National Parks and Wildlife Conservation and IUCN-Nepal.
- Baral, H. S. & Inskipp, C. (2005). *Important bird areas in Nepal*. Nepal: Bird Conservation Nepal.
- Baral, H.S. (1997). *Birds of Chitwan*. Bird Conservation Nepal.
- Baral, H.S. (2000). *Birds of Koshi*. Bird Conservation Nepal, Pub. No. 3, DNPWC, Kathmandu, Nepal.
- Baral, H.S. (2001). *Community structure and habitat associations of lowland grassland birds in Nepal*. Universiteit Van Amsterdam and Cardiff University. (Ph.D. thesis)
- Baral, H.S. (2002). Invasive weed threatens protected area. *Danphe*, 11(3), 10-11.
- Baral, H.S. & Inskipp, C. (2005). *Important Bird Areas in Nepal: Key Sites for Conservation*. Kathmandu and Cambridge, Bird Conservation Nepal and Birdlife International.

- Baral, H.S. & Upadhyay, G.P. (1998). *Birds of Chitwan*. Department of National Parks and Wildlife Conservation and Bird Conservation Nepal, Kathmandu.
- Baral, H.S. & Upadhyay, G.P. (2006). *Birds of Chitwan*. Kathmandu: Bird Conservation Nepal, Participatory Conservation Programme II (UNDP/PCP) and Department of National Parks and Wildlife Conservation, Nepal.
- Baral, H.S., Giri J.B. & Virani, M.Z. (2004). *On the decline of Oriental White-backed Vultures Gyps bengalensis in lowland Nepal*. In Chancellor RD, Meyburg B-U eds. *Raptors Worldwide*. Berlin and Budapest: World Working Group on Birds of Prey and Owls and MME/Birdlife Hungary, 215–219.
- Baral, H.S. (1995). "*Black-necked Stork endangered*". *Newsletter for Birdwatchers* 35 (4), 74–75.
- Basnet, T. (2009). *Birds of Balewa, Baglung District*. Unpublished.
- Basnet, T. B. (2006.) *Birds of Balewa, Baglung (seasonal diversity and species richness)*, A final report submitted to Social Welfare Association of Nepal (SWAN), Kathmandu.
- BCN & DNPWC (2011). *The state of Nepal's Birds*. Bird Conservation Nepal and the Department of National Parks and Wildlife Conservation, Kathmandu.
- BCN and DNPWC (2011). *The State of Nepal's Birds 2010*. Bird Conservation Nepal and Department of National Parks and Wildlife Conservation, Kathmandu.
- BCN and DNPWC (2016). *Birds of Nepal: An Official Checklist*. Department of National Parks and Wildlife Conservation, Kathmandu, Nepal.
- Bhujju, U. R., Shakya, P. R., Basnet, T. B. and Shrestha, S. (2007). *Nepal biodiversity resource book. Protected areas, Ramsar Sites, and World Heritage Sites*. Kathmandu:

International Centre for Integrated Mountain Development, Ministry of Environment, Science and Technology, Government of Nepal and United Nations Environment Programme, Regional Office for Asia and the Pacific.

Bhushal, K. (2013). Migratory birds of Nepal and Challenges in their Conservation. *Munal*, 1-2.

Bibby, C.J. (2004). 'Bird diversity survey methods', in Sutherland, W.J., I. Newton and R.E. Green (eds.) *Bird ecology and conservation*, New York: Oxford University Press, 1-11.

Bibby, C.J., B.N. Phillips & Seddon A.J.E. (1985). Birds of restocked conifer plantations in Wales. *Journal of Applied Ecology* 22, 619-633.

Bibby, C.J., Burgess, N.D. & Hill, D.A. (1992). *Bird Census Techniques*. Academic Press, London, 67-84.

Bibby, C.J., Burgess, N.D., Hill, D.A., Mustoe, S.H. (2000) *Bird Census Techniques*, 2nd ed. Academic Press, London.

Bibby, C.J., Burgess, N.D., Hill, D.A. & Mustoe, S.H. (2000) *Bird census techniques*, Academic Press, London, 302.

Bibi, F., & Ali, Z. (2013). Measurement of diversity indices of avian communities at Taunsa Barrage Wildlife Sanctuary, Pakistan. *Journal of Animal and Plant Sciences*, 23(2), 469-474.

Biodiversity Profile Project (1995). *Red Data Book of the Fauna of Nepal*. Biodiversity Profiles Project Publication no. 4. Kathmandu: Department of National Parks and Wildlife Conservation. Ministry of Forests and Soil Conservation.

Bird Conservation Nepal & Department of National Parks and Wildlife Conservation (2012). *Birds of Nepal: An Official Checklist*. Kathmandu: DNPWC and BCN.

- BirdLife International (2006). *Monitoring Important Bird Areas: a global framework*. Cambridge, UK. BirdLife International. Version 1.2.
- BirdLife International (2010). Lists of globally threatened and near-threatened species in Nepal.
- BirdLife International (2012). IUCN Red List for Birds.
- BirdLife International (2015). Globally threatened and near-threatened species. Available at: <http://www.birdlife.org/CBS> (2014).
- Birds of Chitwan (2000). Bird Education Society, Chitwan.
- Biswas, B. (1960). A new name for the Himalayan Red-winged Babbler, *Pteruthius*. *Bulletin of the British Ornithological Union*. 80(6), 106.
- Borg, W.R. & Gall, M.D. (1989). *Educational Research: An Introduction* 5th. ed. New York: Longman.
- Bried, J. T., Langwig K. E., Dewan A. A., and Gifford N. A. (2011). Habitat associations and survey effort for shrubland birds in an urban pine barrens preserve. *Landscape and Urban Planning* 99, 218-225.
- Brown, J.H. (1981). Two decades of homage to Santa-Rosalía: toward a general theory of diversity. *Am. Zool.*, 21, 877–888.
- Carrascal, L. M., Villén-Pérez, S., & Seoane, J. (2012). Thermal, Food and Vegetation Effects on Winter Bird Species Richness of Mediterranean Oakwoods. *Ecological Research*, 27(2), 293–302.
- Chakdar, B., Choudhury, P., Singha, H. (2016). Avifaunal diversity in Assam University Campus, Silchar, India. *Journal of Threatened Taxa* 8(1): 8369-8378

- Chaudhary, A.A., Hussain, A., Hameed, M., and Ahmad, R. (1997). Biodiversity in Cholistan Desert, Punjab, Pakistan. *Biodiversity of Pakistan, Pakistan Museum of Natural History Islamabad*, 81-100.
- Chaudhary, H. & Inskipp, C. (2017). Bird survey of Annapurna Base Camp trek, Annapurna Conservation Area. *Danphe*, 26(1), 1-11.
- Chhetry, D.T. (2006). Diversity of Wetland Birds around the Koshi Barrage Area. *Our Nature*, 4, 91-95.
- Chitwan Bird Checklist (2013). Department of National Parks and Wildlife Conservation and Bird Education Society, Chitwan, Nepal.
- Choudhary, B. (1996). More news from the largest heronry in Nepal. *Bird Conservation Nepal Bulletin* 5(4), 3.
- Collinge, S. K. (1996). Ecological consequences of habitat fragmentation: Implications for landscape architecture and planning. *Landscape and Urban Planning*, 36(1), 59–77.
- Cueto, V. R., & Lopez de Casenave, J. (2000). Seasonal changes in bird assemblages of coastal woodlands in east-central Argentina. *Studies on Neotropical Fauna and Environment*, 35(3), 173–177.
- Currie, D.J. (1991). Energy and large-scale patterns of animal and plant species richness. *Am. Nat.*, 137, 27–49.
- Curran, L.M., Trigg, S.N., McDonald, A.K., Astiani, D., Hardiono, Y.M., Siregar, P. & Kasischke, E. (2004). Lowland forest loss in protected areas of Indonesian Borneo. *Science*, 303(5660), 1000–1003.

Currie, D.J. & Paquin, V. (1987). Large-scale biogeographical patterns of species richness of trees. *Nature*, 329, 326–327.

Dahal, M. (1999). Poisoning in Dhungre River, Royal Chitwan National Park. *Danphe* 8(1).

Desalgn, A. & Subramanian, C. (2015). Studies on Avian Diversity in Angereb Forest and Adjacent Farm Land With Reference To Rainy And Post Rainy Seasons, Northwestern Ethiopia. *International Journal of Pure and Applied Zoology*. 3(3) , 219-225.

Diesselhorst, G. (1968). BeitragezurOkologie der Vogel Zentral- und Ost- Nepal. *Khumbu Himal*, 2, 1 – 417.

Dinesh, K.P., Keshavamurthy, S.G., Vijay kumar, K., Krishnamurthy, D.V., Prakasha, H.M., Sunil Kumar, S.R. & Bhatta, G. (2007). Additions to the birds of Kuvermpu university campus, shimoga district, Karnataka.

Department of National Parks and Wildlife Conservation, Nepal (DNPWC):  
<http://www.dnpwc.gov.np/protected-areas.asp>. Accessed on 5 October 2012.

Department of National Parks and Wildlife Conservation, Nepal (DNPWC):  
<http://www.dnpwc.gov.np/protected-areas.asp>. Accessed on 7 June 2016.

Department of National Parks and Wildlife Conservation, Nepal (DNPWC):  
<http://www.dnpwc.gov.np/protected-areas.asp>. Accessed on 3 April 2017.

DNPWC/MoFSC/GoN (2009). *Vulture Conservation Action Plan for Nepal (2009-2013)*. Kathmandu. Government of Nepal, Ministry of Forests and Soil Conservation, Department of National Parks and Wildlife Conservation.

DNPWC/MoFSC/GoN, (2015) *Vulture Conservation Action Plan for Nepal (2015-2019)*.

Kathmandu. Government of Nepal, Ministry of Forests and Soil Conservation,  
Department of National Parks and Wildlife

Dutta, B.K., Gupta, A., Das, A.K. & De, A. (2008). *Ecology and Biodiversity of Assam University Campus*. Department of Ecology & Environmental Science, Assam University, Silchar, 33pp.

Estades C.F., Escobar, M.A.H, Tomasevic J.A., Vukasovic, M.A. & Paez, M. (2006). 'Mist nets versus point counts in the estimation of forest bird abundances in south-central Chile. *Ornitologica Neotropical* 17( 2), 203-212.

Estrada, A., Coates-Estrada, R., & Meritt, D. A. (1997). Anthropogenic landscape changes and avian diversity at Los Tuxtlas, Mexico. *Biodiversity and Conservation*, 6(1), 19–43.

Evans, K. L., James, N. A., & Gaston, K. J. (2006). Abundance, species richness and energy availability in the North American avifauna. *Global Ecology and Biogeography*, 15(4), 372–385.

Fleming, R. L. Sr, Fleming, R. L. Jr. and Bangdel, L. S. (1979). *Birds of Nepal* (2<sup>nd</sup>ed.). Kathmandu:Avalok.

Fleming, R.L. Sr., Fleming, R. L. Jr. and Bangdel, L.S. (1976) *Birds of Nepal*. Kathmandu.

Francis, A.P. & Currie, D.J. (2003). A globally consistent richnessclimate relationship for angiosperms. *Am. Nat.*, 161, 523–536..

Gatesire, T., Nsabimana, D., Nyiramana, A., Seburanga, J. L., & Mirville, M. O. (2014). Bird Diversity and Distribution in relation to Urban Landscape Types in Northern Rwanda. *The Scientific World Journal*, 2014, 12.

- George, W.C. (2010). *Bird migration and climate change*. Island Press, Washington, DC.
- Gibbons, D.W., Hill, D.A. & Sutherland, W.J. (1996) 'Birds' in *Sutherland* (ed.) *Ecological Census Techniques: a Handbook*, Cambridge: W.J.University Press, 227-258.
- Giri, T. and Choudhary, H. 2008. Additional Sightings. *Danphe* 17(2):6.
- Giri, T. and Choudhary, H. 2010. Additional Sightings. *Danphe* 19(1):3.
- Giri, T. and Choudhary, H. 2011. Additional Sightings. *Danphe* 20(2):11.
- Girma, Z., Mamo, Y., Mengesha, G., Verma, A. & Asfaw, T. (2017). Seasonal abundance and habitat use of bird species in and around Wondo Genet Forest, south-central Ethiopia. *Ecology and Evolution*. 7(10), 3397-3405.
- Gori, M., Carpaneto, G. M., & Ottino, P. (2003). Spatial distribution and diet of the neotropical otter *Lontra longicaudis* in the Ibera Lake (northern Argentina). *Acta Theriologica*, 48(4), 495–504.
- Green, R. E., Newton, I., Shultz, S., Cunningham, A. A., Gilbert, M., Pain, D. J., & Prakash, V. (2004). Diclofenac poisoning as a cause of vulture population declines across the Indian subcontinent. *Journal of Applied Ecology*, 41(5), 793–800.
- Grimmett, R., Inskipp, C. & Inskipp, T. (1998). *Birds of Indian Subcontinent*. Oxford University Press, Delhi:
- Grimmett, R., Inskipp, C. & Inskipp, T. (2000). *Birds of Nepal*. London, UK: (Christopher Helm.)
- Grimmett, R., Inskipp, C., Inskipp, T. & Baral, H.S. (2000). *Birds of Nepal*. Helm field guides.
- Grimmett, R., Inskipp, C., Inskipp, T. & Baral, H.S. (2016). *Birds of Nepal*. Helm field guides.



- Hanski, I., & Simberloff, D. (1997). The Metapopulation Approach; its history, conceptual domain and application to conservation. In Hanski, I. and Gilpin M.E.(Eds) *Metapopulation Biology: ecology, genetics and evolution*. San Diego, C.A.: Academic Press.
- Hawkes, L.A., Balachandran, S., Batbayar, N., Butter, P.J., Frappell, P.B. Milsom, W.K., Tseveenmyadag, N., Newman, S.H., Scott, G.R., Sathiyaseivam, P., Takekawa, J.Y., Wikelski, M. & Bishop, C.M. (2011). The transHimalayan flights of Bar-headed Geese (*Anser indicus*). *Proceedings of the National Academy of Sciences*, 108 (23), 9516-9519.
- Hedenstrom, A. (2008). Adaptations to migration in birds: behavioural strategies, morphology and scaling effects. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 363(1490), 287–299.
- Heinen, J. T. (1987). New Seasonal Range Records and Status Updates for Birds in Koshi Tappu Wildlife Reserve and Koshi Barrage, Nepal. *Journal of Natural History Museum*, 11(1 – 4): 41 – 50.
- Herzog, S.K., Kessler, M. & Cahill, T.M. (2002). Estimating species richness of tropical bird communities from rapid assessment data. *Auk* 119, 749-769.
- Hinsley, S., Hill, R., Fuller, R., Bellamy, P., & Rothery, P. (2009). Bird species distributions across woodland canopy structure gradients. *Community Ecology*, 10(1), 99–110.
- Hodgson, B. H. (1846). *Catalogue of the Specimens and drawings of mammals and birds of Nepal and Tibet*. British Museum London.

- Honkanen, M., Roberge, J.-M., Rajasärkkä, A., & Mönkkönen, M. (2010). Disentangling the effects of area, energy and habitat heterogeneity on boreal forest bird species richness in protected areas. *Global Ecology and Biogeography*, 19(1), 61–71.
- Inskipp, C. & Inskipp T.P. (2001). *A popular guide to the birds and mammals of the Annapurna conservation area*. King Mahendra Trust for Nature conservation –Annapurna Conservation Area Project, Kaski, Nepal.
- Inskipp, C. (1989). *Nepal's Forest Birds: Their Status and Conservation*. International Council for Bird Preservation, Monograph No. 4, Cambridge.
- Inskipp, C. and Inskipp, T. (1985). *A guide to the birds of Nepal*. London, UK : Croom Helm
- Inskipp, C. and Inskipp, T. (1991). *A guide to the birds of Nepal. Second edition*. London, UK: Christopher Helm.
- Inskipp, C., Baral, H.S. Phuyal, S., Bhatt, T.R., Khatiwada, M., Inskipp, T., Khatiwada, A., Gurung, S., Singh, P.B., Murray, L., Poudyal, L. & Amin, R. (2016). *The Status of Nepal's Birds: The National Red List Series*. Zoological Society of London, UK.
- Jiguet, F., Brotons, L., & Devictor, V. (2011). Community responses to extreme climatic conditions. *Current Zoology*, 57(3), 406–413.
- Johnsingh, A.J.T. & Joshua, J. (1994). Avifauna in Three Vegetation Types on Mundanthurai Plateau, South India. *Journal of Tropical Ecology* 10(3), 323–335.
- Katuwal, H. B., Basnet, K., Khanal, B., Devkota, S., Rai, S. K., Gajurel, J. P., ... Nobis, M. P. (2016). Seasonal changes in bird species and feeding guilds along elevational gradients of the Central Himalayas, Nepal. *PLoS ONE*, 11(7).

- Kessler, W. B. & Milne, K. A. (1982). Morning versus evening detectability of southeast Alaskan birds. *Condor* 84, 447-448.
- Khadka, B.B. (2012). Midwinter Waterbird Count in 2011 at Chitwan National Park. *Danphe* 21 (1).
- Khadka, B.B. (2013). Midwinter Waterbird Count in 2012 at Chitwan National Park. *Danphe* 22(2/3), 3-7.
- Kirkpatrick, W. J. (1973). *An Account of the Kingdom of Nepal*. London, William Miller.
- Koirala, P., Khadka, D.B. & Mishra, A. (2007). Pesticide residues as environmental contaminants in foods in Nepal. *Journal of Agriculture and Environment*, 8,96-100.
- Koli, V.K. (2014). Diversity and status of avifauna in Todgarh-Raoli Wildlife Sanctuary, Rajasthan, India. *Journal of Asia-Pacific Biodiversity*, 7,401-407.
- Laiolo, P. (2005). Spatial and seasonal patterns of bird communities in Italian agroecosystems. *Conservation Biology*, 19(5), 1547–1556.
- Lawton, J. (1999). Are there general laws in ecology? *Oikos*, 84, 177-192.
- Lepage, D. (2016). *Avibase -Bird Checklists of the World- Ethiopia*. Birdlife International. Retrieved from <http://avibase.bsc-eoc.org/checklist.jsp?region=ET>. Accessed on 5/28/16
- MacArthur, R. H., & Wilson, E. O. (1967). *The Theory of Island Biogeography*. Princeton, N.J. Princeton University Press, 203 p.
- MacKinnon, S. & Phillipps, K. (1993). *A Field Guide to the Birds of Borneo, Sumatra, Java and Bali*. Oxford University Press, Oxford 491p.

- Mahboob, S., & Zaib-un-Nisa. (2009). Diversity of avifauna of Trimmu Barrage, District Jhang, Punjab, Pakistan. *Pakistan Journal of Zoology*, 41(1), 43–49.
- Mahboob, S., Zaib-U-Nisa, Alkahem al-Balawi, H. F., Al-Misned, F., Ahmad, Z., & Sultana, S. (2013). Study on avian diversity of thal desert (district Jhang), Punjab, Pakistan. *Life Science Journal*, 10(SPL.ISSUE11), 1–8.
- Main, M.B., Christman, M.C., Karim, A. & Hostetler M. (2011), Species Richness and Diversity of Resident and Migratory Landbirds in Remnant Forest Patches and Residential Areas in the Florida Keys, USA. *International Journal of Ecology*, 2011 (2011), 1-12.
- Manakadan, R & Pittie, A. (2001). Standardised common and scientific names of the birds of the Indian subcontinent. *Buceros* 6(1),1-37.
- Martens, J. (1980). Lautäußerungen, verwandtschaftliche Beziehungen and Verbreitungsgeschichte asiatischer Laubsänger (*Phylloscopus*). *Advances in Ethology*, 22, 1–71.
- McCain, C. M. (2009). Global analysis of bird elevational diversity. *Global Ecology and Biogeography*, 18(3), 346–360.
- Mengesha, G., & Bekele, A. (2008). Diversity and relative abundance of birds of Alatish National Park, North Gondar, Ethiopia. *International Journal of Ecology and Environmental Sciences*, 34(2), 215–222.
- Mierow, D. (1988). *Birds of the Central Himalayas, An Ecological Approach*. Bangkok : Craftsman Press.

- Mundy, P., Butchart, D., Ledger, J. and Piper, S. (1992). *The Vultures of Africa*. Acorn Books and Russel Friedman Books, Johannesburg, South Africa.
- Murgui, E. (2010). Seasonality and nestedness of bird communities in urban parks in Valencia, Spain. *Ecography*, 33(5), 979–984.
- National Health and Medical Research Council (2013). *Australian code for the care and use of animals for scientific purposes*, 8th edn. Canberra: National Health and Medical Research Council. Retrieved from [https://www.deakin.edu.au/\\_\\_data/assets/pdf\\_file/0011/536348/australian-code-for-the-care-and-use-of-animals-for-scientific-purposes-2013.pdf](https://www.deakin.edu.au/__data/assets/pdf_file/0011/536348/australian-code-for-the-care-and-use-of-animals-for-scientific-purposes-2013.pdf)
- Nepali, H. S. (1984). Bird report from the Barun Valley Report. Unpublished. 17
- Newton, I. (2007). *The Migration Ecology of Birds*. Academic Press, London.
- Office of Chitwan National Park (2015). Department of National Parks and Wildlife Conservation. Kathmandu: Office of Chitwan National Park.
- Office of Chitwan National Park (2016). Department of National Parks and Wildlife Conservation. Kathmandu: Office of Chitwan National Park.
- Patil, G.P. and Taille, C. (1979a). An overview of diversity, in *Ecological Diversity in Theory and Practice*, J.F. Grassle, G.P. Patil, W. Smith and C. Taille editors, Fairland (Maryland), International Cooperative Publishing House, 3-27. [A basic work containing the proposals of average rarity diversity indexes and diversity profiles].
- Parker, T.A. (1991). On the use of tape recorders in avifaunal surveys, *Auk*, 108, 443–444.
- Pathan, A. J., Khan, S., Akhtar, N., & Saeed, K. (2014). Diversity and Distribution of Avian Fauna of Swat, Khyber Pakhtunkhwa, Pakistan. *Advances in Zoology*, 2014, 7.

- Pizo, M.A., Simao, I., & Galetti, M., (1997). Daily variation in activity and flock size of two parakeet species from southeastern Brazil. *The Wilson Bulletin* 109(2), 343-348.
- Poudyal, L.P., Singh, P.B. & Maharjan, S. (2008). *Status and distribution of Bengal Florican Houbaropsis bengalensis in Nepal, 2007. Report to the Oriental Bird Club, UK and the Club 300 Foundation for Bird Protection, Sweden.* Kathmandu, Nepal: Department of National Parks and Wildlife Conservation, and Bird Conservation Nepal.
- Poulsen, B.O., Krabbe, N., Frølander, A., Hinojosa, B.M. & Quiroga, O.C. (1997). A rapid assessment of Bolivian and Ecuadorian montane avifaunas using 20-species lists: efficiency, biases and data gathered. *Bird Conservation International*, 7, 53-67.
- Prakash, V., Green, R. E., Pain, D. J., Ranade, S. P., Saravanan, S., Prakash, N., ... Cunningham, A. A. (2007). Recent changes in populations of resident Gyps vultures in India. *Journal of the Bombay Natural History Society*, 104(2), 127–133.
- Price, T., Zee J., Jamdar, K. & Jamdar, N. (2003). Bird species diversity along the Himalaya: a comparison of Himachal Pradesh with Kashmir. *Journal of Bombay Natural History Society* 100, 394-410.
- Ripley, S. D. (1950). Birds from Nepal 1947 – 49. *Journal of Bombay Natural History Society*, 49, 355 – 417.
- Rosenstock, S.S. (1996). *Habitat relationships of breeding birds in northern Arizona ponderosa pine and ponderosa pine-Gambel oak forests*, Arizona: Game and Fish Department Research Branch, Technical Report 23.
- Rosenzweig, M.L. & Ziv, Y. (1999). The echo pattern in species diversity : pattern and process. *Ecography*, 22, 614-628.

- Salewski, V., & Bruderer, B. (2007). The evolution of bird migration—a synthesis. *Naturwissenschaften*, *94*(4), 268–279.
- Sarkar, N. J., Sultana, D., Jaman, M. F., & Rahman, M. K. (2010). Diversity and Population of Avifauna of Two Urban Sites in Dhaka, Bangladesh. *Ecoprint: An International Journal of Ecology*, *16*(0), 1–7.
- Scully, J. A. (1879). *Contribution to Ornithology of Nepal*. Stray Feathers 8.
- Sekercioglu, C.H. (2012). Bird functional diversity and ecosystem services in tropical forests, agroforests and agricultural areas. *Journal of Ornithology* *153*(1), 153–161.
- Shah, T.A., Ahuja, V., Anandam, M. & Srinivasulu, C. (2016). Avifauna of Chamba District, Himachal Pradesh, India with emphasis on Kalatop-Khajjiar Wildlife Sanctuary and its surroundings. *Journal of Threatened Taxa* *8*(1), 8333–8357.
- Shakya, S., Shrestha, A. & Kalsi, R.S. (2000). Distribution of Swamp Francolin *Francolinus gularis* in the terai grasslands of Nepal. *Proceeding of the International Galliformes Symposium 2000*.
- Shannon, C. E. and W. Weaver (1949). *The Mathematical Theory of Communication*. University of Illinois Press, Urbana, Illinois. 144pp.
- Sharma, K.C. (1994). *Current experiences and practices in pesticide use in the Bagmati zone*, ADPI Series. No. 9, ICIMOD, Kathmandu.
- Shrestha, P.L., & Neupane, F.P. (2002). *Socio-economic contexts on pesticide use in Nepal*. In: Hermann, A., Schumann, S. (Eds.), *International Workshop on Environmental Risk Assessment of Pesticides and Integrated Pest Management in Developing Countries*, Kathmandu, Nepal, 6–9 November 2001: 205–223.

- Shrestha, T.K. (2000). *Birds in Nepal*, 2, Kathmandu: R.K. Printers.
- Shultz, S., Baral, H. S., Charman, S., Cunningham, A. A., Das, D., Ghalsasi, G. R., ... Prakash, V. (2004). Diclofenac poisoning is widespread in declining vulture populations across the Indian subcontinent. *Proceedings of the Royal Society B: Biological Sciences*, 271(Suppl\_6), 458–460.
- Singh, J.P. & Roy, S.P. (1990). Some Aspects of Ecology of Birds of Kawar Lake, Begusarai (Bihar), *Journal of Fresh Water Biology*, 2(3), 75 – 188.
- Singh, P. B. (2004). Population status and habitat utilisation of Swamp Francolin in Royal Sukla Phanta Wildlife Reserve, Nepal. *Birding ASIA* 2, 83.
- SNP (2016). *Birds of Sagarmatha National Park and its Buffer Zone*. Department of National Parks and Wildlife Conservation/ Sagarmatha National Park Office, Namche, Solukhumbu, Nepal.
- Suárez-Seoane, S., García de la Morena, E. L., Morales Prieto, M. B., Osborne, P. E., & de Juana, E. (2008). Maximum entropy niche-based modelling of seasonal changes in little bustard (*Tetrax tetrax*) distribution. *Ecological Modelling*, 219(1–2), 17–29.
- Subba, B. R. (1994). Checklist of Birds of Biratnagar. *Newsletter for Bird Watchers*, 34 (6), 128 – 129.
- Subba, B.R. (1995). Checklist of Birds of Dharan. *Newsletter for Bird watchers*, 35(3), 50-53.
- Subba, B.R. (1997). Checklist of Birds of Gajurmukhi V.D.C.of Ilam. *Vishleshan*, 2, 20-23.
- Subedi, T.R. (2015). East to west migration of Steppe Eagle (*Aquila nipalensis*) and other raptors in Nepal; abundance, timing and age class determination. NOU Research Report No. 1. Nepalese Ornithological Union, Kathmandu Nepal.



Subedi, T., Gurung, S., Smit, H. J. & DeCandido, R. (2014) *Autumn 2013 Raptor migration in Nepal*.

Surana, R., Subba, B.R. & Limbu, K.P. (2007). Avian diversity during rehabilitation stage of Chimdi Lake, Sunsari, Nepal. *Our Nature*, 5, 75-80.

Thakur ML, Mattu VK, Lal H, et al. (2010). Avifauna of Arki Hills, Solan (Himachal Pradesh), India. *Indian Birds* 5: 162-166.

Thakuri, J.J. (2011). An Ornithological Survey of Reshunga Potential Important Bird Area. A report to Oriental Bird Club, UK.

Thakuri, J.J. (2016). An Ornithological Survey of Panchase Protected Forest. *Danphe* 25,5-12.

Thakuri, J. J. & Thapa, I. (2009). Bird survey along the Bagmati River corridor. *Danphe* 18(2), 1-9.

Thapa, I. & Thakuri, J.J. (2009). *Study of Wild bird trade issues in Nepal*. Unpublished report by Bird Conservation Nepal to the World Parrot Trust and WWF Nepal, Kathmandu. The IUCN Red List of Threatened Species.

Von Humboldt, F.H.A. (1807). *Essai sur la geographie des plantes*. von Humboldt, Paris, France.

Version 2014.3 Retrieved from [www.iucnredlist.org](http://www.iucnredlist.org) accessed on 15 February 2015.

Wiktander, U., Olsson, O., & Nilsson, S. G. (2001). Seasonal variation in home-range size, and habitat area requirement of the lesser spotted woodpecker (*Dendrocopos minor*) in southern Sweden. *Biological Conservation*, 100(3),

Wiens, J. A. (1989b). Spatial scaling in ecology. *Functional Ecology* 3:385–397 387–395.

- Wilson, W. H. (2011). Bird Migration and Global Change.— George W.Cox . 2010. Island Press, Washington, D.C. 304 pp. ISBN- 13: 978-1-59726-688-8. *The Condor*, 113(2), 469–470.
- Wright, D.H. (1983). Species–energy theory: an extension of species-area theory. *Oikos*, 41, 496–506.
- Wright, D.H., Currie, D.J. & Maurer, B.A. (1993). Energy supply and patterns of species richness on local and regional scales. In: *Species Diversity in Ecological Communities: Historical and Geographic Perspectives* (eds Ricklefs, R.E. & Schluter, D.). University of Chicago Press, Chicago, IL, USA, pp. 66–74
- Yallop, M.L., Connell, M.J. & Bullock, R. (2003). Water birds Herbivory on a newly created wetland complex: Potential implication for site management and habitat creation. *Wetland Ecology and Management*, 12, 395-408.

# APPENDICES

## Appendix – I

### Checklist of birds

	Order/Family/Common Name/Scientific Name		Relative Abundance in each visit				Number of bird in each visit				Distribution of birds in trail in each visit			
			I	II	III	IV	I	II	III	IV	I	II	III	IV
	<b>GALLIFORMES</b>													
	<b>Phasianidae</b>													
1	Black Francolin	<i>Francolinus francolinus</i>	7	3	3	6	8	7	6	12	2	1&2	2	1&3
2	Indian Peafowl	<i>Pavo cristatus</i>	4	2	8	3	9	5	19	3	2&3	1&2	2&3	2
3	Kalij Pheasant	<i>Lophura leucomelanos</i>	8	6	2	3	11	10	2	5	1&2	1&3	3	2&3
4	Red Junglefowl	<i>Gallus gallus</i>	7	2	1	3	12	5	1	3	2	2	2	2&3
	<b>ANSERIFORMES</b>													
	<b>Dendrocygnidae</b>													
5	Lesser Whistling Duck	<i>Dendrocygna javanica</i>	3	7	5	3	15	26	20	18	1&2	2, 3&4	1,2,3 &4	2&3
	<b>Anatidae</b>													
6	Bar-headed Goose	<i>Anser indicus</i>		6				201				2&3		
7	Greylag Goose	<i>Anser anser</i>		2				4				3		
8	Ruddy Shelduck	<i>Tadorna ferruginea</i>		9				378				1,2,3&4		
9	Red-crested Pochard	<i>Rhodonessa rufina</i>		7				16				3		
10	Greater White	<i>Anser albifrons</i>		1				9				3		

	Fronted Goose													
11	Common Merganser	<i>Mergus merganser</i>		9				219				1,2,3&4		
12	Common Shelduck	<i>Tadorna tadorna</i>		1				2				3		
13	Gadwall	<i>Anas strepera</i>		9				201				2&3		
14	Mallard	<i>Anas platyrhynchos</i>		8				89				2&3		
15	Spot-billed Duck	<i>Anas poecilorhyncha</i>		1				18				3		
16	Northern Pintail	<i>Anas acuta</i>		1				21				3		
17	Eurasian Wigeon	<i>Anas penelope</i>		7				24				2&3		
	<b>PICIFORMES</b>													
	<b>Picidae</b>													
18	Grey-capped Pygmy Woodpecker	<i>Dendrocopos canicapillus</i>	8	2	1	2	8	2	1	2	1,2,3&4	2	2	1&2
19	Fulvous-breasted Woodpecker	<i>Dendrocopos macei</i>	7	2	2	3	10	2	4	3	1,3&4	3	3	1&2
20	Rufous Woodpecker	<i>Celeus brachyurus</i>			5				7					1&2
21	Lesser Yellownape	<i>Picus chlorolophus</i>	2	1	7	3	2	1	10	3	2	2	2&3	3
22	Greater Yellownape	<i>Picus flavinucha</i>	3				3				2			
23	Streak-throated Woodpecker	<i>Picus xanthopygaeus</i>	8	2	1	3	8	2	1	3	1,2&4	2	2	1&2
24	Grey-headed Woodpecker	<i>Picus canus</i>	2	7	3	2	2	9	3	2	1	1,2&4	2	2
25	Himalayan Flameback	<i>Dinopium shorii</i>	4	3	9	1	4	3	11	1	1&3	2&3	1,2,3&4	2
26	Greater Flameback	<i>Chrysocolaptes lucidus</i>	8	2	1	1	8	2	1	1	1,2&3	3	3	3
27	Black-rumped Flameback	<i>Dinopium benghalense</i>	2	1	7	2	2	1	9	2	2	2	1,2&3	3
28	Great Slaty Woodpecker	<i>Mulleripicus pulverulentus</i>	4		2		4		2		1		1	

29	Eurasian Wryneck	<i>Jynx torquilla</i>		1				4				2		
	<b>Megalaimidae</b>													
30	Lineated Barbet	<i>Megalaima lineata</i>	2	7	2	1	2	7	2	1	2	1,2&3	2	1
31	Blue-throated Barbet	<i>Megalaima asiatica</i>	3	6	4	5	3	10	6	5	1	1&2	2&3	1,2&3
32	Coppersmith Barbet	<i>Megalaima haemacephala</i>	9	3	3	2	19	5	4	2	1,2,3 &4	1&3	2&3	z
	<b>BUCEROTIFORMES</b>													
	<b>Bucerotidae</b>													
33	Oriental Pied-Hornbill	<i>Anthracoceros albirostris</i>	2	2	7	2	2	2	8	2	2	1&2	2	2
34	Great Hornbill	<i>Buceros bicornis</i>												
	<b>UPUPIFORMS</b>													
	<b>Upupidae</b>													
35	Common Hoopoe	<i>Upupa epos</i>	7	2	1	3	9	2	1	5	2&3	3	3	3
	<b>TROGONIFORMES</b>													
	<b>Trogonidae</b>													
36	Red-headed Trogon	<i>Harpactes erythrocephalus</i>	1	1	7	1	1	1	7	1	2	2	1&2	2
	<b>CORACIIFORMES</b>													
	<b>Coraciidae</b>													
37	Indian Roller	<i>Coracias benghalensis</i>	2	7	3	1	2	11	5	1	3	2&3	3	3
38	Dollar bird	<i>Eurystomus orientalis</i>				7				9				2,3&4
	<b>Alcedinidae</b>													
39	Common Kingfisher	<i>Alcedo atthis</i>	8	2	1	3	11	4	1	3	1&3	1	1	1&3
	<b>Hylcyonidae</b>													
40	Stork-billed Kingfisher	<i>Halcyon capensis</i>	7	1	1	2	8	1	1	2	1	1	1	1

41	Ruddy Kingfisher	<i>Halcyon coromanda</i>												
42	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	8	1			8	1			1	1		
	<b>Cerylidae</b>													
43	Pied Kingfisher	<i>Ceryle rudis</i>	1	7			1	9			1	1		
	<b>Meropidae</b>													
44	Blue-bearded Bee-eater	<i>Nyctyornis athertoni</i>			4	6			6	9			2&3	2&3
45	Green Bee-eater	<i>Merops orientalis</i>	2	2	2	7	2	3	2	12	2	2	2	2&3
46	Blue-tailed Bee-eater	<i>Merops philippinus</i>				8				8				1,2&3
47	Chestnut-headed Bee-eater	<i>Merops leschenaulti</i>			2	9			2	13			2	1,3&4
	<b>CUCULIFORMES</b>													
	<b>Cuculidae</b>													
48	Pied Cuckoo	<i>Clamator jacobinus</i>				10				18				1,2,3 &4
49	Plaintive Cuckoo	<i>Cacomantis merulinus</i>				1				1				2
50	Oriental Cuckoo	<i>Cuculus saturatus</i>												
51	Chestnut-winged Cuckoo	<i>Clamator coromandus</i>				10				18				1&3
52	Common Hawk Cuckoo	<i>Hierococcyx varius</i>	8	2	2	1	10	2	2	1	2&3	2	2	2
53	Grey-bellied Cuckoo	<i>Cacomantis passerinus</i>				2				2				2
54	Indian Cuckoo	<i>Cuculus micropterus</i>				8				25				1,2&3
55	Eurasian Cuckoo	<i>Cuculus canorus</i>				7				18				2,3&4
56	Drongo Cuckoo	<i>Surniculus lugubris</i>				11				23				1,2&3
57	Asian Koel	<i>Eudynamys scolopacea</i>				7				15				1
58	Green-billed Malkoha	<i>Phaenicophaeus tristis</i>	7	2		2	7			2	1	2		1&2
	<b>Centropodidae</b>													

59	Greater Coucal	<i>Centropus sinensis</i>	2	2	7	2	2	5	9	2	2	2	1&2	2
60	Lesser Coucal	<i>Centropus bengalensis</i>	2	1	8	2	2	1	8	2	2	1	1&2	2
	<b>PSITTACIFORMES</b>													
	<b>Psittacidae</b>													
61	Alexandrine Parakeet	<i>Psittacula eupatria</i>	2	3	7	2	2	5	14	2	2&4	2	2	2
62	Rose-ringed Parakeet	<i>Psittacula krameri</i>	2	3	9	2	2	3	11	2	2	2	2	2
63	Slaty-headed Parakeet	<i>Psittacula himalayana</i>	6	6	9	8	186	71	298	78	2	2	2	2
64	Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	5	2	7	1	5	2	18	1	2&4	2	2	2
65	Red-breasted Parakeet	<i>Psittacula alexandri</i>	2	2	8	2	2	2	12	2	2	2	2&3	2
	<b>APODIFORMES</b>													
	<b>Apodidae</b>													
66	White-throated Needletail	<i>Hirundapus caudacutus</i>				2				2				2
67	White-rumped Spinetail	<i>Zonavena sylvatica</i>		2	7			2	9			3	2&3	
68	House Swift	<i>Apus affinis</i>	8	1	2	1	8	1	2	1	3	3	3	3
69	Himalayan Swiftlet	<i>Colocalia brevirostris</i>		10				12				2&3		
70	Alpine Swift	<i>Tachymarptis melba</i>		1				1				3		
71	Fork-tailed Swift	<i>Apus pacificus</i>		1	1			2	1			2	2	
	<b>Hemiprocnidae</b>													
72	Crested Treeswift	<i>Hemiprocne coronate</i>	8	3	7	4	24	11	18	14	1,2&3	2	1,2&3	2
	<b>STRIGIFORMES</b>													
	<b>Strigidae</b>													
73	Oriental Scops Owl	<i>Otus sunia</i>	5		6		5		8		1&2		1&3	

74	Brown Hawk-Owl	<i>Ninox scutulata</i>		3	8			3	11			3	3	
75	Brown Fish Owl	<i>Ketupa zeylonensis</i>	4	2		5	4	2		7	1&2	2		1&3
76	Jungle Owlet	<i>Glaucidium radiatum</i>	1	4	9	1	1	4	9	1	1	1&3	1,2&3	1
77	Mottled Wood Owl	<i>Strix ocellata</i>												
78	Spotted Owlet	<i>Athene brama</i>	2	8	2	1	2	12	2	1	2	2&3	2	2
	<b>Caprimulgidae</b>													
79	Large-tailed Nightjar	<i>Caprimulgus macrurus</i>	2	3	7	2	2	4	10	2	1	1	1&2	1
80	Grey Nightjar	<i>Caprimulgus indicus</i>				1				1				3
81	Indian Nightjar	<i>Caprimulgus asiaticus</i>				2				2				3
82	Savanna Nightjar	<i>Caprimulgus affinis</i>		2	8	2		2	8	2		3	3	3
	<b>COLUMBIFORMES</b>													
	<b>Columbidae</b>													
83	Rock Pigeon	<i>Columba livia</i>	7	6	6	7	36	32	34	42	1,2,3 &4	2&3	2	2
84	Common Wood Pigeon	<i>Columba palumbus</i>		2	1			6	1			1	1&3	
85	Ashy Wood Pigeon	<i>Columba pulchricollis</i>		1				4					2&3	
86	Orange-breasted Green Pigeon	<i>Treron bicincta</i>	2	8	3	2	2	10	5	3	1&2	2&4	2	2
87	Yellow-footed Green Pigeon	<i>Treron phoenicoptera</i>	1	2	7	3	1	3	9	5	3	3	3&4	3
88	Pompadour Green Pigeon	<i>Treron pompadora</i>	7	2			12	3			3	3		
89	Oriental Turtle Dove	<i>Streptopelia orientalis</i>		7	14	2		13	33	4		1&2	1,2,3 &4	1&3
90	Spotted Dove	<i>Streptopelia chinensis</i>	4	2	9	2	6	5	10	2	3&4	4	1,2,3 &4	4
91	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	7	2	3	2	12	4	6	2	1&2	2	1	2



92	Emerald Dove	<i>Chalcophaps indica</i>	8	2	7	2	10	2	9	2	2&3	2	2	3
93	Red Collared Dove	<i>Streptopelia tranquebarica</i>	7	1	2	3	11	1	2	4	2&3	2	2	3
	<b>GRUIFORMES</b>													
	<b>Otididae</b>													
94	Bengal Florican	<i>Houbaropsis bengalensis</i>			1				1				3	
	<b>Gruidae</b>													
95	Common Crane	<i>Grus grus</i>		1				10				1		
96	Demoiselle Crane	<i>Grus virgo</i>			1				5				2	
	<b>Rallidae</b>													
97	Slaty-legged Crake	<i>Rallina eurizonoides</i>												
98	Brown Crake	<i>Amaurornis akool</i>			7	2			9	2			1&2	2
99	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	7	3	1	2	8	4	1	2	1&2	2	1	1
100	Ruddy-breasted Crake	<i>Porzana fusca</i>	5	2	2	1	8	2	2	2	3	3	3	3
101	Purple Swamphen	<i>Porphyrio porphyrio</i>		1				1				2		
102	Common Moorhen	<i>Gallinula chloropus</i>		9				138				1&3		
103	Common Coot	<i>Fulica atra</i>		2				23				2&3		
104	Watercock	<i>Gallicrex cinerea</i>				2				2		1		
105	Slaty-breasted Rail	<i>Gallirallus striatus</i>			1				1				3	
	<b>CICONIIFORMES</b>													
	<b>Scolopacidae</b>													
106	Common Snipe	<i>Gallinago gallinago</i>	2	7	2	1	2	11	2	1	2&3	2,3&4	3	3
107	Common Greenshank	<i>Tringa nebularia</i>	2	8	3	2	4	65	7	2	2&3	1,2&3	2	2
108	Green Sandpiper	<i>Tringa ochropus</i>	2	9	2		4	15	4		2	2&3	3	
109	Common Sandpiper	<i>Actitis hypoleucos</i>	7	2	1	1	13	2	1	2	1,3&4	2	2	4
110	Black-tailed Godwit	<i>Limosa limosa</i>		1				4				3		

111	Pintail Snipe	<i>Gallinago stenura</i>		2	1			9	3			2&3	2	
112	Jack Snipe	<i>Lymnocyptes minimus</i>		2				5				3		
113	Whimbrel	<i>Numenius phaeopus</i>		1				11				3		
114	Eurasian Curlew	<i>Numenius arquata</i>		1				8				3		
115	Spotted Redshank	<i>Tringa erythropus</i>		1				6				3		
116	Common Redshank	<i>Tringa totanus</i>		1				15				2		
117	Wood Sandpiper	<i>Tringa glareola</i>		1	1			10	7			2&3	2	
118	Little Stint	<i>Calidris minuta</i>		2	1			21	11			2	2	
119	Temminck's Stint	<i>Calidris temminckii</i>		8	3			120	45			1,2&3	2&3	
120	Eurasian Woodcock	<i>Scolopax rusticola</i>		1				2				3		
	<b>Jacanidae</b>													
121	Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>				1				1				3
122	Bronze-winged Jacana	<i>Metopidius indicus</i>	2	1	1	8	2	1	1	10	1	1	1	1,2,3 &4
	<b>Burhinidae</b>													
123	Eurasian Thick-knee	<i>Burhinus oedicnemus</i>	4	6	3	3	6	8	3	4	1&2	2&3	2	2
	<b>Charadriidae</b>													
124	Pied Avocet	<i>Recurvirostra avosetta</i>		1				1				3		
125	Little Ringed Plover	<i>Charadrius dubius</i>	4	7	3	2	6	19	6	4	2&3	1,2,3&4	2,3	2
126	Kentish Plover	<i>Charadrius alexandrinus</i>		10				14				2&3		
127	River Lapwing	<i>Vanellus duvaucelii</i>	7	3	2	2	9	8	3	2	3	3	3	3
128	Red-wattled Lapwing	<i>Vanellus indicus</i>	1	9	1	2	1	10	2	2	2	1,2,3&4	2	2
129	Northern Lapwing	<i>Vanellus vanellus</i>		1				1				1		
130	Grey-headed Lapwing	<i>Vanellus cinereus</i>		1				1				2		

	<b>Glareolidae</b>													
131	Little Pratincole	<i>Glareola lactea</i>	4	5	3	4	5	6	4	6	1&3	1,2&3	2&3	2&3
	<b>Laridae</b>													
132	Black-headed Gull	<i>Larus ridibundus</i>		1	1			1	1			2&3	1&3	
133	Brown-headed Gull	<i>Larus brunnicephalus</i>		2	1			2	1			2&3	1	
134	Little Tern	<i>Sterna albifrons</i>				1				1				2
135	White-winged Tern	<i>Chlidonias leucopterus</i>			1				1				3	
	<b>Accipitridae</b>													
136	Osprey	<i>Pandion haliaetus</i>	7	1	2	2	8	1	2	2	3	3	2	3
137	Oriental Honey-buzzard	<i>Pernis ptilorhyncus</i>	2	7	2	1	2	8	2	1	4	1&4	1	1
138	Common Buzzard	<i>Buteo buteo</i>		3	1			3	1			2&3	2	
139	Black-shouldered Kite	<i>Elanus caeruleus</i>	5		6		8		9		2&3		2&3	
140	Black Kite	<i>Milvus migrans</i>	4	3	1	7	8	4	2	7	1&3	1&2	1	1,2&4
141	Grey-headed Fish Eagle	<i>Ichthyophaga ichhyaetus</i>	1	7	2	1	1	7	2	1	2	2&3	2	2
142	Crested Serpent Eagle	<i>Spilornis cheela</i>	1	8	3		1	8	3		1&3	1,2&3	1	
143	Booted Eagle	<i>Hieraaetus pennatus</i>		1				1				3		
144	Short-toed Snake Eagle	<i>Circaetus gallicus</i>		2				2				1		
145	Black Eagle	<i>Ichtyaetus malayensis</i>		3	3			3	2			1,2&3	1&3	
146	Steppe Eagle	<i>Aquila nipalensis</i>		4				4				2&3		
147	Changeable Hawk Eagle	<i>Spizaetus cirrhatus</i>			4				4				2&3	
148	Cinereous Vulture	<i>Aegyptius monachus</i>		1				1				2		
149	Egyptian Vulture	<i>Neophron percnopterus</i>												
150	White-rumped	<i>Gyps bengalensis</i>												

	Vulture													
151	Red-headed Vulture	<i>Sarcogyps calvus</i>												
152	Eurasian Griffon	<i>Gyps fulvus</i>		2				2				2		
153	Crested Goshawk	<i>Accipiter trivirgatus</i>	1	2	2	1	1	2	2	2	2	2	3	2
154	Shikra	<i>Accipiter badius</i>		7	2			7	4			1	1	
155	White-tailed Eagle	<i>Haliaeetus albicilla</i>		1				1				2		
156	Himalayan Griffon	<i>Gyps himalayensis</i>		3	2			3	2			1,2&3	1&3	
157	Eurasian Marsh Harrier	<i>Circus aeruginosus</i>		3				3				3		
158	Pied Harrier	<i>Circus melanoleucos</i>		2				2				3		
159	Northern Goshawk	<i>Accipiter gentilis</i>		1				1				2		
160	Long-legged Buzzard	<i>Buteo rufinus</i>		1				1				2		
161	Upland Buzzard	<i>Buteo hemilasius</i>			1				1				3	
162	Hen Harrier	<i>Circus cyaneus</i>		2				2				2		
	<b>Falconidae</b>													
163	Collared Falconet	<i>Microhierax caerulescens</i>	3	4	5	3	5	7	8	4	1&3	2&3	1&2	1,2&3
164	Common Kestrel	<i>Falco tinnunculus</i>		7	2			7	4			1&3	3	
165	Peregrine Falcon	<i>Falco peregrinus</i>		1				1				3		
166	Red-necked Falcon	<i>Falco chicquera</i>		2				2				3		
167	Eurasian Hobby	<i>Falco subbuteo</i>		1				1				2		
168	Oriental Hobby	<i>Falco severus</i>		1				1				3		
	<b>Podicipedidae</b>													
169	Little Grebe	<i>Tachybaptus ruficollis</i>		1				1				1		
170	Great Crested Grebe	<i>Podiceps cristatus</i>		1				1				1		
	<b>Anhingidae</b>													
171	Oriental Darter	<i>Anhinga melanogaster</i>	2		7	2	3		9	2	1		1&2	1
	<b>Phalacrocoracidae</b>													
172	Little Cormorant	<i>Phalacrocorax niger</i>		1				5						

173	Great Cormorant	<i>Phalacrocorax carbo</i>		9	5			139	75			2&3	2&3	
	<b>Ardeidae</b>													
174	Little Egret	<i>Egretta garzetta</i>	2	9	7	2	4	30	9	2	2	2	2&3	3
175	Grey Heron	<i>Ardea cinerea</i>		10	5			16	5			1,2&3	1&3	
176	Purple Heron	<i>Ardea purpurea</i>												
177	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	1	7	2	1	1	21	5	1	2	1,2&4	1	2
178	Indian Pond Heron	<i>Ardeola grayii</i>	1	7	2	1	1	11	2	1	3	3&4	4	4
179	Great Egret	<i>Casmerodius albus</i>	4	5	3	3	4	7	3	4	1&3	1&2	1&3	2&3
180	Intermediate Egret	<i>Mesophoyx intermedia</i>	1	7	2	2	2	14	4	2	2	1,2,3&4	3	3
181	Cattle Egret	<i>Bubulcus ibis</i>	7	1	2	2	8	1	4	3	3	3	3	3
182	Little Heron	<i>Butorides striatus</i>	1	7	1		1	7	1		3	3	3	
183	Great Bittern	<i>Botaurus stellaris</i>	1				1				2			
184	Yellow Bittern	<i>Ixobrychus sinensis</i>				2				2				3
185	Black Bittern	<i>Dupetor flavicollis</i>												
186	Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i>	3		1	2	3		2	2	1		2	2
	<b>Threskiornithidae</b>													
187	Black Ibis	<i>Pseudibis papillosa</i>	2	8	3	1	3	28	6	1	2	1,2,3&4	2	2
188	Eurasian Spoonbill	<i>Platalea leucorodia</i>	1				1				2			
	<b>Ciconiidae</b>													
189	Asian Openbill	<i>Anastomus oscitans</i>	7	2	3		9	5	5		3	3	3	
190	Black Stork	<i>Ciconia nigra</i>		7	6			35	16			2&3	3	
191	White Stork	<i>Ciconia ciconia</i>			1				1				3	
192	Woolly-necked Stork	<i>Ciconia episcopus</i>	2	7	2	1	2	10	2	1	2&4	2&4	2	2
193	Lesser Adjutant	<i>Leptoptilos javanicus</i>	3	7	2	1	3	9	2	1	1	1,2&3	1	2
	<b>PASSERIFORMES</b>													

	<b>Pittidae</b>													
194	Hooded Pitta	<i>Pitta sordida</i>				8				16				1,2&3
195	Indian Pitta	<i>Pitta brachyura</i>				7				14				2&3
	<b>Irenidae</b>													
196	Golden-fronted Leaf bird	<i>Chloropsis aurifrons</i>	7	2	2	3	11	2	2	4	2&3	3	3	3
197	Orange-bellied Leaf bird	<i>Chloropsis hardwickii</i>	2	3	7	4	2	3	8	5	2	2&3	2,3&4	2&4
	<b>Laniidae</b>													
198	Long-tailed Shrike	<i>Lanius schach</i>		7	2			3	11			2&3	1	
199	Grey-backed Shrike	<i>Lanius tephronotus</i>		1	1			1				2	3	
200	Brown Shrike	<i>Lanius cristatus</i>		1				1				3		
201	Rufous-tailed Shrike	<i>Lanius isabellinus</i>		2				1				3		
202	Bay-backed Shrike	<i>Lanius vittatus</i>		1				1				3		
	<b>Corvidae</b>													
203	Red-billed Blue Magpie	<i>Urocissa erythrorthyncha</i>	5	7	3	4	16	28	8	12	1&2	1,2,3&4	2&3	1&2
204	Rufous Treepie	<i>Dendrocitta vagabunda</i>	7	2	3	1	10	4	4	1	2&3	2	2	2
205	House Crow	<i>Corvus splendens</i>	7	3	2	2	14	11	3	5	1,2,3&4	2,3&4	3	3
206	Large-billed Crow	<i>Corvus macrorhynchos</i>	9	7	8	9	88	76	110	74	1,2,3&4	1,2,3,&4	1,2,3&4	1,2,3&4
207	Ashy Woodswallow	<i>Artamus fuscus</i>			7				9				2&3	
208	Maroon Oriole	<i>Oriolus traillii</i>		2	1			2	2			2		
209	Eurasian Golden Oriole	<i>Oriolus oriolus</i>			3	7			5	10				2&3
210	Black-hooded Oriole	<i>Oriolus xanthonus</i>			8				6				1&2	
211	Large Cuckooshrike	<i>Coracina macei</i>	7			2	7			2	1&3			2
212	Small Minivet	<i>Pericrocotus cinnamomeus</i>		3	9			8	11			1&3	1,2,3&4	

213	Rosy Minivet	<i>Pericrocotus roseus</i>	4	3	1	2	8	6	5	4	1&2	1&3	1	2
214	Scarlet Minivet	<i>Pericrocotus flammeus</i>	8	2	1	2	10	3	1	2	1&3	3	3	3
215	Long-tailed Minivet	<i>Pericrocotus ethologus</i>		5	4			19	16			1,2&3	1&3	
216	Bar-winged Flycatcher-shrike	<i>Hemipus picatus</i>	2	1	3	7	2	1	4	9	2	2	2&3	2&3
217	White-throated Fantail	<i>Rhipidura albicollis</i>	6	7	6	7	9	11	6	7	1&3	1,2&3	2&3	1,2,3 &4
218	Yellow-bellied Fantail	<i>Rhipidura hypoxantha</i>		1				2				3		
219	Black Drongo	<i>Dicrurus macrocercus</i>			7				12				2,3&4	
220	Ashy Drongo	<i>Dicrurus leucophaeus</i>			13	9			46	31			3&4	1,2&3
221	White-bellied Drongo	<i>Dicrurus caerulescens</i>	2	7	1	2	2	7	2	2	2	2&3	2	2
222	Crow-billed Drongo	<i>Dicrurus annectans</i>				10				14				2&3
223	Bronzed Drongo	<i>Dicrurus aeneus</i>	4	6	5	3	8	9	15	6	1&2	1,2&3	1&2	3&4
224	Lesser Racket-tailed Drongo	<i>Dicrurus remifer</i>			2				2				3	
225	Spangled Drongo	<i>Dicrurus hottentottus</i>	8	1	2	1	8	1	2	2	1&2	1	1	1
226	Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>	4	3	2		8	5	2		2&3	2	2	
227	Black-naped Monarch	<i>Hypothymis azurea</i>	2				2				3			
228	Asian Paradise-flycatcher	<i>Terpsiphone paradisi</i>				8				13				2&3
229	Common Iora	<i>Aegithina tiphia</i>	3	1	2	7	4	1	2	7	3	3	3	1&3
230	Large Woodshrike	<i>Tephrodomis gularis</i>												
231	Common Woodshrike	<i>Tephrodomis pondicerianus</i>	2	3	7	2	2	4	7	3	1	2	1&2	3
	<b>Muscicapidae</b>													
232	Orange-headed	<i>Zoothera citrina</i>				2				4				3

	Thrush													
233	Isabelline Wheater	<i>Oenanthe isabellina</i>												
234	Blue Whistling Thrush	<i>Myophonus caeruleus</i>	9	7	8	7	25	18	17	21	1,2,3 &4	1,2,3& 4	1,2,3 &4	1,2,3 &4
235	Chestnut-bellied Rock Thrush	<i>Monticola rufiventris</i>		2				2				3		
236	Blue-capped Rock Thrush	<i>Monticola cinclorhynchus</i>		3	2			5	2			2&3	3	
237	Tickell's Thrush	<i>Turdus unicolor</i>		3				8				1,2&3		
238	Dark-throated Thrush	<i>Turdus ruficollis</i>		2				2				2		
239	Scaly Thrush	<i>Zoothera dauma</i>	2				2				3			
240	Red-throated Flycatcher	<i>Ficedula albicilla</i>												
241	Kashmir Flycatcher	<i>Ficedula subrubra</i>												
242	Rufous-gorgeted Flycatcher	<i>Ficedula strophiiata</i>	2	1	2	1	2	1	2	2	1	2	2	1
243	Pale-chinned Flycatcher	<i>Cyornis poliogenys</i>	3	2	8	1	4	2	15	2	2&3	3	1,2&3	3
244	Grey-headed Canary Flycatcher	<i>Culicicapa ceylonensis</i>		4	9	9		6	25	20		1&2	1,2,3 &4	1,2,3 &4
245	Rusty-tailed Flycatcher	<i>Muscicapa ruficauda</i>		2				3				3		
246	Slaty-backed Flycatcher	<i>Ficedula hodgsonii</i>		1				1				2		
247	Pale-Blue Flycatcher	<i>Cyornis unicolor</i>		2	3			3	3			2&3	2	
248	Asian-Brown Flycatcher	<i>Muscicapa dauurica</i>		2	1			2	2			2&3	3	
249	Ultramarine	<i>Ficedula superciliaris</i>		6				8				2&3		



	Flycatcher													
250	Verditer Flycatcher	<i>Eumyias thalassina</i>		18	6			28	8			1,2&3	2&3	
251	Blue-throated Flycatcher	<i>Cyornis rubeculoides</i>		4	3			4	5			2&3	2&3	
252	Oriental Magpie Robin	<i>Copsychus saularis</i>	7	2	3	5	10	2	4	7	1,2&3	2	2	1&2
253	White-rumped Shama	<i>Copsychus malabaricus</i>	1	2	7	2	1	2	11	2	3	3	2&3	2
254	White-capped Water Redstart	<i>Chaimarrornis leucocephalus</i>		1				1				3		
255	Black Redstart	<i>Phoenicurus ochruros</i>		10	4			16	6			2&3	1&2	
256	Common Stonechat	<i>Saxicola torquata</i>		7				10				2		
257	White-tailed Stonechat	<i>Saxicola leucura</i>	2	2	7	1	3	2	9	1	3	3	2&3	3
258	Pied Bushcaht	<i>Saxicola caprata</i>	4	3	7	2	5	4	11	2	2&3	1&2	1&3	2
259	Grey Bushchat	<i>Saxicola ferrea</i>			2				2				3	
260	Eurasian Blackbird	<i>Turdus merula</i>		2				2				1		
261	Siberian Rubythroat	<i>Luscinia colliope</i>		7	2			11	5			1,2&3	1&3	
262	White-tailed Rubythroat	<i>Luscinia pect oralis</i>		10	5			16	8			1,2&3	2&3	
263	Bluethroat	<i>Luscinia svecica</i>		10	3			15	7			2&3	1&2	
264	Indian Blue Robin	<i>Luscinia brunnea</i>		2				4				3		
265	Plumbeous Water Redstart	<i>Rhyacornis fuliginosus</i>		2				2				2		
266	Grey-winged Blackbird	<i>Turdus boulboul</i>		2								2&3		
	<b>Sturnidae</b>													
267	Brahminy Starling	<i>Sturnus pagodarum</i>	4	3	2	2	4	4	3	2	1&3	2&3	1	2
268	Asian Pied Starling	<i>Sturnus contra</i>	2	3	8	1	2	4	9	1	2	2	2&3	2
269	Chestnut-tailed	<i>Sturnus malabaricus</i>			7				7				1&3	

	Starling													
270	Common Myna	<i>Acridotheres tristis</i>	7	5	6	4	10	6	6	5	1,2&3	1&2	1,2&3	1&3
271	Jungle Myna	<i>Acridotheres fuscus</i>	9	4	3	2	12	4	4	2	1,2&4	1&2	2&3	1&2
	<b>Sittidae</b>													
272	Chestnut-bellied Nuthatch	<i>Sitta castanea</i>	2	7	1	1	2	7	1	1	2	1,2&3	2	2
273	Velvet-fronted Nuthatch	<i>Sitta frontalis</i>	5	7	3	2	12	10	4	2	1&2	1,2&3	2&3	1
274	Wallcreeper	<i>Tichodroma muraria</i>		1				1				2		
	<b>Paridae</b>													
275	Great Tit	<i>Parus major</i>	3	9	1	3	5	16	1	4	1&2	1,2&3	1	2&3
276	Sultan Tit	<i>Melanochlora sultanea</i>	1				1				2			
	<b>Hirundinidae</b>													
277	Plain Martin	<i>Riparia paludicola</i>			7				18				3	
278	Barn Swallow	<i>Hirundo rustica</i>	2	2	7	2	3	2	8	2	2	3	2&3	3
279	Sand Martin	<i>Riparia riapria</i>			1				1				1	
280	Red-rumped Swallow	<i>Hirundo daurica</i>		2	8	3		2	10	4		2	2&4	1
	<b>Pycnonotidae</b>													
281	Black-crested Bulbul	<i>Pycnonotus melanicterus</i>	5		6		8		9		3&4		2&4	
282	Black Bulbul	<i>Hysipetes leucocephalus</i>	16	14	15	18	126	87	118	76	1,2,3 &4	1,2,3& 4	1,2,3 &4	1,2,3 &4
283	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	2	3	8	2	3	4	14	4	1	1	1,2&3	2
284	Himalayan Bulbul	<i>Pycnonotus leucogenys</i>	9	9	8	9	65	67	98	84	1,2,3 &4	1,2,3& 4	1,2,3 &4	1,2,3 &4
285	Red-vented Bulbul	<i>Pycnonotus cafer</i>	7	3	2	8	11	5	4	18	1,2&3	2	2	1,2,3 &4
	<b>Cisticolidae</b>													

286	Zitting Cisticola	<i>Cisticola juncidis</i>	2	8	2	2	3	11	2	2	3	2&3	2	2
287	Bright-capped Cisticola	<i>Cisticola exilis</i>	1				1				3			
288	Striated Prinia	<i>Prinia criniger</i>	3	4	5	2	4	6	7	2	1&2	2&3	1&2	1
289	Grey-crowned Prinia	<i>Prinia cinereocapilla</i>	2	3	4	2	2	4	5	2	1	1&3	2&3	2
290	Grey-breasted Prinia	<i>Prinia hodgsonii</i>			9				14				2,3&4	
291	Graceful Prinia	<i>Prinia gracilis</i>	1				1				3			
292	Jungle Prinia	<i>Prinia sylvatica</i>			1				1				2	
293	Yellow-bellied Prinia	<i>Prinia flaviventris</i>	4	7	3	2	5	10	4	2	1,2&4	1,2&3	2	2
294	Ashy Prinia	<i>Prinia socialis</i>												
295	Plain Prinia	<i>Prinia inornata</i>	7	2	2	1	9	3	2	2	1,2&4	2&3	2	2
	<b>Zosteropidae</b>													
296	Oriental White-eye	<i>Zosterops palpebrosus</i>	9	8	9	9	85	81	51	36	1,2,3 &4	1,2,3& 4	1,2,3 &4	1,2,3 &4
	<b>Sylviidae</b>													
297	Blyth's Leaf Warbler	<i>Phylloscopus reguloides</i>		9	1			19	1			2,3&4	2	
298	Chestnut-crowned Bush Warbler	<i>Cettia major</i>		1				1				2		
299	Grey-sided Bush Warbler	<i>Cettia brunnifrons</i>		2				3				2		
300	Spotted Bush Warbler	<i>Bradypterus thoracicus</i>		2				3				1		
301	Paddyfield Warbler	<i>Acrocephalus agricola</i>		10	4			14	4			2&3	3	
302	Thick-bellied Warbler	<i>Acrocephalus aedon</i>		1				1				3		
303	Smoky Warbler	<i>Phylloscopus fulgiventis</i>		6	2			14	5			1,2&3	2	
304	Western Crowned	<i>Phylloscapus</i>		2				2				2		

	Warbler		<i>occipitalis</i>											
305	Large-billed Leaf Warbler		<i>Phylloscopus magnirostris</i>	2			3				2			
306	Hoary Throated Barwing		<i>Actinodura nipalensis</i>											
307	Yellow-bellied Warbler		<i>Abroscopus superciliaris</i>	2			2				1			
308	Pale-footed Bush Warbler		<i>Cettia pallidipes</i>		1			1			2			
309	Aberrant Bush Warbler		<i>Cettia flavolivacea</i>	10	4		17	6			2&3	3		
310	Blyth's Reed Warbler		<i>Acrocephalus dumetorum</i>	8	1		15	1			1,2&3	3		
311	Clamorous Reed Warbler		<i>Acrocephalus stentoreus</i>	1			1				2			
312	Tickell's Leaf Warbler		<i>Phylloscopus affinis</i>	12	2		21	4			1,2&3	2		
313	Nepal Wren Babbler		<i>Pnoepyga pusilla</i>											
314	Lemon-rumped Warbler		<i>Phylloscopus chloronotus</i>	10	3		15	5			1&3	1		
315	Hume's Warbler		<i>Phylloscopus humei</i>	2			2				2			
316	Greenish Warbler		<i>Phylloscopus trochiloides</i>	9	3		16	5			2&3	1&2		
317	Golden-spectacled Warbler		<i>Seicercus burkii</i>	2			2				3			
318	Whistler's Warbler		<i>Seicercus whistleri</i>	4	3		4	4			2&3	2&3		
319	Grey-hooded Warbler		<i>Seicercus xanthoschistos</i>	15	5		36	14			1,2&3	2&3		
320	Chestnut-crowned		<i>Seicercus castaniceps</i>	10	4		28	9			2&3	1		

	Warbler													
321	Sulphur-bellied Warbler	<i>Phylloscopus griseolus</i>		1				2				3		
322	Chestnut-headed Tesia	<i>Tesia castaneocoronata</i>												
323	Common Chiffchaff	<i>Phylloscopus collybita</i>		7				10				3		
324	Common Tailorbird	<i>Orthotomus sutorius</i>	9	5	7	8	12	8	7	10	1,2,3 &4	1,2&3	1,2&3	1,2,3 &4
325	Dusky Warbler	<i>Phylloscopus fuscatus</i>		2				4				2		
326	Striated Grassbird	<i>Megalurus palustris</i>	1				1				3			
327	Bristled Grassbird	<i>Chaetornis striatus</i>			1				1				3	
328	Rufous-rumped Grassbird	<i>Graminicola bengalensis</i>	2		3	2	2		4	3	1	2&3	1	1
329	White-throated Laughingthrush	<i>Garrulax albogularis</i>			1				1				4	
330	White-crested Laughingthrush	<i>Garrulax leucolophus</i>	4	7	3	6	4	7	3	6	2&4	2,3&4	2&4	1,2&3
331	Lesser Necklaced Laughingthrush	<i>Garrulax monileger</i>	3	2	8	4	4	5	12	5	1&2	1	1,2&3	1&3
332	Greater Necklaced Laughingthrush	<i>Garrulax pectoralis</i>	5	9	3	4	7	12	3	6	1&3	1,2,3&4	1&3	1&2
333	Blue-winged Laughingthrush	<i>Garrulax squamatus</i>	1				1				2			
334	Puff-throated Babbler	<i>Pellorneum ruficeps</i>	9	6	8	7	28	19	19	20	1,2,3 &4	1,3&4	1,2&3	1,2,3 &4
335	White-browed Scimitar Babbler	<i>Pamatorhinus schisticeps</i>		3	2	3		5	3	4		1&3	1&2	2&3
336	Striped Tit Babbler	<i>Macronous gularis</i>	4	2	7	3	6	2	18	6	1&2	2	1,2&3	1,2&4
337	Chestnut-capped Babbler	<i>Timalia pileata</i>	2	8	3	2	5	11	4	2	2	2&3	2&3	3

338	Yellow-eyed Babbler	<i>Chrysomma sinense</i>			4	3			4	5			2&3	2&3
339	Spiny Babbler	<i>Turdoides nipalensis</i>			1				1				2	
340	Striated Babbler	<i>Turdoides earlei</i>	3	2	9	3	6	5	15	7	2	2	2,3&4	3
341	Jungle Babbler	<i>Turdoides striatus</i>	4	8	5	3	6	15	8	6	1&3	1,2&3	1&2	2&3
342	Eurasian Woodcock	<i>Scolopax rusticola</i>			1				1				3	
343	Himalayan Cutia	<i>Cutia nipalensis</i>	1	2	1	1	1	4	1	1	2	1	1	2
344	White-bellied Yuhina	<i>Yuhina zantholeuca</i>	2	3		2	2	4		2	3	1&2		1
345	Nepal Fulvetta	<i>Alcippe nipalensis</i>		4		3		7		4		1&4		1&4
	<b>Alaudidae</b>													
346	Rufous-winged Bushlark	<i>Mirafra assamica</i>	3	2	7	3	3	4	9	5	1&3	2	1&2	2
347	Ashy-crowned Sparrow Lark	<i>Eremopterix grisea</i>	4	3	3		4	4	3		2&3	1&3	1&2	
348	Sand Lark	<i>Calandrella raytal</i>	7	4	3	2	10	6	3	2	1,2&3	2&3	1&3	2
349	Oriental Skylark	<i>Alauda gulgula</i>	3			1	3			1	2&3			2
	<b>Nectariniidae</b>													
350	Thick-billed Flowerpecker	<i>Dicaeum agile</i>	1				1				3			
351	Pale-billed Flowerpecker	<i>Dicaeum erythrorhynchus</i>	2	3	4	5	2	5	5	8	1	1&2	1&2	1,2,3 &4
352	Yellow-vented Flowerpecker	<i>Dicaeum chrysorrheum</i>	1				1				3			
353	Crimson Sunbird	<i>Aethopyga siparaja</i>	7	1	2	2	7	1	2	2	1,2&3	3	2	3
354	Purple Sunbird	<i>Anthreptes asiatica</i>		5	3	4		5	4	5		2&3	2	2&3
355	Streaked Spiderhunter	<i>Arachnothera magna</i>	4		6		5		8		2&3		2&3	
	<b>Passeridae</b>													
356	House Sparrow	<i>Passer domesticus</i>	7	4	6	5	16	8	10	15	1,2&3	1&3	1&2	2&3

357	Eurasian Sparrow	Tree <i>Passer montanus</i>	5	3	8	6	16	12	24	17	1&3	1	1,2,3 &4	2
358	Chestnut-shouldered Petronia	<i>Petronia xanthocollis</i>			4	4			4	7			1&3	1&2
359	White Wagtail	<i>Motacilla alba</i>		2				5				1		
360	White-browed Wagtail	<i>Motacilla maderaspatensis</i>	7				7				1			
361	Citrine Wagtail	<i>Motacilla citreola</i>		5	1			8	1			1&2	1	
362	Yellow Wagtail	<i>Motacilla flava</i>		10	4			14	4			1,2&3	3	
363	Grey Wagtail	<i>Motacilla cinerea</i>		11	3			19	5			1&3	2&3	
364	Paddyfield Pipit	<i>Anthus rufulus</i>	9	4	3	6	20	8	7	10	1,2&3	2&3	2	1&2
365	Richard's Pipit	<i>Anthus richardi</i>		4	3			5	4			1&2	1&3	
366	Olive-backed Pipit	<i>Anthus hodgsoni</i>		7	2			19	4			1&2	3	
367	Rosy Pipit	<i>Anthus roseatus</i>		7				9				3		
368	Black-breasted Weaver	<i>Ploceus benghalensis</i>	3		2	3	3		3	4	2&3		2	2&3
369	Tawny Pipit	<i>Anthus campestris</i>			1				2				3	
370	Baya Weaver	<i>Ploceus philippinus</i>	4	3	7	2	4	3	7	3	2	2	1,2&3	3
371	Red Avadavat	<i>Amandava amandava</i>	3	4			4	8			2&3	1&3		
372	Indian Silverbill	<i>Lonchura malabarica</i>	1				1				3			
373	White-rumped Munia	<i>Lonchura striata</i>		2				18				2		
374	Scaly-breasted Munia	<i>Lonchura punctulata</i>	2	8	3	2	4	25	8	5	1	1,2&3	2	3
375	Black-headed Munia	<i>Lonchura Malacca</i>			1				1				4	
	<b>Fringillidae</b>													
376	Crested Bunting	<i>Melophus Iothami</i>		1				4				2		
377	Common Rosefinch	<i>Carpodacus erythrinus</i>		11	5			36	7			2&3	2&3	
378	Yellow-breasted Bunting	<i>Emberiza aureola</i>		1				1				3		

## Appendix II

### Systematic list and status of Birds in Chitwan National Park

	Order/Family/Common Name/Scientific Name	IUCN Status	Residential Status	Relative Abundance	Feeding Habits
	<b>GALLIFORMES</b>				
	<b>Phasianidae</b>				
1	Black Francolin <i>Francolinus francolinus</i>	LC	R	C	Omnivorous
2	Indian Peafowl <i>Pavo cristatus</i>	NT	R	C	Omnivorous
3	Kalij Pheasant <i>Lophura leucomelanos</i>	LC	R	C	Omnivorous
4	Red Junglefowl <i>Gallus gallus</i>	LC	R	C	Omnivorous
	<b>ANSERIFORMES</b>				
	<b>Dendrocygnidae</b>				
5	Lesser Whistling Duck <i>Dendrocygna javanica</i>	LC	R	C	Herbivorous
	<b>Anatidae</b>				
6	Bar-headed Goose <i>Anser indicus</i>	NT	WV	UC	Herbivorous
7	Greylag Goose <i>Anser anser</i>	NT	WV	O	Herbivorous
8	Ruddy Shelduck <i>Tadorna ferruginea</i>	NT	WV	C	Omnivorous
9	Red-crested Pochard <i>Rhodonessa rufina</i>	LC	WV	C	Omnivorous
10	Greater White Fronted Goose <i>Anser albifrons</i>	LC	R	OC	Omnivorous
11	Common Merganser <i>Mergus merganser</i>	LC	WV	C	Omnivorous
12	Common Shelduck <i>Tadorna tadorna</i>	LC	WV	OC	Omnivorous



13	Gadwall	<i>Anas strepera</i>	LC	WV	C	Herbivorous
14	Mallard	<i>Anas platyrhynchos</i>	LC	WV	C	Omnivorous
15	Spot-billed Duck	<i>Anas poecilorhyncha</i>	NT	WV	OC	Omnivorous
16	Northern Pintail	<i>Anas acuta</i>	EN	WV	OC	Omnivorous
17	Eurasian Wigeon	<i>Anas penelope</i>	LC	WV	C	Herbivorous
	<b>PICIFORMES</b>					
	<b>Picidae</b>					
18	Grey-capped Pygmy Woodpecker	<i>Dendrocopos canicapillus</i>	LC	R	C	Omnivorous
19	Fulvous-breasted Woodpecker	<i>Dendrocopos macei</i>	LC	R	C	Omnivorous
20	Rufous Woodpecker	<i>Celeus brachyurus</i>	LC	R	OC	Carnivorous
21	Lesser Yellownape	<i>Picus chlorolophus</i>	LC	R	C	Insectivorous
22	Greater Yellownape	<i>Picus flavinucha</i>	LC	R	UC	Insectivorous
23	Streak-throated Woodpecker	<i>Picus xanthopygaeus</i>	LC	R	C	Insectivorous
24	Grey-headed Woodpecker	<i>Picus canus</i>	LC	R	C	Omnivorous
25	Himalayan Flameback	<i>Dinopium shorii</i>	LC	R	C	Omnivorous
26	Greater Flameback	<i>Chrysocolaptes lucidus</i>	LC	R	C	Insectivorous
27	Black-rumped Flameback	<i>Dinopium benghalense</i>	LC	R	C	Insectivorous
28	Great Slaty Woodpecker	<i>Mulleripicus pulverulentus</i>	EN	R	UC	Insectivorous
29	Eurasian Wryneck	<i>Jynx torquilla</i>	LC	WV	OC	Insectivorous
	<b>Megalaimidae</b>					

30	Lineated Barbet	<i>Megalaima lineata</i>	LC	R	C	Omnivorous
31	Blue-throated Barbet	<i>Megalaima asiatica</i>	LC	R	UC	Omnivorous
32	Coppersmith Barbet	<i>Megalaima haemacephala</i>	LC	R	C	Omnivorous
	<b>BUCEROTIFORMES</b>					
	<b>Bucerotidae</b>					
33	Oriental Pied-Hornbill	<i>Anthracoceros albirostris</i>	NT	R	C	Omnivorous
34	Great Hornbill	<i>Buceros bicornis</i>	EN	R	OC	Carnivorous
	<b>UPUPIFORMS</b>					
	<b>Upupidae</b>					
35	Common Hoopoe	<i>Upupa epos</i>	LC	R	C	Insectivorous
	<b>TROGONIFORMES</b>					
	<b>Trogonidae</b>					
36	Red-headed Trogon	<i>Harpactes erythrocephalus</i>	EN	R	C	Insectivorous
	<b>CORACIIFORMES</b>					
	<b>Coraciidae</b>					
37	Indian Roller	<i>Coracias benghalensis</i>	LC	R	C	Carnivorous
38	Dollar bird	<i>Eurystomus orientalis</i>	LC	SV	C	Carnivorous
	<b>Alcedinidae</b>					
39	Common Kingfisher	<i>Alcedo atthis</i>	LC	R	C	Carnivorous
	<b>Hylecyonidae</b>					
40	Stork-billed Kingfisher	<i>Halcyon capensis</i>	LC	R	OC	Carnivorous

41	Ruddy Kingfisher	<i>Halcyon coromanda</i>	CR	R	OC	Carnivorous
42	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	LC	R	C	Carnivorous
	<b>Cerylidae</b>					
43	Pied Kingfisher	<i>Ceryle rudis</i>	LC	R	C	Carnivorous
	<b>Meropidae</b>					
44	Blue-bearded Bee-eater	<i>Nyctyornis athertoni</i>	LC	SV	UC	Insectivorous
45	Green Bee-eater	<i>Merops orientalis</i>	LC	R	C	Insectivorous
46	Blue-tailed Bee-eater	<i>Merops philippinus</i>	LC	R	C	Insectivorous
47	Chestnut-headed Bee-eater	<i>Merops leschenaulti</i>	LC	R	C	Insectivorous
	<b>CUCULIFORMES</b>					
	<b>Cuculidae</b>					
48	Pied Cuckoo	<i>Clamator jacobinus</i>	LC	SV	VC	Carnivorous
49	Plaintive Cuckoo	<i>Cacomantis merulinus</i>	LC	SV	OC	Insectivorous
50	Oriental Cuckoo	<i>Cuculus saturatus</i>	LC	SV	OC	Insectivorous
51	Chestnut-winged Cuckoo	<i>Clamator coromandus</i>	NT	SV	VC	Carnivorous
52	Common Hawk Cuckoo	<i>Hierococcyx varius</i>	LC	R	C	Insectivorous
53	Grey-bellied Cuckoo	<i>Cacomantis passerinus</i>	LC	SV	OC	Insectivorous
54	Indian Cuckoo	<i>Cuculus micropterus</i>	LC	SV	C	Insectivorous
55	Eurasian Cuckoo	<i>Cuculus canorus</i>	LC	SV	C	Insectivorous
56	Drongo Cuckoo	<i>Surniculus lugubris</i>	LC	SV	VC	Carnivorous

57	Asian Koel	<i>Eudynamys scolopacea</i>	LC	SV	C	Omnivorous
58	Green-billed Malkoha	<i>Phaenicophaeus tristis</i>	LC	R	C	Insectivorous
	<b>Centropodidae</b>					
59	Greater Coucal	<i>Centropus sinesis</i>	LC	R	C	Carnivorous
60	Lesser Coucal	<i>Centropus bengalensis</i>	LC	R	C	Insectivorous
	<b>PSITTACIFORMES</b>					
	<b>Psittacidae</b>					
61	Alexandrine Parakeet	<i>Psittacula eupatria</i>	NT	R	C	Frugivorous
62	Rose-ringed Parakeet	<i>Psittacula krameri</i>	LC	R	C	Frugivorous
63	Slaty-headed Parakeet	<i>Psittacula himalayana</i>	LC	R	C	Frugivorous
64	Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	LC	R	C	Frugivorous
65	Red-breasted Parakeet	<i>Psittacula alexandri</i>	VU	R	C	Frugivorous
	<b>APODIFORMES</b>					
	<b>Apodidae</b>					
66	White-throated Needletail	<i>Hirundapus caudacutus</i>	LC	SV	OC	Insectivorous
67	White-rumped Spinetail	<i>Zoonavena sylvatica</i>	NT	R	C	Insectivorous
68	House Swift	<i>Apus affinis</i>	LC	R	C	Insectivorous
69	Himalayan Swiftlet	<i>Colocalia brevirostris</i>	LC	WV	VC	Insectivorous
70	Alpine Swift	<i>Tachymarptis melba</i>	LC	WV	OC	Insectivorous
71	Fork-tailed Swift	<i>Apus pacificus</i>	LC	WV	OC	Insectivorous

	<b>Hemiprocnidae</b>					
72	Crested Treeswift	<i>Hemiproctne coronate</i>	LC	R	C	Insectivorous
	<b>STRIGIFORMES</b>					
	<b>Strigidae</b>					
73	Oriental Scops Owl	<i>Otus sunia</i>	DD	R	UC	Carnivorous
74	Brown Hawk-Owl	<i>Ninox scutulata</i>	LC	R	C	Carnivorous
75	Brown Fish Owl	<i>Ketupa zeylonensis</i>	VU	R	UC	Carnivorous
76	Jungle Owlet	<i>Glaucidium radiatum</i>	LC	R	C	Carnivorous
77	Mottled Wood Owl	<i>Strix ocellata</i>	DD	R	OC	Carnivorous
78	Spotted Owlet	<i>Athene brama</i>	LC	R	C	Carnivorous
	<b>Caprimulgidae</b>					
79	Large-tailed Nightjar	<i>Caprimulgus macrurus</i>	NT	R	C	Insectivorous
80	Grey Nightjar	<i>Caprimulgus indicus</i>	LC	SV	OC	Insectivorous
81	Indian Nightjar	<i>Caprimulgus asiaticus</i>	EN	SV	OC	Insectivorous
82	Savanna Nightjar	<i>Caprimulgus affinis</i>	NT	R	C	Insectivorous
	<b>COLUMBIFORMES</b>					
	<b>Columbidae</b>					
83	Rock Pigeon	<i>Columba livia</i>	LC		C	Frugivorous
84	Common Wood Pigeon	<i>Columba palumbus</i>	LC	WV	OC	Frugivorous
85	Ashy Wood Pigeon	<i>Columba pulchricollis</i>	LC	WV	OC	Frugivorous
86	Orange-breasted Green Pigeon	<i>Treron bicincta</i>	LC	R	C	Frugivorous
87	Yellow-footed Green Pigeon	<i>Treron phoenicoptera</i>	LC	R	C	Frugivorous

88	Pompadour Green Pigeon	<i>Treron pompadora</i>	LC	R	C	Frugivorous
89	Oriental Turtle Dove	<i>Streptopelia orientalis</i>	LC	WV	VC	Frugivorous
90	Spotted Dove	<i>Streptopelia chinensis</i>	LC	R	C	Frugivorous
91	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	LC	R	C	Frugivorous
92	Emerald Dove	<i>Chalcophaps indica</i>	LC	R	C	Frugivorous
93	Red Collared Dove	<i>Streptopelia tranquebarica</i>	LC	R	C	Frugivorous
	<b>GRUIFORMES</b>					
	<b>Otididae</b>					
94	Bengal Florican	<i>Houbaropsis bengalensis</i>	CR	R	OC	Omnivorous
	<b>Gruidae</b>					
95	Common Crane	<i>Grus grus</i>	NT	WV	OC	Omnivorous
96	Demoiselle Crane	<i>Grus virgo</i>	VU	PV	OC	Omnivorous
	<b>Rallidae</b>					
97	Slaty-legged Crake	<i>Rallina eurizonoides</i>	EN	R	OC	Omnivorous
98	Brown Crake	<i>Amaurornis akool</i>	LC	R	C	Omnivorous
99	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	LC	R	C	Omnivorous
100	Ruddy-breasted Crake	<i>Porzana fusca</i>	LC	R	UC	Omnivorous
101	Purple Swamphen	<i>Porphyrio porphyrio</i>	LC	WV	OC	Omnivorous
102	Common Moorhen	<i>Gallinula chloropus</i>	LC	WV	C	Omnivorous
103	Common Coot	<i>Fulica atra</i>	LC	WV	OC	Omnivorous
104	Watercock	<i>Gallicrex cinerea</i>	NT	SV	OC	Omnivorous

105	Slaty-breasted Rail	<i>Gallirallus striatus</i>	NT	PV	OC	Omnivorous
	<b>CICONIFORMES</b>					
	<b>Scolopacidae</b>					
106	Common Snipe	<i>Gallinago gallinago</i>	LC	WV	C	Carnivorous
107	Common Greenshank	<i>Tringa nebularia</i>	LC	R	C	Carnivorous
108	Green Sandpiper	<i>Tringa ochropus</i>	LC	R	C	Carnivorous
109	Common Sandpiper	<i>Actitis hypoleucos</i>	LC	R	C	Carnivorous
110	Black-tailed Godwit	<i>Limosa limosa</i>	NT	PV	OC	Omnivorous
111	Pintail Snipe	<i>Gallinago stenura</i>	LC	WV	OC	Carnivorous
112	Jack Snipe	<i>Lymnocyptes minimus</i>	LC	WV	OC	Omnivorous
113	Whimbrel	<i>Numenius phaeopus</i>	LC	WV	OC	Omnivorous
114	Eurasian Curlew	<i>Numenius arquata</i>	CR	WV	OC	Carnivorous
115	Spotted Redshank	<i>Tringa erythropus</i>	LC	WV	OC	Carnivorous
116	Common Redshank	<i>Tringa totanus</i>	LC	WV	OC	Carnivorous
117	Wood Sandpiper	<i>Tringa glareola</i>	LC	WV	OC	Carnivorous
118	Little Stint	<i>Calidris minuta</i>	LC	WV	OC	Omnivorous
119	Temminck's Stint	<i>Calidris temminckii</i>	LC	WV	C	Omnivorous
120	Eurasian Woodcock	<i>Scolopax rusticola</i>	LC	PV	OC	Omnivorous
	<b>Jacanidae</b>					
121	Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>	VU	SV	OC	Omnivorous
122	Bronze-winged Jacana	<i>Metopidius indicus</i>	LC	R	C	Omnivorous
	<b>Burhinidae</b>					
123	Eurasian Thick-knee	<i>Burhinus oedicephalus</i>	LC	R	UC	Omnivorous

	<b>Charadriidae</b>					
124	Pied Avocet	<i>Recurvirostra avosetta</i>	LC	WV	OC	Omnivorous
125	Little Ringed Plover	<i>Charadrius dubius</i>	LC	R	C	Carnivorous
126	Kentish Plover	<i>Charadrius alexandrinus</i>	LC	WV	VC	Carnivorous
127	River Lapwing	<i>Vanellus duvaucelii</i>	NT	R	C	Carnivorous
128	Red-wattled Lapwing	<i>Vanellus indicus</i>	LC	R	C	Omnivorous
129	Northern Lapwing	<i>Vanellus vanellus</i>	NT	WV	OC	Carnivorous
130	Grey-headed Lapwing	<i>Vanellus cinereus</i>	LC	WV	OC	Carnivorous
	<b>Glareolidae</b>					
131	Little Pratincole	<i>Glareola lactea</i>	LC	R	UC	Omnivorous
	<b>Laridae</b>					
132	Black-headed Gull	<i>Larus ridibundus</i>	VU	WV	OC	Omnivorous
133	Brown-headed Gull	<i>Larus brunnicephalus</i>	VU	WV	OC	Omnivorous
134	Little Tern	<i>Sterna albifrons</i>	VU	SV	OC	Carnivorous
135	White-winged Tern	<i>Chlidonias leucopterus</i>	LC	PV	OC	Carnivorous
	<b>Accipitridae</b>					
136	Osprey	<i>Pandion haliaetus</i>	LC	R	C	Carnivorous
137	Oriental Honey-buzzard	<i>Pernis ptilorhyncus</i>	LC	R	C	Carnivorous
138	Common Buzzard	<i>Buteo buteo</i>	LC	WV	UC	Carnivorous
139	Black-shouldered Kite	<i>Elanus caeruleus</i>	LC	R	UC	Carnivorous
140	Black Kite	<i>Milvus migrans</i>	LC	R	C	Carnivorous
141	Grey-headed Fish	<i>Ichthyophaga</i>	CR	R	C	Carnivorous



	Eagle	<i>ichthyaetus</i>				
142	Crested Serpent Eagle	<i>Spilornis cheela</i>	LC	R	C	Carnivorous
143	Booted Eagle	<i>Hieraetus pennatus</i>	LC	WV	OC	Carnivorous
144	Short-toed Snake Eagle	<i>Circaetus gallicus</i>	LC	WV	OC	Carnivorous
145	Black Eagle	<i>Ictinaetus malayensis</i>	LC	WV	OC	Carnivorous
146	Steppe Eagle	<i>Aquila nipalensis</i>	VU	WV	UC	Carnivorous
147	Changeable Hawk Eagle	<i>Spizaetus cirrhatus</i>	LC	R	UC	Carnivorous
148	Cinereous Vulture	<i>Aegyptius monachus</i>	EN	WV	UC	Carnivorous
149	Egyptian Vulture	<i>Neophron percnopterus</i>	VU	R	OC	Carnivorous
150	White-rumped Vulture	<i>Gyps bengalensis</i>	CR	R	OC	Carnivorous
151	Red-headed Vulture	<i>Sarcogyps calvus</i>	EN	R	OC	Carnivorous
152	Eurasian Griffon	<i>Gyps fulvus</i>	DD	WV	OC	Carnivorous
153	Crested Goshawk	<i>Accipiter trivirgatus</i>	LC	R	OC	Carnivorous
154	Shikra	<i>Accipiter badius</i>	LC	R	C	Carnivorous
155	White-tailed Eagle	<i>Haliaeetus albicilla</i>	CR	WV	OC	Carnivorous
156	Himalayan Griffon	<i>Gyps himalayensis</i>	VU	WV	UC	Carnivorous
157	Eurasian Marsh Harrier	<i>Circus aeruginosus</i>	LC	WV	UC	Carnivorous
158	Pied Harrier	<i>Circus melanoleucos</i>	VU	WV	OC	Carnivorous
159	Northern Goshawk	<i>Accipiter gentilis</i>	LC	WV	OC	Carnivorous
160	Long-legged Buzzard	<i>Buteo rufinus</i>	NT	WV	OC	Carnivorous
161	Upland Buzzard	<i>Buteo hemilasius</i>	DD	PV	OC	Omnivorous
162	Hen Harrier	<i>Circus cyaneus</i>	LC	WV	OC	Omnivorous

	<b>Falconidae</b>					
163	Collared Falconet	<i>Microhierax caerulescens</i>	NT	R	UC	Carnivorous
164	Common Kestrel	<i>Falco tinnunculus</i>	LC	WV	C	Carnivorous
165	Peregrine Falcon	<i>Falco peregrinus</i>	LC	WV	OC	Carnivorous
166	Red-necked Falcon	<i>Falco chicquera</i>	LC	WV	OC	Carnivorous
167	Eurasian Hobby	<i>Falco subbuteo</i>	LC	WV	OC	Carnivorous
168	Oriental Hobby	<i>Falco severus</i>	CR	WV	OC	Carnivorous
	<b>Podicipedidae</b>					
169	Little Grebe	<i>Tachybaptus ruficollis</i>	LC	R	OC	Omnivorous
170	Great Crested Grebe	<i>Podiceps cristatus</i>	LC	WV	OC	Omnivorous
	<b>Anhingidae</b>					
171	Oriental Darter	<i>Anhinga melanogaster</i>	NT	R	C	Carnivorous
	<b>Phalacrocoracidae</b>					
172	Little Cormorant	<i>Phalacrocorax niger</i>	LC	WV	OC	Carnivorous
173	Great Cormorant	<i>Phalacrocorax carbo</i>	NT	WV	C	Carnivorous
	<b>Ardeidae</b>					
174	Little Egret	<i>Egretta garzetta</i>	LC	R	C	Carnivorous
175	Grey Heron	<i>Ardea cinerea</i>	LC	R	VC	Carnivorous
176	Purple Heron	<i>Ardea purpurea</i>	LC	R	OC	Carnivorous
177	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	LC	R	C	Carnivorous
178	Indian Pond Heron	<i>Ardeola grayii</i>	LC	R	C	Carnivorous
179	Great Egret	<i>Casmerodius albus</i>	LC	R	UC	Carnivorous

180	Intermediate Egret	<i>Mesophoyx intermedia</i>	LC	R	C	Carnivorous
181	Cattle Egret	<i>Bubulcus ibis</i>	LC	R	C	Carnivorous
182	Little Heron	<i>Butorides striatus</i>	LC	R	C	Carnivorous
183	Great Bittern	<i>Botaurus stellaris</i>	LC	PV	OC	Carnivorous
184	Yellow Bittern	<i>Ixobrychus sinensis</i>	LC	SV	OC	Carnivorous
185	Black Bittern	<i>Dupetor flavicollis</i>	NT	R	OC	Carnivorous
186	Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i>	LC	R	UC	Carnivorous
	<b>Threskiornithidae</b>					
187	Black Ibis	<i>Pseudibis papillosa</i>	LC	R	C	Omnivorous
188	Eurasian Spoonbill	<i>Platalea leucorodia</i>	LC	PV	OC	Omnivorous
	<b>Ciconiidae</b>					
189	Asian Openbill	<i>Anastomus oscitans</i>	VU	R	C	Carnivorous
190	Black Stork	<i>Ciconia nigra</i>	VU	WV	C	Carnivorous
191	White Stork	<i>Ciconia ciconia</i>	VU	PV	OC	Carnivorous
192	Woolly-necked Stork	<i>Ciconia episcopus</i>	VU	R	C	Carnivorous
193	Lesser Adjutant	<i>Leptoptilos javanicus</i>	VU	R	C	Carnivorous
	<b>PASSERIFORMES</b>					
	<b>Pittidae</b>					
194	Hooded Pitta	<i>Pitta sordida</i>	VU	SV	C	Carnivorous
195	Indian Pitta	<i>Pitta brachyura</i>	LC	SV	C	Insectivorous
	<b>Irenidae</b>					
196	Golden-fronted Leaf bird	<i>Chloropsis aurifrons</i>	LC	R	C	Insectivorous

197	Orange-bellied Leaf bird	<i>Chloropsis hardwickii</i>	LC	R	C	Insectivorous
	<b>Laniidae</b>					
198	Long-tailed Shrike	<i>Lanius schach</i>	LC	R	C	Carnivorous
199	Grey-backed Shrike	<i>Lanius tephronotus</i>	LC	R	C	Carnivorous
200	Brown Shrike	<i>Lanius cristatus</i>	LC	WV	C	Carnivorous
201	Rufous-tailed Shrike	<i>Lanius isablinus</i>	LC	WV	OC	Carnivorous
202	Bay-backed Shrike	<i>Lanius vittatus</i>	LC	PV	OC	Carnivorous
	<b>Corvidae</b>					
203	Red-billed Blue Magpie	<i>Urocissa erythrorthyncha</i>	LC	R	C	Omnivorous
204	Rufous Treepie	<i>Dendrocitta vagabunda</i>	LC	R	C	Omnivorous
205	House Crow	<i>Corvus splendens</i>	LC	R	C	Omnivorous
206	Large-billed Crow	<i>Corvus macrorhynchos</i>	LC	R	C	Omnivorous
207	Ashy Woodswallow	<i>Artamus fuscus</i>	LC	R	C	Omnivorous
208	Maroon Oriole	<i>Oriolus traillii</i>	LC	WV	OC	Omnivorous
209	Eurasian Golden Oriole	<i>Oriolus oriolus</i>	LC	SV	C	Omnivorous
210	Black-hooded Oriole	<i>Oriolus xanthornus</i>	LC	R	C	Omnivorous
211	Large Cuckooshrike	<i>Coracina macei</i>	LC	R	C	Omnivorous
212	Small Minivet	<i>Pericrocotus cinnamomeus</i>	LC	R	C	Insectivorous
213	Rosy Minivet	<i>Pericrocotus roseus</i>	LC	R	C	Insectivorous
214	Scarlet Minivet	<i>Pericrocotus flammeus</i>	LC	R	C	Insectivorous

215	Long-tailed Minivet	<i>Pericrocotus ethologus</i>	LC	WV	UC	Omnivorous
216	Bar-winged Flycatcher-shrike	<i>Hemipus picatus</i>	LC	R	C	Omnivorous
217	White-throated Fantail	<i>Rhipidura albicollis</i>	LC	R	C	Omnivorous
218	Yellow-bellied Fantail	<i>Rhipidura hypoxantha</i>	LC	WV	OC	Omnivorous
219	Black Drongo	<i>Dicrurus macrocercus</i>	LC	R	C	Carnivorous
220	Ashy Drongo	<i>Dicrurus leucophaeus</i>	LC	SV	VC	Omnivorous
221	White-bellied Drongo	<i>Dicrurus caerulescens</i>	LC	R	C	Carnivorous
222	Crow-billed Drongo	<i>Dicrurus annectans</i>	LC	SV	VC	Omnivorous
223	Bronzed Drongo	<i>Dicrurus aeneus</i>	LC	R	UC	Omnivorous
224	Lesser Racket-tailed Drongo	<i>Dicrurus remifer</i>	LC	R	OC	Omnivorous
225	Spangled Drongo	<i>Dicrurus hottentottus</i>	LC	R	C	Omnivorous
226	Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>	LC	R	UC	Omnivorous
227	Black-naped Monarch	<i>Hypothymis azurea</i>	LC	R	OC	Omnivorous
228	Asian Paradise-flycatcher	<i>Terpsiphone paradisi</i>	LC	SV	C	Omnivorous
229	Common Iora	<i>Aegithina tiphia</i>	LC	R	C	Insectivorous
230	Large Woodshrike	<i>Tephrodomis gularis</i>	LC	R	OC	Insectivorous
231	Common Woodshrike	<i>Tephrodomis pondicerianus</i>	LC	R	C	Insectivorous
	<b>Muscicapidae</b>					
232	Orange-headed Thrush	<i>Zoothera citrina</i>	LC	SV	OC	Omnivorous
233	Isabelline Wheater	<i>Oenanthe isabellina</i>	LC	R	OC	Insectivorous

234	Blue Whistling Thrush	<i>Myophonus caeruleus</i>	LC	R	C	Carnivorous
235	Chestnut-bellied Rock Thrush	<i>Monticola rufiventris</i>	LC	WV	OC	Omnivorous
236	Blue-capped Rock Thrush	<i>Monticola cinclorhynchus</i>	LC	WV	UC	Omnivorous
237	Tickell's Thrush	<i>Turdus unicolor</i>	LC	WV	UC	Omnivorous
238	Dark-throated Thrush	<i>Turdus ruficollis</i>	LC	WV	OC	Omnivorous
239	Scaly Thrush	<i>Zoothera dauma</i>	LC	R	OC	Omnivorous
240	Red-throated Flycatcher	<i>Ficedula albicilla</i>	DD	R	C	Omnivorous
241	Kashmir Flycatcher	<i>Ficedula subrubra</i>	VU	WV	OC	Insectivorous
242	Rufous-gorgeted Flycatcher	<i>Ficedula strophciata</i>	LC	R	OC	Insectivorous
243	Pale-chinned Flycatcher	<i>Cyornis poliogenys</i>	LC	R	C	Omnivorous
244	Grey-headed Canary Flycatcher	<i>Culicicapa ceylonensis</i>	LC	R	C	Omnivorous
245	Rusty-tailed Flycatcher	<i>Muscicapa ruficauda</i>	LC	WV	OC	Insectivorous
246	Slaty-backed Flycatcher	<i>Ficedula hodgsonii</i>	NT	WV	OC	Omnivorous
247	Pale-Blue Flycatcher	<i>Cyornis unicolor</i>	LC	WV	UC	Insectivorous
248	Asian-Brown Flycatcher	<i>Muscicapa dauurica</i>	LC	WV	OC	Insectivorous
249	Ultramarine Flycatcher	<i>Ficedula superciliaris</i>	LC	WV	UC	Insectivorous
250	Verditer Flycatcher	<i>Eumyias thalassina</i>	LC	WV	VC	Insectivorous
251	Blue-throated Flycatcher	<i>Cyornis rubeculoides</i>	LC	WV	UC	Insectivorous

252	Oriental Magpie Robin	<i>Copsychus saularis</i>	LC	R	C	Insectivorous
253	White-rumped Shama	<i>Copsychus malabaricus</i>	LC	R	C	Insectivorous
254	White-capped Water Redstart	<i>Chaimarrornis leucocephalus</i>	LC	WV	OC	Omnivorous
255	Black Redstart	<i>Phoenicurus ochruros</i>	LC	WV	VC	Insectivorous
256	Common Stonechat	<i>Saxicola torquata</i>	LC	WV	C	Insectivorous
257	White-tailed Stonechat	<i>Saxicola leucura</i>	NT	R	C	Insectivorous
258	Pied Bushchat	<i>Saxicola caprata</i>	LC	R	C	Insectivorous
259	Grey Bushchat	<i>Saxicola ferrea</i>	LC	R	OC	Omnivorous
260	Eurasian Blackbird	<i>Turdus merula</i>	LC	WV	OC	Omnivorous
261	Siberian Rubythroat	<i>Luscinia colliope</i>	LC	WV	C	Insectivorous
262	White-tailed Rubythroat	<i>Luscinia pectoralis</i>	LC	WV	VC	Insectivorous
263	Bluethroat	<i>Luscinia svecica</i>	LC	WV	VC	Insectivorous
264	Indian Blue Robin	<i>Luscinia brunnea</i>	LC	WV	OC	Insectivorous
265	Plumbeous Water Redstart	<i>Rhyacornis fuliginosus</i>	LC	WV	OC	Insectivorous
266	Grey-winged Blackbird	<i>Turdus boulboul</i>	LC	WV	OC	Insectivorous
	<b>Sturnidae</b>					
267	Brahminy Starling	<i>Sturnus pagodarum</i>	LC	R	UC	Omnivorous
268	Asian Pied Starling	<i>Sturnus contra</i>	LC	R	C	Omnivorous
269	Chestnut-tailed Starling	<i>Sturnus malabaricus</i>	LC	R	C	Omnivorous
270	Common Myna	<i>Acridotheres tristis</i>	LC	R	C	Omnivorous

271	Jungle Myna	<i>Acridotheres fuscus</i>	LC	R	C	Omnivorous
	<b>Sittidae</b>					
272	Chestnut-bellied Nuthatch	<i>Sitta castanea</i>	LC	R	C	Omnivorous
273	Velvet-fronted Nuthatch	<i>Sitta frontalis</i>	LC	R	C	Omnivorous
274	Wallcreeper	<i>Tichodroma muraria</i>	LC	WV	OC	Insectivorous
	<b>Paridae</b>					
275	Great Tit	<i>Parus major</i>	LC	R	C	Omnivorous
276	Sultan Tit	<i>Melanochlora sultanea</i>	EN	R	O	Omnivorous
	<b>Hirundinidae</b>					
277	Plain Martin	<i>Riparia paludicola</i>	NT	R	C	Insectivorous
278	Barn Swallow	<i>Hirundo rustica</i>	LC	R	C	Omnivorous
279	Sand Martin	<i>Riparia riapria</i>	DD	PV	OC	Insectivorous
280	Red-rumped Swallow	<i>Hirundo daurica</i>	LC	R	C	Insectivorous
	<b>Pycnonotidae</b>					
281	Black-crested Bulbul	<i>Pycnonotus melanicterus</i>	LC	R	UC	Omnivorous
282	Black Bulbul	<i>Hysipetes leucocephalus</i>	LC	R	VC	Omnivorous
283	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	LC	R	C	Omnivorous
284	Himalayan Bulbul	<i>Pycnonotus leucogenys</i>	LC	R	C	Omnivorous
285	Red-vented Bulbul	<i>Pycnonotus cafer</i>	LC	R	C	Omnivorous
	<b>Cisticolidae</b>					



286	Zitting Cisticola	<i>Cisticola juncidis</i>	LC	R	C	Insectivorous
287	Bright-capped Cisticola	<i>Cisticola exilis</i>	LC	R	OC	Insectivorous
288	Striated Prinia	<i>Prinia criniger</i>	LC	R	UC	Insectivorous
289	Grey-crowned Prinia	<i>Prinia cinereocapilla</i>	CR	R	UC	Insectivorous
290	Grey-breasted Prinia	<i>Prinia hodgsonii</i>	LC	R	C	Insectivorous
291	Graceful Prinia	<i>Prinia gracilis</i>	LC	R	OC	Insectivorous
292	Jungle Prinia	<i>Prinia sylvatica</i>	LC	R	OC	Insectivorous
293	Yellow-bellied Prinia	<i>Prinia flaviventris</i>	NT	R	C	Insectivorous
294	Ashy Prinia	<i>Prinia socialis</i>	LC	R	OC	Insectivorous
295	Plain Prinia	<i>Prinia inornata</i>	LC	R	C	Insectivorous
	<b>Zosteropidae</b>					
296	Oriental White-eye	<i>Zosterops palpebrosus</i>	LC	R	C	Insectivorous
	<b>Sylviidae</b>					
297	Blyth's Leaf Warbler	<i>Phylloscopus reguloides</i>	LC	WV	C	Insectivorous
298	Chestnut-crowned Bush Warbler	<i>Cettia major</i>	LC	WV	OC	Insectivorous
299	Grey-sided Bush Warbler	<i>Cettia brunnifrons</i>	LC	WV	OC	Insectivorous
300	Spotted Bush Warbler	<i>Bradypterus thoracicus</i>	LC	WV	OC	Insectivorous
301	Paddyfield Warbler	<i>Acrocephalus agricola</i>	LC	WV	VC	Insectivorous
302	Thick-bellied Warbler	<i>Acrocephalus aedon</i>	LC	WV	OC	Insectivorous
303	Smoky Warbler	<i>Phylloscopus</i>	LC	WV	UC	Insectivorous

		<i>fuligiventer</i>				
304	Western Crowned Warbler	<i>Phylloscopus occipitalis</i>	LC	WV	OC	Insectivorous
305	Large-billed Leaf Warbler	<i>Phylloscopus magnirostris</i>	LC	WV	OC	Insectivorous
306	Hoary Throated Barwing	<i>Actinodura nipalensis</i>	LC	R	OC	Insectivorous
307	Yellow-bellied Warbler	<i>Abroscopus superciliaris</i>	VU	WV	OC	Insectivorous
308	Pale-footed Bush Warbler	<i>Cettia pallidipes</i>	LC	R	OC	Insectivorous
309	Aberrant Bush Warbler	<i>Cettia flavolivacea</i>	LC	WV	VC	Insectivorous
310	Blyth's Reed Warbler	<i>Acrocephalus dumetorum</i>	LC	WV	C	Insectivorous
311	Clamorous Reed Warbler	<i>Acrocephalus stentoreus</i>	NT	WV	OC	Insectivorous
312	Tickell's Leaf Warbler	<i>Phylloscopus affinis</i>	LC	WV	VC	Insectivorous
313	Nepal Wren Babbler	<i>Pnoepyga pusilla</i>	LC	R	OC	Insectivorous
314	Lemon-rumped Warbler	<i>Phylloscopus chloronotus</i>	LC	WV	VC	Insectivorous
315	Hume's Warbler	<i>Phylloscopus humei</i>	LC	WV	OC	Insectivorous
316	Greenish Warbler	<i>Phylloscopus trochiloides</i>	LC	WV	C	Insectivorous
317	Golden-spectacled Warbler	<i>Seicercus burkii</i>	LC	WV	OC	Insectivorous
318	Whistler's Warbler	<i>Seicercus whistleri</i>	LC	R	UC	Insectivorous
319	Grey-hooded Warbler	<i>Seicercus xanthoschistos</i>	LC	WV	VC	Omnivorous

320	Chestnut-crowned Warbler	<i>Seicercus castaniceps</i>	LC	WV	VC	Insectivorous
321	Sulphur-bellied Warbler	<i>Phylloscapus griseolus</i>	LC	PV	OC	Insectivorous
322	Chestnut-headed Tesia	<i>Tesia castaneocoronata</i>	LC	R	OC	Insectivorous
323	Common Chiffchaff	<i>Phylloscopus collybita</i>	LC	WV	C	Insectivorous
324	Common Tailorbird	<i>Orthotomus sutorius</i>	LC	R	C	Insectivorous
325	Dusky Warbler	<i>Phylloscopus fuscatus</i>	LC	WV	OC	Insectivorous
326	Striated Grassbird	<i>Megalurus palustris</i>	CR	R	OC	Insectivorous
327	Bristled Grassbird	<i>Chaetornis striatus</i>	VU	R	OC	Insectivorous
328	Rufous-rumped Grassbird	<i>Graminicola bengalensis</i>	EN	R	UC	Insectivorous
329	White-throated Laughingthrush	<i>Garrulax albogularis</i>	LC	R	OC	Insectivorous
330	White-crested Laughingthrush	<i>Garrulax leucolophus</i>	LC	R	C	Omnivorous
331	Lesser Necklaced Laughingthrush	<i>Garrulax monileger</i>	VU	R	C	Omnivorous
332	Greater Necklaced Laughingthrush	<i>Garrulax pectoralis</i>	VU	R	C	Omnivorous
333	Blue-winged Laughingthrush	<i>Garrulax squamatus</i>	NT	R	OC	Omnivorous
334	Puff-throated Babbler	<i>Pellorneum ruficeps</i>	LC	R	C	Omnivorous
335	White-browed Scimitar Babbler	<i>Pamatorhinus schisticeps</i>	NT	R	UC	Omnivorous
336	Striped Tit Babbler	<i>Macronous gularis</i>	LC	R	C	Insectivorous
337	Chestnut-capped	<i>Timalia pileata</i>	NT	R	C	Insectivorous

	Babbler					
338	Yellow-eyed Babbler	<i>Chrysomma sinense</i>	NT	R	UC	Insectivorous
339	Spiny Babbler	<i>Turdoides nipalensis</i>	LC	R	OC	Insectivorous
340	Striated Babbler	<i>Turdoides earlei</i>	LC	R	C	Insectivorous
341	Jungle Babbler	<i>Turdoides striatus</i>	LC	R	C	Insectivorous
342	Eurasian Woodcock	<i>Scolopax rusticola</i>	LC	PV	OC	Insectivorous
343	Himalayan Cutia	<i>Cutia nipalensis</i>	NT	R	OC	Omnivorous
344	White-bellied Yuhina	<i>Yuhina zantholeuca</i>	LC	R	UC	Omnivorous
345	Nepal Fulvetta	<i>Alcippe nipalensis</i>	LC	R	UC	Omnivorous
	<b>Alaudidae</b>					
346	Rufous-winged Bushlark	<i>Mirafra assamica</i>	LC	R	C	Insectivorous
347	Ashy-crowned Sparrow Lark	<i>Eremopterix grisea</i>	LC	R	UC	Insectivorous
348	Sand Lark	<i>Calandrella raytal</i>	LC	R	C	Insectivorous
349	Oriental Skylark	<i>Alauda gulgula</i>	LC	R	UC	Omnivorous
	<b>Nectariniidae</b>					
350	Thick-billed Flowerpecker	<i>Dicaeum agile</i>	LC	R	OC	Omnivorous
351	Pale-billed Flowerpecker	<i>Dicaeum erythrorhynchus</i>	LC	R	UC	Frugivorous
352	Yellow-vented Flowerpecker	<i>Dicaeum chrysorrheum</i>	CR	R	OC	Omnivorous
353	Crimson Sunbird	<i>Aethopyga siparaja</i>	LC	R	C	Omnivorous
354	Purple Sunbird	<i>Anthreptes asiatica</i>	LC	R	UC	Omnivorous
355	Streaked Spiderhunter	<i>Arachnothera magna</i>	LC	R	UC	Omnivorous

	<b>Passeridae</b>					
356	House Sparrow	<i>Passer domesticus</i>	LC	R	C	Omnivorous
357	Eurasian Tree Sparrow	<i>Passer montanus</i>	LC	R	C	Omnivorous
358	Chestnut-shouldered Petronia	<i>Petronia xanthocollis</i>	LC	R	UC	Omnivorous
359	White Wagtail	<i>Motacilla alba</i>	LC	WV	OC	Insectivorous
360	White-browed Wagtail	<i>Motacilla maderaspatensis</i>	LC	R	C	Omnivorous
361	Citrine Wagtail	<i>Motacilla citreola</i>	LC	WV	UC	Insectivorous
362	Yellow Wagtail	<i>Motacilla flava</i>	LC	WV	VC	Insectivorous
363	Grey Wagtail	<i>Motacilla cinerea</i>	LC	WV	VC	Insectivorous
364	Paddyfield Pipit	<i>Anthus rufulus</i>	LC	R	C	Omnivorous
365	Richard's Pipit	<i>Anthus richardi</i>	LC	R	UC	Insectivorous
366	Olive-backed Pipit	<i>Anthus hodgsoni</i>	LC	WV	C	Omnivorous
367	Rosy Pipit	<i>Anthus roseatus</i>	LC	WV	C	Omnivorous
368	Black-breasted Weaver	<i>Ploceus benghalensis</i>	VU	R	UC	Carnivorous
369	Tawny Pipit	<i>Anthus campestris</i>	LC	R	OC	Omnivorous
370	Baya Weaver	<i>Ploceus philippinus</i>	NT	R	C	Omnivorous
371	Red Avadavat	<i>Amandava amandava</i>	NT	R	UC	Herbivorous
372	Indian Silverbill	<i>Lonchura malabarica</i>	NT	R	OC	Herbivorous
373	White-rumped Munia	<i>Lonchura striata</i>	LC	WV	OC	Herbivorous
374	Scaly-breasted Munia	<i>Lonchura punctulata</i>	LC	R	C	Frugivorous
375	Black-headed Munia	<i>Lonchura Malacca</i>	LC	R	OC	Frugivorous
	<b>Fringillidae</b>					

376	Crested Bunting	<i>Melophus Iothami</i>	LC	WV	OC	Herbivorous
377	Common Rosefinch	<i>Carpodacus erythrinus</i>	LC	WV	VC	Frugivorous
378	Yellow-breasted Bunting	<i>Emberiza aureola</i>	CR	WV	OC	Omnivorous

**CR= Critically Endangered; EN=Endangered; LC= Least Concern; NT= Near Threatened; VU=Vulnerable; DD= Data Deficient; R= Resident; SV= Summer visitor; WV= Winter visitor; PV= Passage visitor; C= Common; VC= Very common; UC= Uncommon; OC= Occasional**

### Appendix III

#### Species-list of the plants of Chitwan National Park

A – Core Forests

B - Riverine Forests

C - Grassland

S.No.	Family names	Botanical names	Local names	A	B	C
1.	Acanthaceae	<i>Barleria cristata</i> L.	Kuro	x		
2.	Acanthaceae	<i>Hemigraphis hirta</i> (Vahl) T. Anders.		x		
3.	Acanthaceae	<i>Justicia</i> sp.	Bisaune jhar		x	
4.	Acanthaceae	<i>Lepidagathis incurva</i> Buch.-Ham ex D. Don	Bankuro		x	
5.	Acanthaceae	<i>Nelsonia canescens</i> (Lam.) Spreng.		x		
6.	Acanthaceae	<i>Rungia parviflora</i> (Retz.) Nees	Saraudi	x	x	x
7.	Amaranthaceae	<i>Achyranthes aspera</i> L.	Datiwan		x	
8.	Apiaceae	<i>Centella asiatica</i> (L.) Urb.	Ghodtapre		x	x
9.	Apiaceae	<i>Hydrocotyle</i> <i>sibthorpioides</i> Lam.	Sano ghodtapre	x	x	
10.	Apiaceae	<i>Oenanthe javanica</i> (Blume) DC.		x		
11.	Apocynaceae	<i>Holarrhena</i> <i>pubescens</i> (Buch.- Ham.) Wall. ex G. Don	Dudhkhirro	x		
12.	Apocynaceae	<i>Trachelospermum</i> <i>lucidum</i> (D. Don) K. Schum.	Salikal	x		
13.	Apocynaceae	<i>Vallaris solanacea</i> (Roth) Kuntze	Dudhe lahara		x	
14.	Arecaceae	<i>Phoenix humilis</i> Royle ex Baccari.	Dhotipate/Thakal	x		
15.	Asclepiadaceae	<i>Gongronema</i> <i>nepalense</i> (Wall.)		x		

S.No.	Family names	Botanical names	Local names	A	B	C
		Deene				
16.	Aspidiaceae	<i>Tectaria macrodonta</i> (Fee) C. Chr.	Kali neuro	x		
17.	Aspidiaceae	<i>Thelypteris auriculata</i> (J. Smith) K. Iwatsuki	Bishkoche	x	x	x
18.	Asteraceae	<i>Ageratum conyzoides</i> L.	Gandhe (Seto)		x	
19.	Asteraceae	<i>Ageratum houstonianum</i> Mill.	Gandhe (Nilo)	x	x	x
20.	Asteraceae	<i>Artemisia dubia</i> Wall. ex Besser	Titepati		x	
21.	Asteraceae	<i>Blumea laciniata</i> DC.	Thulo mulapate	x		x
22.	Asteraceae	<i>Blumea</i> sp.	Thulo mulapate	x		
23.	Asteraceae	<i>Blumeopsis flava</i> (DC.) Gagnep.	Toriganda	x		
24.	Asteraceae	<i>Cirsium arvense</i> (L.) Scop.	Gainda kande	x		
25.	Asteraceae	<i>Conyza leucantha</i> (D. Don) Ludlow & Raven	Mulapate		x	
26.	Asteraceae	<i>Eclipta prostrata</i> (L.) L.	Bhringraj	x		
27.	Asteraceae	<i>Elephantopus scaber</i> L.	Thinko	x		
28.	Asteraceae	<i>Eupatorium odoratum</i> L.	Banmara		x	
29.	Asteraceae	<i>Inula rubricaulis</i> (DC.) C. B. Clarke.	Kan pate	x		
30.	Asteraceae	<i>Ixeris polycephala</i> Cass.	Dudhe jhar		x	
31.	Asteraceae	<i>Launaea aspleniifolia</i> (Willd.) Hook. f.	Sano mulapate	x		x
32.	Asteraceae	<i>Synedrella nodiflora</i> Gaertn.	Pahenle jhar		x	
33.	Asteraceae	<i>Vernonia cinerea</i> (L.)	Jhurjhure	x	x	



S.No.	Family names	Botanical names	Local names	A	B	C
		Less.				
34.	Bombacaceae	<i>Bombax ceiba</i> L.	Simal	x	x	x
35.	Boraginaceae	<i>Trichodesma indicum</i> (L.) R. Br.	Gerguj			x
36.	Burseraceae	<i>Garuga pinnata</i> Roxb.	Dabdabe	x		
37.	Combretaceae	<i>Terminalia alata</i> Heyne ex Roth	Saj	x		
38.	Combretaceae	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Barro	x		
39.	Combretaceae	<i>Terminalia chebula</i> Retz.	Harro	x		
40.	Commelinaceae	<i>Commelina benghalensis</i> L.	Bankane/Jangali kane	x	x	
41.	Cordiaceae	<i>Ehretia laevis</i> Roxb.	Dhatrung	x	x	
42.	Cornaceae	<i>Swida oblonga</i> (Wall.) Sojak	Latikath	x		
43.	Cucurbitaceae	<i>Momordica charantia</i> L.	Ban kareli		x	
44.	Cucurbitaceae	<i>Solena heterophylla</i> Lour.	Gol kankari	x		
45.	Cyperaceae	<i>Cyperus</i> sp.	Mothe	x	x	
46.	Dilleniaceae	<i>Dillenia pentagyna</i> Roxb.	Tantari	x		
47.	Dioscoreaceae	<i>Dioscorea bulbifera</i> L.	Ban tarul	x		
48.	Dioscoreaceae	<i>Dioscorea deltoidea</i> Wall. ex Griseb.	Ban tarul	x	x	
49.	Dioscoreaceae	<i>Dioscorea hamiltonii</i> Hook. f.	Ban tarul	x		
50.	Dipterocarpaceae	<i>Shorea robusta</i> Gaertn.	Sal	x		
51.	Equisetaceae	<i>Equisetum debile</i> Roxb. ex Vaucher	Hadjorni/Aankhle jhar	x	x	x
52.	Euphorbiaceae	<i>Antidesma acidum</i>	Archal	x		

S.No.	Family names	Botanical names	Local names	A	B	C
		Retz.				
53.	Euphorbiaceae	<i>Bridelia retusa</i> (L.) Spreng.	Gayo/Lahare gayo	x		
54.	Euphorbiaceae	<i>Mallotus philippensis</i> (Lam.) Muell -Arg.	Sindure	x		
55.	Euphorbiaceae	<i>Phyllanthus emblica</i> L.	Amala	x		
56.	Euphorbiaceae	<i>Phyllanthus urinaria</i> L.	Bhuiamala	x		
57.	Euphorbiaceae	<i>Trewia nudiflora</i> L.	Vellar	x	x	
58.	Labiatae	<i>Colebrookea oppositifolia</i> Sm.	Dhurseli	x	x	
59.	Labiatae	<i>Ocimum basilicum</i> L.	Babari		x	
60.	Labiatae	<i>Pogostemon benghalensis</i> (Burm.f.) Kuntze	Rudilo	x	x	
61.	Labiatae	<i>Rabdosia ternifolia</i> (D. Don) Hara.	Bhimsenpati jhar	x		
62.	Lauraceae	<i>Litsea chartacea</i> (Wall. ex Nees) Hook. f.		x		
63.	Lauraceae	<i>Litsea monopetala</i> (Roxb.) Pers.	Kutmiro	x		x
64.	Leeaceae	<i>Leea crispa</i> van Royen ex L.	Guithe Padari/Padari	x		
65.	Leeaceae	<i>Leea macrophylla</i> Roxb. ex Hornem.	Galen	x		
66.	Leguminosae	<i>Acacia catechu</i> (L.f.) Willd.	Khayer	x		
67.	Leguminosae	<i>Acacia pennata</i> (L.) Willd.	Ararikanda		x	
68.	Leguminosae	<i>Bauhinia malabarica</i> Roxb.	Amili	x		
69.	Leguminosae	<i>Butea monosperma</i> (Lam.) Kuntze	Palans	x		

S.No.	Family names	Botanical names	Local names	A	B	C
70.	Leguminosae	<i>Caesalpinia bonduc</i> (L.).Roxb.	Bhaise kanda	x		
71.	Leguminosae	<i>Cassia fistula</i> L.	Rajbrikchya	x		
72.	Leguminosae	<i>Codariocalyx motorius</i> (Houttyn) Ohashi		x		
73.	Leguminosae	<i>Crotalaria prostrata</i> Rottb. ex Willd	Chhinchhine baja			x
74.	Leguminosae	<i>Crotalaria sessiliflora</i> L.	Chhinchhine baja			x
75.	Leguminosae	<i>Crotalaria</i> sp.	Boksi ghangar	x		
76.	Leguminosae	<i>Crotalaria</i> sp.	Chhippi			x
77.	Leguminosae	<i>Dalbergia latifolia</i> Roxb.	Satisal	x		
78.	Leguminosae	<i>Dalbergia sissoo</i> Roxb ex DC.	Sisau		x	
79.	Leguminosae	<i>Derris</i> sp.	Derri	x		
80.	Leguminosae	<i>Desmodium gangeticum</i> (L.) DC.	Bhattamasejhar	x		x
81.	Leguminosae	<i>Desmodium</i> sp.	Sal lahara	x		
82.	Leguminosae	<i>Desmodium triflorum</i> (L.) DC.	Chariamiliki mausi	x		x
83.	Leguminosae	<i>Flemmgia macrophylla</i> (Willd.) Merr.	Bhattamasi/Tinpate ghans	x		x
84.	Leguminosae	<i>Millettia extensa</i> (Benth.) Baker	Gaujo	x		
85.	Leguminosae	<i>Phaseolus mungo</i> L.	Ban masyang	x		
86.	Leguminosae	<i>Spatholobus parviflorus</i> (Roxb.) Kuntze	Madane/Debre lahara	x		
87.	Leguminosae	<i>Uraria lagopus</i> DC.	Nilo tanki	x		
88.	Liliaceae	<i>Asparagus racemosus</i> Willd.	kurilo	x		
89.	Liliaceae	<i>Smilax ovalifolia</i>	Kukur daino	x		

S.No.	Family names	Botanical names	Local names	A	B	C
		Roxb. ex Don				
90.	Lythraceae	<i>Lagerstroemia parviflora</i> Roxb.	Botdhairo	x		
91.	Malvaceae	<i>Sida rhombifolia</i> L.	Balu	x		
92.	Malvaceae	<i>Urena lobata</i> L.	Balu/Chhipi		x	
93.	Melastomataceae	<i>Melastoma melabathricum</i> L.	Angeri		x	
94.	Meliaceae	<i>Melia azedarach</i> L.	Bakaino		x	
95.	Menispermaceae	<i>Cissampelos pareira</i> L.	Batulpate	x	x	
96.	Menispermaceae	<i>Stephania elegans</i> Hook. f. & Thoms.	Batulpate	x	x	
97.	Menispermaceae	<i>Tinospora sinensis</i> (Lour.) Merr.	Gudargano		x	
98.	Myrsinaceae	<i>Maesa chisia</i> Buch.-Ham ex D. Don	Bilaune	x		
99.	Myrsinaceae	<i>Myrsine semiserrata</i> Wall.	Kalikath (Karauta)		x	
100.	Myrsinaceae	<i>Myrsine</i> sp.	Damai kath	x	x	
101.	Myrtaceae	<i>Cleistocalyx operculatus</i> (Roxb.) Merr. & Perry	Kyamun	x		x
102.	Myrtaceae	<i>Syzygium cumini</i> (L.) Skeels	Jamun	x		
103.	Ophioglossaceae	<i>Ophioglossum petiolatum</i> Hook.	Jibre sag	x	x	
104.	Oxalidaceae	<i>Oxalis corniculata</i> L.	Chariamili	x	x	
105.	Poaceae	<i>Brachiaria</i> spp.	Banso	x	x	
106.	Poaceae	<i>Chrysopogon aciculatus</i> (Retz.) Trin.	Kuro ghans		x	
107.	Poaceae	<i>Cynodon dactylon</i> (L.) Pers.	Dubo	x	x	x
108.	Poaceae	<i>Desmostachya bipinnata</i> (L.) Stapf	Kush	x		x

S.No.	Family names	Botanical names	Local names	A	B	C
109.	Poaceae	<i>Digitria ciliaris</i> (Retz.) Koeler	Chitre banso		x	
110.	Poaceae	<i>Eragrostris tenella</i> (L.) Beauvois	Junge banso		x	x
111.	Poaceae	<i>Eragrostris unioloides</i> (Retz.) Nees ex Steudel	Chiure banso		x	
112.	Poaceae	<i>Hemarthria compressa</i> (L.f.) R. Br.	Ghode dubo	x		x
113.	Poaceae	<i>Imperata cylindrica</i> (L.) Beauvois	Siru	x	x	x
114.	Poaceae	<i>Oplismenus burmannii</i> (Retz.) Beauvois	Ote banso	x		
115.	Poaceae	<i>Paspalum scrobiculatum</i> L.	Mane banso		x	
116.	Poaceae	<i>Phragmites karka</i> (Retz.) Trin. ex Steudel	Masino narkat	x		x
117.	Poaceae	<i>Saccharum benghalense</i> Retz.	Baruwa	x		x
118.	Poaceae	<i>Saccharum spontaneum</i> L.	Kans	x	x	x
119.	Poaceae	<i>Themeda arundinacea</i> (Roxb.) Ridley	Khadahi	x		x
120.	Polygonaceae	<i>Polygonum barbatum</i> L.	Pire bikh		x	
121.	Primulaceae	<i>Androsace umbellata</i> (Lour.) Merr.	Chhate primula		x	
122.	Rhamnaceae	<i>Zizyphus nummularia</i> (Burm. f.) Wight & Arn.	Deshi bayer	x		
123.	Rhamnaceae	<i>Zizyphus mauritiana</i> Lam.	Bayer			x

S.No.	Family names	Botanical names	Local names	A	B	C
124.	Rosaceae	<i>Fragaria indica</i> Andr.	Bhuin kafal		x	
125.	Rubiaceae	<i>Anthocephalus chinensis</i> (Lam.) A. Rich.	Karam	x		
126.	Rubiaceae	<i>Borreria articularis</i> (L.f.) F. N. Williams		x		
127.	Rubiaceae	<i>Mitragyna parviflora</i> (Roxb.) Korth.	Kaim	x		
128.	Rubiaceae	<i>Xeromphis spinosa</i> (Thunb.) Key	Mainkanda	x	x	x
129.	Rubiaceae	<i>Xeromphis uliginosa</i> (Retz.) Maheshwari	Pidar	x		
130.	Rutaceae	<i>Murraya koenigii</i> (L.) Spreng.	Asare	x	x	x
131.	Rutaceae	<i>Skimmia arborescens</i> T. Anderson ex Gamble	Asare	x		
132.	Sapindaceae	<i>Schleichera oleosa</i> (Lour.) Oken	kusum	x		
133.	Schizaeaceae	<i>Lygodium flexuosum</i> (L.) Sw.	parewapoti	x		
134.	Scrophulariaceae	<i>Bacopa hamiltoniana</i> (Benth.) Wettst.		x		
135.	Scrophulariaceae	<i>Lindernia</i> sp.				x
136.	Scrophulariaceae	<i>Mecardonia procumbens</i> (Mill.) Small		x		x
137.	Solanaceae	<i>Physalis divaricata</i> D. Don	Patpate		x	
138.	Solanaceae	<i>Solanum aculeatissimum</i> Jacq.	Kantakari		x	
139.	Solanaceae	<i>Solanum surrattense</i> Burm. f.	Kantakari	x	x	x
140.	Sterculiaceae	<i>Helicteres isora</i> L.	Simthi	x		
141.	Sterculiaceae	<i>Pterospermum acerifolium</i> (L.)	Singane	x		

S.No.	Family names	Botanical names	Local names	A	B	C
		Willd.				
142.	Tiliaceae	<i>Grewia helicterifolia</i> Wall. ex G Don	Kharbuja	x		
143.	Tiliaceae	<i>Grewia sapida</i> Roxb. ex DC.	Pharsa	x		x
144.	Tiliaceae	<i>Grewia subinaequalis</i> DC.	Dafer	x		
145.	Typhaceae	<i>Typha angustifolia</i> L.	Pater	x		x
146.	Verbenaceae	<i>Callicarpa</i> <i>macrophylla</i> Vahl	Dhaichamla	x		
147.	Verbenaceae	<i>Clerodendrum</i> <i>viscosum</i> Vent	Bhanthi	x	x	
148.	Verbenaceae	<i>Gmelina arborea</i> Roxb.	Khamari	x		
149.	Verbenaceae	<i>Lippia nodiflora</i> (L.) Rich.	Bhuin okra	x		x
150.	Verbenaceae	<i>Premna integrifolia</i> L.	Gindari		x	
151.	Vitaceae	<i>Cissus repens</i> Lam.	Charchare lahara		x	

## Appendix IV

### Shannon - Weiner diversity index (four seasons)

<b>Birds of Autumn Season</b>						
	<b>Order/Family/Common Name/Scientific Name</b>	<b>Number of bird in Autumn visit</b>				
<b>S.No.</b>			<b>Pi</b>	<b>lnPi</b>	<b>Pi*lnPi</b>	
	<b>GALLIFORMES</b>					
	<b>Phasianidae</b>					
1	Black Francolin	<i>Francolinus francolinus</i>	8	0.0053	-5.240	-0.02778
2	Indian Peafowl	<i>Pavo cristatus</i>	9	0.00596	-5.122	-0.03055
			4			
3	Kalij Pheasant	<i>Lophura leucomelanos</i>	11	0.00729	-4.921	-0.03587
4	Red Junglefowl	<i>Gallus gallus</i>	12	0.00795	-4.834	-0.03844
			2			
	<b>ANSERIFORMES</b>					
	<b>Dendrocygnidae</b>					
5	Lesser Whistling Duck	<i>Dendrocygna javanica</i>	15	0.00994	-4.611	-0.04584
	<b>PICIFORMES</b>					



	<b>Picidae</b>					
6	Grey-capped Pygmy Woodpecker	<i>Dendrocopos canicapillus</i>	8	0.00530 2	-5.240	-0.02778
7	Fulvous-breasted Woodpecker	<i>Dendrocopos macei</i>	10	0.00662 7	-5.017	-0.03324
8	Lesser Yellownape	<i>Picus chlorolophus</i>	2	0.00132 5	-6.626	-0.00878
9	Greater Yellownape	<i>Picus flavinucha</i>	3	0.00198 8	-6.221	-0.01237
10	Streak-throated Woodpecker	<i>Picus xanthopygaeus</i>	8	0.00530 2	-5.240	-0.02778
11	Grey-headed Woodpecker	<i>Picus canus</i>	2	0.00132 5	-6.626	-0.00878
12	Himalayan Flameback	<i>Dinopium shorii</i>	4	0.00265 1	-5.933	-0.01573
13	Greater Flameback	<i>Chrysocolaptes lucidus</i>	8	0.00530 2	-5.240	-0.02778
14	Black-rumped Flameback	<i>Dinopium benghalense</i>	2	0.00132 5	-6.626	-0.00878
15	Great Slaty Woodpecker	<i>Mulleripicus pulverulentus</i>	4	0.00265 1	-5.933	-0.01573
	<b>Megalaimidae</b>					

16	Lineated Barbet	<i>Megalaima lineate</i>	2	0.00132 5	-6.626	-0.00878
17	Blue-throated Barbet	<i>Megalaima asiatica</i>	3	0.00198 8	-6.221	-0.01237
18	Coppersmith Barbet	<i>Megalaima haemacephala</i>	19	0.01259 1	-4.375	-0.05508
	<b>BUCEROTIFORMES</b>					
	<b>Bucerotidae</b>					
19	Oriental Pied-Hornbill	<i>Anthracoceros albirostris</i>	2	0.00132 5	-6.626	-0.00878
	<b>UPUPIFORMS</b>					
	<b>Upupidae</b>					
20	Common Hoopoe	<i>Upupa epos</i>	9	0.00596 4	-5.122	-0.03055
	<b>TROGONIFORMES</b>					
	<b>Trogonidae</b>					
21	Red-headed Trogon	<i>Harpactes erythrocephalus</i>	1	0.00066 3	-7.319	-0.00485
	<b>CORACIFORMES</b>					
	<b>Coraciidae</b>					
22	Indian Roller	<i>Coracias benghalensis</i>	2	0.00132 5	-6.626	-0.00878

	<b>Alcedinidae</b>					
23	Common Kingfisher	<i>Alcedo atthis</i>	11	0.00729	-4.921	-0.03587
	<b>Hylcyonidae</b>					
24	Stork-billed Kingfisher	<i>Halcyon capensis</i>	8	0.00530 2	-5.240	-0.02778
25	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	8	0.00530 2	-5.240	-0.02778
	<b>Cerylidae</b>					
26	Pied Kingfisher	<i>Ceryle rudis</i>	1	0.00066 3	-7.319	-0.00485
	<b>Meropidae</b>					
27	Green Bee-eater	<i>Merops orientalis</i>	2	0.00132 5	-6.626	-0.00878
	<b>CUCULIFORMES</b>					
	<b>Cuculidae</b>					
28	Common Hawk Cuckoo	<i>Hierococcyx varius</i>	10	0.00662 7	-5.017	-0.03324
29	Green-billed Malkoha	<i>Phaenicophaeus tristis</i>	7	0.00463 9	-5.373	-0.02493
	<b>Centropodidae</b>					
30	Greater Coucal	<i>Centropus sinesis</i>	2	0.00132 5	-6.626	-0.00878

31	Lesser Coucal	<i>Centropus bengalensis</i>	2	0.00132 5	-6.626	-0.00878
	<b>PSITTACEFORMES</b>					
	<b>Psittacidae</b>					
32	Alexandrine Parakeet	<i>Psittacula eupatria</i>	2	0.00132 5	-6.626	-0.00878
33	Rose-ringed Parakeet	<i>Psittacula krameri</i>	2	0.00132 5	-6.626	-0.00878
34	Slaty-headed Parakeet	<i>Psittacula himalayana</i>	186	0.12326	-2.093	-0.25804
35	Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	5	0.00331 3	-5.710	-0.01892
36	Red-breasted Parakeet	<i>Psittacula alexandri</i>	2	0.00132 5	-6.626	-0.00878
	<b>APODIFORMES</b>					
	<b>Apodidae</b>					
37	House Swift	<i>Apus affinis</i>	8	0.00530 2	-5.240	-0.02778
	<b>Hemiprocynidae</b>					
38	Crested Treeswift	<i>Hemiprocne coronate</i>	24	0.01590 5	-4.141	-0.06586
	<b>STRIGIFORMES</b>					
	<b>Strigidae</b>					

39	Oriental Scops Owl	<i>Otus sunia</i>	5	0.00331 3	-5.710	-0.01892
40	Brown Fish Owl	<i>Ketupa zeylonensis</i>	4	0.00265 1	-5.933	-0.01573
41	Jungle Owlet	<i>Glaucidium radiatum</i>	1	0.00066 3	-7.319	-0.00485
42	Spotted Owlet	<i>Athene brama</i>	2	0.00132 5	-6.626	-0.00878
	<b>Caprimulgidae</b>					
43	Large-tailed Nightjar	<i>Caprimulgus macrurus</i>	2	0.00132 5	-6.626	-0.00878
	<b>COLUMBIFORMES</b>					
	<b>Columbidae</b>					
44	Rock Pigeon	<i>Columba livia</i>	36	0.02385 7	-3.736	-0.08912
45	Orange-breasted Green Pigeon	<i>Treron bicincta</i>	2	0.00132 5	-6.626	-0.00878
46	Yellow-footed Green Pigeon	<i>Treron phoenicoptera</i>	1	0.00066 3	-7.319	-0.00485
47	Pompadour Green Pigeon	<i>Treron pompadora</i>	12	0.00795 2	-4.834	-0.03844
48	Spotted Dove	<i>Streptopelia chinensis</i>	6	0.00397	-5.527	-0.02198

				6		
49	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	12	0.00795 2	-4.834	-0.03844
50	Emerald Dove	<i>Chalcophaps indica</i>	10	0.00662 7	-5.017	-0.03324
51	Red Collared Dove	<i>Streptopelia tranquebarica</i>	11	0.00729	-4.921	-0.03587
	<b>GRUIFORMES</b>					
	<b>Rallidae</b>					
52	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	8	0.00530 2	-5.240	-0.02778
53	Ruddy-breasted Crake	<i>Porzana fusca</i>	8	0.00530 2	-5.240	-0.02778
	<b>CICONIFORMES</b>					
	<b>Scolopacidae</b>					
54	Common Snipe	<i>Gallinago gallinago</i>	2	0.00132 5	-6.626	-0.00878
55	Common Greenshank	<i>Tringa nebularia</i>	4	0.00265 1	-5.933	-0.01573
56	Green Sandpiper	<i>Tringa ochropus</i>	4	0.00265 1	-5.933	-0.01573
57	Common Sandpiper	<i>Actitis hypoleucos</i>	13	0.00861 5	-4.754	-0.04096

	<b>Jacanidae</b>						
58	Bronze-winged Jacona	<i>Metapides indicus</i>	2	0.00132	5	-6.626	-0.00878
	<b>Burhimidae</b>						
59	Eurasian Thick-knee	<i>Burhinus oedicephalus</i>	6	0.00397	6	-5.527	-0.02198
	<b>Charadriidae</b>						
60	Little Ringed Plover	<i>Charadrius dubius</i>	6	0.00397	6	-5.527	-0.02198
61	River Lapwing	<i>Vanellus duvaucelli</i>	9	0.00596	4	-5.122	-0.03055
62	Red-wattled Lapwing	<i>Vanellus indicus</i>	1	0.00066	3	-7.319	-0.00485
	<b>Glareolidae</b>						
63	Little Pratincole	<i>Glareola lactea</i>	5	0.00331	3	-5.710	-0.01892
	<b>Accipitridae</b>						
64	Osprey	<i>Pandion haliaetus</i>	8	0.00530	2	-5.240	-0.02778
65	Oriental Honey-buzzard	<i>Pernis ptilorhynchus</i>	2	0.00132	5	-6.626	-0.00878
66	Black-shouldered Kite	<i>Elanus caeruleus</i>	8	0.00530	2	-5.240	-0.02778

				2		
67	Black Kite	<i>Milvus migrans</i>	8	0.00530		
				2	-5.240	-0.02778
68	Grey-headed Fish Eagle	<i>Ichthyophaga ichthyaetus</i>	1	0.00066		
				3	-7.319	-0.00485
69	Crested Serpent Eagle	<i>Spilornis cheela</i>	1	0.00066		
				3	-7.319	-0.00485
70	Crested Goshawk	<i>Accipiter trivirgatus</i>	1	0.00066		
				3	-7.319	-0.00485
	<b>Falconidae</b>					
71	Collared Falconer	<i>Microhierax caerulescens</i>	5	0.00331		
				3	-5.710	-0.01892
	<b>Anhingidae</b>					
72	Oriental Darter	<i>Anhinga melanogaster</i>	3	0.00198		
				8	-6.221	-0.01237
	<b>Ardeidae</b>					
73	Little Egret	<i>Egretta garzetta</i>	4	0.00265		
				1	-5.933	-0.01573
74	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	1	0.00066		
				3	-7.319	-0.00485
75	Indian Pond Heron	<i>Ardeola grayii</i>	1	0.00066		
				3	-7.319	-0.00485



76	Great Egret	<i>Casmerodius albus</i>	4	0.00265 1	-5.933	-0.01573
77	Intermediate Egret	<i>Mesophoyx intermedia</i>	2	0.00132 5	-6.626	-0.00878
78	Cattle Egret	<i>Bubulcus ibis</i>	8	0.00530 2	-5.240	-0.02778
79	Little Heron	<i>Butorides striatus</i>	1	0.00066 3	-7.319	-0.00485
80	Great Bittern	<i>Botaurus stellaris</i>	1	0.00066 3	-7.319	-0.00485
81	Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i>	3	0.00198 8	-6.221	-0.01237
	<b>Threskiornithidae</b>					
82	Black Ibis	<i>Pseudibis papillosa</i>	3	0.00198 8	-6.221	-0.01237
83	Eurasian Spoonbill	<i>Platalea leucorodia</i>	1	0.00066 3	-7.319	-0.00485
	<b>Ciconidae</b>					
84	Asian Openbill	<i>Anastomus oscitans</i>	9	0.00596 4	-5.122	-0.03055
85	Woolly-necked Stork	<i>Ciconia episcopus</i>	2	0.00132 5	-6.626	-0.00878

86	Lesser Adjutant	<i>Leptoptilos javanicus</i>	3	0.00198 8	-6.221	-0.01237
	<b>PASSERIFORMES</b>					
	<b>Irenidae</b>					
87	Golden-fronted Leaf bird	<i>Chloropsis auriformes</i>	11	0.00729	-4.921	-0.03587
88	Orange-bellied Leaf bird	<i>Chloropsis hardwickii</i>	2	0.00132 5	-6.626	-0.00878
	<b>Corvidae</b>					
89	Red-billed Blue Magpie	<i>Urocissa erythrorthyncha</i>	16	0.01060 3	-4.547	-0.04821
90	Rufous Treepie	<i>Dendrocitta vagabunda</i>	10	0.00662 7	-5.017	-0.03324
91	House Crow	<i>Corvus splendens</i>	14	0.00927 8	-4.680	-0.04342
92	Large-billed Crow	<i>Corvus macrorhynchos</i>	88	0.05831 7	-2.842	-0.16573
93	Large Cuckooshrike	<i>Coracina macei</i>	7	0.00463 9	-5.373	-0.02493
94	Rosy Minivet	<i>Pericrocotus roseus</i>	8	0.00530 2	-5.240	-0.02778
95	Scarlet Minivet	<i>Pericrocotus flammeus</i>	10	0.00662 7	-5.017	-0.03324

96	Bar-winged Flycatcher-shrike	<i>Hemipus picatus</i>	2	0.00132 5	-6.626	-0.00878
97	White-throated Fantail	<i>Rhipidura albicollis</i>	9	0.00596 4	-5.122	-0.03055
98	White-bellied Drongo	<i>Dicrurus caerulescens</i>	2	0.00132 5	-6.626	-0.00878
99	Bronzed Drongo	<i>Dicrurus aeneus</i>	8	0.00530 2	-5.240	-0.02778
100	Spangled Drongo	<i>Dicrurus hottentottus</i>	8	0.00530 2	-5.240	-0.02778
101	Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>	8	0.00530 2	-5.240	-0.02778
102	Black-naped Monarch	<i>Hypothymis azurea</i>	2	0.00132 5	-6.626	-0.00878
103	Common Iora	<i>Aegithina tiphia</i>	4	0.00265 1	-5.933	-0.01573
104	Common Woodshrike	<i>Tephrodomis pondicenanus</i>	2	0.00132 5	-6.626	-0.00878
	<b>Muscicapidae</b>					
105	Blue Whistling Thrush	<i>Myophonus caeruleus</i>	25	0.01656 7	-4.100	-0.06793
106	Scaly Thrush	<i>Zoothera dauma</i>	2	0.00132	-6.626	-0.00878

				5		
107	Rufous-gorgeted Flycatcher	<i>Ficedula strophinata</i>	2	0.00132		
				5	-6.626	-0.00878
108	Pale-chinned Flycatcher	<i>Cyornis poliogenys</i>	4	0.00265		
				1	-5.933	-0.01573
109	Oriental Magpie Robin	<i>Copsychus saularis</i>	10	0.00662		
				7	-5.017	-0.03324
110	White-rumped Shama	<i>Copsychus malabaricus</i>	1	0.00066		
				3	-7.319	-0.00485
111	White-tailed Stonechat	<i>Saxicola leucura</i>	3	0.00198		
				8	-6.221	-0.01237
112	Pied Bushcaht	<i>Saxicola caprata</i>	5	0.00331		
				3	-5.710	-0.01892
	<b>Sturnidae</b>					
113	Brahminy Starling	<i>Sturnus pagodarum</i>	4	0.00265		
				1	-5.933	-0.01573
114	Asian Pied Starling	<i>Sturnus contra</i>	2	0.00132		
				5	-6.626	-0.00878
115	Common Myna	<i>Acridotheres tristis</i>	10	0.00662		
				7	-5.017	-0.03324
116	Jungle Myna	<i>Acridotheres fuscus</i>	12	0.00795		
				2	-4.834	-0.03844

	<b>Sittidae</b>						
117	Chestnut-bellied Nuthatch	<i>Sitta castanea</i>	2	0.00132	5	-6.626	-0.00878
118	Velvet-fronted Nuthatch	<i>Sitta frontalis</i>	12	0.00795	2	-4.834	-0.03844
	<b>Paridae</b>						
119	Great Tit	<i>Parus major</i>	5	0.00331	3	-5.710	-0.01892
120	Sultan Tit	<i>Melanochlora sultanea</i>	1	0.00066	3	-7.319	-0.00485
	<b>Hirundinidae</b>						
121	Barn Swallow	<i>Hirundo rustica</i>	3	0.00198	8	-6.221	-0.01237
	<b>Pyconotidae</b>						
122	Black-crested Bulbul	<i>Pycnonotus melanicterus</i>	8	0.00530	2	-5.240	-0.02778
123	Black Bulbul	<i>Hysipetes leucocephalus</i>	126	0.08349	9	-2.483	-0.20732
124	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	3	0.00198	8	-6.221	-0.01237
125	Himalayan Bulbul	<i>Pycnonotus leucogenys</i>	65	0.04307	5	-3.145	-0.13546

126	Red-vented Bulbul	<i>Pycnonotus cafer</i>	11	0.00729	-4.921	-0.03587
	<b>Cisticolidae</b>					
127	Zitting Cisticola	<i>Cisticola juncidis</i>	3	0.00198	-6.221	-0.01237
128	Bright-capped Cisticola	<i>Cisticola exilis</i>	1	0.00066	-7.319	-0.00485
129	Striated Prinia	<i>Prinia criniger</i>	4	0.00265	-5.933	-0.01573
130	Grey-crowned Prinia	<i>Prinia cinereocapilla</i>	2	0.00132	-6.626	-0.00878
131	Graceful Prinia	<i>Prinia gracilis</i>	1	0.00066	-7.319	-0.00485
132	Yellow-bellied Prinia	<i>Prinia flaviventris</i>	5	0.00331	-5.710	-0.01892
133	Plain Prinia	<i>Prinia inornata</i>	9	0.00596	-5.122	-0.03055
	<b>Zosteropidae</b>					
134	Oriental White-eye	<i>Zosterops paepobrosus</i>	85	0.05632	-2.877	-0.16203
	<b>Sylviidae</b>					
135	Common Tailorbird	<i>Orthotomus sutorius</i>	12	0.00795	-4.834	-0.03844

136	Striated Grassbird	<i>Megahurus palustris</i>	1	0.00066 3	-7.319	-0.00485
137	Rufous-rumped Grassbird	<i>Graminicola bengalensis</i>	2	0.00132 5	-6.626	-0.00878
138	White-crested Laughingthrush	<i>Garrulax leucolophus</i>	4	0.00265 1	-5.933	-0.01573
139	Lesser Necklaced Laughingthrush	<i>Garrulax monileger</i>	4	0.00265 1	-5.933	-0.01573
140	Greater Necklaced Laughingthrush	<i>Garrulax pectoralis</i>	7	0.00463 9	-5.373	-0.02493
141	Blue-winged Laughingthrush	<i>Garrulax squamatus</i>	1	0.00066 3	-7.319	-0.00485
142	Puff-throated Babbler	<i>Pellorneum ruficeps</i>	28	0.01855 5	-3.987	-0.07398
143	Striped Tit Babbler	<i>Macronous gularis</i>	6	0.00397 6	-5.527	-0.02198
144	Chestnut-capped Babbler	<i>Timalia pileata</i>	5	0.00331 3	-5.710	-0.01892
145	Striated Babbler	<i>Turdoides earlei</i>	6	0.00397 6	-5.527	-0.02198
146	Jungle Babbler	<i>Turdoides striatus</i>	6	0.00397 6	-5.527	-0.02198

147	Himalayan Cutia	<i>Cutia nipalensis</i>	1	0.00066 3	-7.319	-0.00485
148	White-bellied Yuhina	<i>Yuhina zantholeuca</i>	2	0.00132 5	-6.626	-0.00878
	<b>Alaudidae</b>					
149	Rufous-winged Bushlark	<i>Mirafra assamica</i>	3	0.00198 8	-6.221	-0.01237
150	Ashy-crowned Sparrow Lark	<i>Eremopterix grisea</i>	4	0.00265 1	-5.933	-0.01573
151	Sand Lark	<i>Calandrella roytal</i>	10	0.00662 7	-5.017	-0.03324
152	Oriental Skylark	<i>Alauda gulgula</i>	3	0.00198 8	-6.221	-0.01237
	<b>Nectariniidae</b>					
153	Thick-billed Flowerpecker	<i>Dicaeum agile</i>	1	0.00066 3	-7.319	-0.00485
154	Pale-billed Flowerpecker	<i>Dicaeum erythrorhynchos</i>	2	0.00132 5	-6.626	-0.00878
155	Yellow-vented Flowerpecker	<i>Dicaeum chrysorrheum</i>	1	0.00066 3	-7.319	-0.00485
156	Crimson Sunbird	<i>Anthreptes siparaja</i>	7	0.00463 9	-5.373	-0.02493



157	Streaked Spiderhunter	<i>Archnothera magna</i>	5	0.00331 3	-5.710	-0.01892
	<b>Passeridae</b>					
158	House Sparrow	<i>Passer domesticus</i>	16	0.01060 3	-4.547	-0.04821
159	Eurasian Tree Sparrow	<i>Passer montanus</i>	16	0.01060 3	-4.547	-0.04821
160	White-browed Wagtail	<i>Motacilla maderaspatensis</i>	7	0.00463 9	-5.373	-0.02493
161	Paddyfield Pipit	<i>Anthus rufulus</i>	20	0.01325 4	-4.323	-0.0573
162	Black-breasted Weaver	<i>Ploceus benghalensis</i>	3	0.00198 8	-6.221	-0.01237
163	Baya Weaver	<i>Ploceus philippinus</i>	4	0.00265 1	-5.933	-0.01573
164	Red Avadavat	<i>Amandava amandava</i>	4	0.00265 1	-5.933	-0.01573
165	Indian Silverbill	<i>Lonchura malabarica</i>	1	0.00066 3	-7.319	-0.00485
166	Scaly-breasted Munia	<i>Lonchura punctulata</i>	4	0.00265 1	-5.933	-0.01573
	<b>Total</b>		<b>1509</b>	<b>1</b>	<b>-</b>	<b>-4.22826</b>

					<b>964.728</b>	
<b>Birds of Winter season</b>						
S.No.	<b>Order/Family/Common Name/Scientific Name</b>	<b>Number of Birds</b>				
				<b>Pi</b>	<b>lnPi</b>	<b>Pi*lnPi</b>
	<b>GALLIFORMES</b>					
	<b>Phasianidae</b>					
1	Black Francolin <i>Francolinus francolinus</i>	7		0.001834382	- 6.30105	- 0.01156
2	Indian Peafowl <i>Pavo cristatus</i>	5		0.001310273	- 6.63752	- -0.0087
3	Kalij Pheasant <i>Lophura leucomelanos</i>	10		0.002620545	- 5.94437	- 0.01558
4	Red Junglefowl <i>Gallus gallus</i>	5		0.001310273	- 6.63752	- -0.0087
	<b>ANSERIFORMES</b>			0		
	<b>Dendrocygnidae</b>			0		
5	Lesser Whistling Duck <i>Dendrocygna javanica</i>	26		0.006813417	- 4.98886	- 0.03399
	<b>Anatidae</b>			0		
6	Bar-headed Goose <i>Anser indicus</i>	201		0.052672956	-	-

					2.94365	0.15505
7	Greylag Goose	<i>Anser anser</i>	4	0.001048218	-	-
8	Ruddy Shelduck	<i>Tadorna ferruginea</i>	378	0.099056604	6.86066	0.00719
9	Red-crested Pochard	<i>Rhodonessa rufina</i>	16	0.004192872	-	-
10	Greater White Fronted Goose	<i>Anser albifrons</i>	9	0.002358491	5.47437	0.02295
11	Common Merganser	<i>Mergus merganser</i>	219	0.057389937	-	-
12	Common Shelduck	<i>Tadorna tadorna</i>	2	0.000524109	2.85789	0.16401
13	Gadwall	<i>Anas sirepera</i>	201	0.052672956	-	-
14	Mallard	<i>Anas platyrhynchos</i>	89	0.023322851	7.55381	0.00396
15	Spot-billed Duck	<i>Anas poecilorhyncha</i>	18	0.004716981	-	-
16	Northern Pintail	<i>Anas acuta</i>	21	0.005503145	5.35659	0.02527
17	Eurasian Wigeon	<i>Anas penelope</i>	24	0.006289308	-	-
					-5.0689	-

						0.03188
	<b>PICIFORMES</b>			0		
	<b>Picidae</b>			0		
18	Grey-capped Pygmy Woodpecker	<i>Dendrocopos canicapillus</i>	2	0.000524109	- 7.55381	- 0.00396
19	Fulvous-breasted Woodpecker	<i>Dendrocopos macei</i>	2	0.000524109	- 7.55381	- 0.00396
20	Lesser Yellownape	<i>Picus chlorolophus</i>	1	0.000262055	- 8.24696	- 0.00216
21	Streak-throated Woodpecker	<i>Picus xanthopygaeus</i>	2	0.000524109	- 7.55381	- 0.00396
22	Grey-headed Woodpecker	<i>Picus canus</i>	9	0.002358491	- 6.04973	- 0.01427
23	Himalayan Flameback	<i>Dinopium shorii</i>	3	0.000786164	- 7.14835	- 0.00562
24	Greater Flameback	<i>Chrysocolaptes lucidus</i>	2	0.000524109	- 7.55381	- 0.00396
25	Black-rumped Flameback	<i>Dinopium benghalense</i>	1	0.000262055	- 8.24696	- 0.00216
26	Eurasia Wryneck	<i>Jynx torquilla</i>	4	0.001048218	- 6.86066	- 0.00719
	<b>Megalaimidae</b>			0		

27	Lineated Barbet	<i>Megalaima lineate</i>	7	0.001834382	-	-
28	Blue-throated Barbet	<i>Megalaima asiatica</i>	10	0.002620545	5.94437	0.01558
29	Coppersmith Barbet	<i>Megalaima haemacephala</i>	5	0.001310273	6.63752	-0.0087
	<b>BUCEROTIFORMES</b>			0		
	<b>Bucerotidae</b>			0		
30	Oriental Pied-Hornbill	<i>Anthracoceros albirostris</i>	2	0.000524109	7.55381	0.00396
	<b>UPUPIFORMS</b>			0		
	<b>Upupidae</b>			0		
31	Common Hoopoe	<i>Upupa epos</i>	2	0.000524109	7.55381	0.00396
	<b>TROGONIFORMES</b>			0		
	<b>Trogonidae</b>			0		
32	Red-headed Trogon	<i>Harpactes erythrocephalus</i>	1	0.000262055	8.24696	0.00216
	<b>CORACIFORMES</b>			0		
	<b>Coraciidae</b>			0		
33	Indian Roller	<i>Coracias benghalensis</i>	11	0.0028826	5.84906	0.01686

	<b>Alcedinidae</b>			0		
34	Common Kingfisher	<i>Alcedo atthis</i>	4	0.001048218	- 6.86066	- 0.00719
	<b>Hylcyonidae</b>			0		
35	Stork-billed Kingfisher	<i>Halcyon capensis</i>	1	0.000262055	- 8.24696	- 0.00216
36	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	1	0.000262055	- 8.24696	- 0.00216
	<b>Cerylidae</b>			0		
37	Pied Kingfisher	<i>Ceryle rudis</i>	9	0.002358491	- 6.04973	- 0.01427
	<b>Meropidae</b>			0		
38	Green Bee-eater	<i>Merops orientalis</i>	3	0.000786164	- 7.14835	- 0.00562
	<b>CUCULIFORMES</b>			0		
	<b>Cuculidae</b>			0		
39	Common Hawk Cuckoo	<i>Hierococcyx varius</i>	2	0.000524109	- 7.55381	- 0.00396
40	Green-billed Malkoha	<i>Phaenicophaeus tristis</i>		0		
	<b>Centropodidae</b>			0		
41	Greater Coucal	<i>Centropus sinensis</i>	5	0.001310273	- 6.63752	- -0.0087

42	Lesser Coucal	<i>Centropus bengalensis</i>	1	0.000262055	- 8.24696	- 0.00216
	<b>PSITTACEFORMES</b>			0		
	<b>Psittacidae</b>			0		
43	Alexandrine Parakeet	<i>Psittacula eupatria</i>	5	0.001310273	- 6.63752	- -0.0087
44	Rose-ringed Parakeet	<i>Psittacula krameri</i>	3	0.000786164	- 7.14835	- 0.00562
45	Slaty-headed Parakeet	<i>Psittacula himalayana</i>	71	0.01860587	- 3.98428	- 0.07413
46	Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	2	0.000524109	- 7.55381	- 0.00396
47	Red-breasted Parakeet	<i>Psittacula alexandri</i>	2	0.000524109	- 7.55381	- 0.00396
	<b>APODIFORMES</b>			0		
	<b>Apodidae</b>			0		
48	White-rumped Spinetail	<i>Zoonavena sylvatica</i>	2	0.000524109	- 7.55381	- 0.00396
49	House Swift	<i>Apus affinis</i>	1	0.000262055	- 8.24696	- 0.00216
50	Himalayan Swiftlet	<i>Colocalia brevirostris</i>	12	0.003144654	- 5.76205	- 0.01812

51	Alpine Swift	<i>Tachymarptis melba</i>	1	0.000262055	- 8.24696	- 0.00216
52	Fork-tailed Swift	<i>Apus pacificus</i>	2	0.000524109	- 7.55381	- 0.00396
	<b>Hemiprocyridae</b>			0		
53	Crested Treeswift	<i>Hemiprocne coronate</i>	11	0.0028826	- 5.84906	- 0.01686
	<b>STRIGIFORMES</b>			0		
	<b>Strigidae</b>			0		
54	Brown Hawk-Owl	<i>Ninox scutulata</i>	3	0.000786164	- 7.14835	- 0.00562
55	Brown Fish Owl	<i>Ketupa zeylonensis</i>	2	0.000524109	- 7.55381	- 0.00396
56	Jungle Owlet	<i>Glaucidium radiatum</i>	4	0.001048218	- 6.86066	- 0.00719
57	Spotted Owlet	<i>Athene brama</i>	12	0.003144654	- 5.76205	- 0.01812
	<b>Caprimulgidae</b>			0		
58	Large-tailed Nightjar	<i>Caprimulgus macrurus</i>	4	0.001048218	- 6.86066	- 0.00719
59	Savanna Nightjar	<i>Caprimulgus affinis</i>	2	0.000524109	- 7.55381	- 0.00396



	<b>COLUMBIFORMES</b>			0		
	<b>Columbidae</b>			0		
60	Rock Pigeon	<i>Columba livia</i>	32	0.008385744	-4.78122	-0.04009
61	Common Wood Pigeon	<i>Columba palumbus</i>	6	0.001572327	-6.4552	-0.01015
62	Ashy Wood Pigeon	<i>Columba pulchricollis</i>	4	0.001048218	-6.86066	-0.00719
63	Orange-breasted Green Pigeon	<i>Treron bicincta</i>	10	0.002620545	-5.94437	-0.01558
64	Yellow-footed Green Pigeon	<i>Treron phoenicoptera</i>	3	0.000786164	-7.14835	-0.00562
65	Pompadour Green Pigeon	<i>Treron pompadora</i>	3	0.000786164	-7.14835	-0.00562
66	Oriental Turtle Dove	<i>Streptopelia orientalis</i>	13	0.003406709	-5.68201	-0.01936
67	Spotted Dove	<i>Streptopelia chinensis</i>	5	0.001310273	-6.63752	-0.0087
68	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	4	0.001048218	-6.86066	-0.00719
69	Emerald Dove	<i>Chalcophaps indica</i>	2	0.000524109	-7.55381	-0.00396

70	Red Collared Dove	<i>Streptopelia tranquebarica</i>	1	0.000262055	- 8.24696	- 0.00216
	<b>GRUIFORMES</b>			0		
	<b>Gruidae</b>			0		
71	Common Crane	<i>Grus grus</i>	10	0.002620545	- 5.94437	- 0.01558
	<b>Rallidae</b>			0		
72	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	4	0.001048218	- 6.86066	- 0.00719
73	Ruddy-breasted Crake	<i>Porzana fusca</i>	2	0.000524109	- 7.55381	- 0.00396
74	Purple Swamphen	<i>Porphyrio porphyrio</i>	1	0.000262055	- 8.24696	- 0.00216
75	Common Moorhen	<i>Gallinula chloropus</i>	138	0.036163522	-3.3197	- 0.12005
76	Common Coot	<i>Fulica atra</i>	23	0.006027254	- 5.11146	- 0.03081
	<b>CICONIFORMES</b>			0		
	<b>Scolopacidae</b>			0		
77	Common Snipe	<i>Gallinago gallinago</i>	11	0.0028826	- 5.84906	- 0.01686
78	Common Greenshank	<i>Tringa nebularia</i>	65	0.017033543	-	-

					4.07257	0.06937
79	Green Sandpiper	<i>Tringa ochropus</i>	15	0.003930818	-	-
80	Common Sandpiper	<i>Actitis hypoleucos</i>	2	0.000524109	5.53891	0.02177
81	Black-tailed Godwit	<i>Limosa limosa</i>	4	0.001048218	-	-
82	Pintail Snipe	<i>Gallinago stenura</i>	9	0.002358491	6.86066	0.00719
83	Jack Snipe	<i>Lymnocyptes minimus</i>	5	0.001310273	-	-
84	Whimbrel	<i>Numenius phaeopus</i>	11	0.0028826	6.63752	-0.0087
85	Eurasian Curlew	<i>Numenius arquata</i>	8	0.002096436	-	-
86	Spotted Redshank	<i>Tringa erythropus</i>	6	0.001572327	5.84906	0.01686
87	Common Redshank	<i>Tringa tetanus</i>	15	0.003930818	-	-
88	Wood Sandpiper	<i>Tringa glareola</i>	10	0.002620545	5.53891	0.02177
89	Little Stint	<i>Calidris minuta</i>	21	0.005503145	-	-

					5.20244	0.02863
90	Temminck's Stint	<i>Calidris temminckii</i>	120	0.031446541	- 3.45947	- 0.10879
91	Eurasian Woodcock	<i>Scolopax rusticola</i>	2	0.000524109	- 7.55381	- 0.00396
	<b>Jacaniidae</b>			0		
92	Bronze-winged Jacona	<i>Metapidus indicus</i>	1	0.000262055	- 8.24696	- 0.00216
	<b>Burhimidae</b>			0		
93	Eurasian Thick-knee	<i>Burhinus oediconemus</i>	8	0.002096436	- 6.16752	- 0.01293
	<b>Charadriidae</b>			0		
94	Pied Avocet	<i>Recurvirostra avosetia</i>	1	0.000262055	- 8.24696	- 0.00216
95	Little Ringed Plover	<i>Charadrius dubius</i>	19	0.004979036	- 5.30252	- -0.0264
96	Kentish Plover	<i>Charadrius alexandrinus</i>	14	0.003668763	- -5.6079	- 0.02057
97	River Lapwing	<i>Vanellus duvaucelli</i>	8	0.002096436	- 6.16752	- 0.01293
98	Red-wattled Lapwing	<i>Vanellus indicus</i>	10	0.002620545	- 5.94437	- 0.01558

99	Northern Lapwing	<i>Vanellus vanellus</i>	1	0.000262055	- 8.24696	- 0.00216
100	Grey-headed Lapwing	<i>Vanellus cinereus</i>	1	0.000262055	- 8.24696	- 0.00216
	<b>Glareolidae</b>			0		
101	Little Pratincole	<i>Glareola lactea</i>	6	0.001572327	-6.4552	- 0.01015
	<b>Laridae</b>			0		
102	Black-headed Gull	<i>Larus ridibundus</i>	1	0.000262055	- 8.24696	- 0.00216
103	Brown-headed Gull	<i>Larus brunnicephalus</i>	2	0.000524109	- 7.55381	- 0.00396
	<b>Accipitridae</b>			0		
104	Osprey	<i>Pandion haliaetus</i>	1	0.000262055	- 8.24696	- 0.00216
105	Oriental Honey-buzzard	<i>Pernis ptilorhyncus</i>	8	0.002096436	- 6.16752	- 0.01293
106	Common Buzzard	<i>Buteo buteo</i>	3	0.000786164	- 7.14835	- 0.00562
107	Black Kite	<i>Milvus migrans</i>	4	0.001048218	- 6.86066	- 0.00719
108	Grey-headed Fish Eagle	<i>Ichthyophaga ichhyaetus</i>	7	0.001834382	-	-

					6.30105	0.01156
109	Crested Serpent Eagle	<i>Spilornis cheela</i>	8	0.002096436	-	-
					6.16752	0.01293
110	Booted Eagle	<i>Hieraaetus pennatus</i>	1	0.000262055	-	-
					8.24696	0.00216
111	Short-toed Snake Eagle	<i>Circaetus gallicus</i>	2	0.000524109	-	-
					7.55381	0.00396
112	Black Eagle	<i>Ictinaetus malayensis</i>	3	0.000786164	-	-
					7.14835	0.00562
113	Steppe Eagle	<i>Aquila nipalensis</i>	4	0.001048218	-	-
					6.86066	0.00719
114	Cinereous Vulture	<i>Aegypius monachus</i>	1	0.000262055	-	-
					8.24696	0.00216
115	Eurasian Griffon	<i>Gyps fulvus</i>	2	0.000524109	-	-
					7.55381	0.00396
116	Crested Goshawk	<i>Accipiter trivirgatus</i>	2	0.000524109	-	-
					7.55381	0.00396
117	Shikra	<i>Accipiter badius</i>	7	0.001834382	-	-
					6.30105	0.01156
118	White-tailed Eagle	<i>Haliaeetus albicilla</i>	1	0.000262055	-	-
					8.24696	0.00216
119	Himalayan Griffon	<i>Gyps himalayensis</i>	3	0.000786164	-	-

					7.14835	0.00562
120	Eurasian Marsh Harrier	<i>Circus aeruginosus</i>	3	0.000786164	-	-
121	Pied Harrier	<i>Circus melanoleucos</i>	2	0.000524109	7.55381	0.00396
122	Northern Goshawk	<i>Accipiter gentilis</i>	1	0.000262055	-	-
123	Long-legged Buzzard	<i>Buteo rufinus</i>	1	0.000262055	8.24696	0.00216
124	Hen Harrier	<i>Circus cyaneus</i>	2	0.000524109	-	-
	<b>Falconidae</b>			0		
125	Collared Falconer	<i>Microhierax caerulescens</i>	7	0.001834382	6.30105	0.01156
126	Common Kestrel	<i>Falco tinnunculus</i>	7	0.001834382	-	-
127	Peregrine Falcon	<i>Falco peregrinus</i>	1	0.000262055	6.30105	0.01156
128	Red-necked Falcon	<i>Falco chicquere</i>	2	0.000524109	-	-
129	Eurasian Hobby	<i>Falco subbuteo</i>	1	0.000262055	7.55381	0.00396
					8.24696	0.00216

130	Oriental Hobby	<i>Falco severus</i>	1	0.000262055	- 8.24696	- 0.00216
	<b>Podicipedidae</b>			0		
131	Little Grebe	<i>Tachybaptus ruficollis</i>	1	0.000262055	- 8.24696	- 0.00216
132	Great Crested Grebe	<i>Podiceps cristatus</i>	1	0.000262055	- 8.24696	- 0.00216
	<b>Phalacrocoracidae</b>			0		
133	Little Comorant	<i>Phalacrocorax niger</i>	5	0.001310273	- 6.63752	- -0.0087
134	Great Comorant	<i>Phalacrocorax carbo</i>	139	0.036425577	- 3.31248	- 0.12066
	<b>Ardeidae</b>			0		
135	Little Egret	<i>Egretta garzetta</i>	30	0.007861635	- 4.84576	- -0.0381
136	Grey Heron	<i>Ardea cinerea</i>	16	0.004192872	- 5.47437	- 0.02295
137	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	21	0.005503145	- 5.20244	- 0.02863
138	Indian Pond Heron	<i>Ardeola grayii</i>	11	0.0028826	- 5.84906	- 0.01686
139	Great Egret	<i>Casmerodius albus</i>	7	0.001834382	-	-



					6.30105	0.01156
140	Intermediate Egret	<i>Mesophoyx intermedia</i>	14	0.003668763	-5.6079	0.02057
141	Cattle Egret	<i>Bubulcus ibis</i>	1	0.000262055	-	-
142	Little Heron	<i>Butorides striatus</i>	7	0.001834382	-	-
	<b>Threskiornithidae</b>			0		
143	Black Ibis	<i>Pseudibis papillosa</i>	28	0.007337526	-	-
	<b>Ciconidae</b>			0		
144	Asian Openbill	<i>Anastomus oscitans</i>	5	0.001310273	-	-
145	Black Stork	<i>Ciconia nigra</i>	35	0.009171908	6.63752	-0.0087
146	Woolly-necked Stork	<i>Ciconia episcopus</i>	10	0.002620545	-	-
147	Lesser Adjutant	<i>Leptoptilos javanicus</i>	9	0.002358491	5.94437	0.01558
	<b>PASSERIFORMES</b>			0		
	<b>Irenidae</b>			0		
148	Golden-fronted Leaf bird	<i>Chloropsis auriformes</i>	2	0.000524109	-	-

					7.55381	0.00396
149	Orange-bellied Leaf bird	<i>Chloropsis hardwickii</i>	3	0.000786164	-	-
	<b>Laniidae</b>			0		
150	Long-tailed Shrike	<i>Lanius schach</i>	3	0.000786164	-	-
151	Grey-backed Shrike	<i>Lanius tephronotus</i>	1	0.000262055	8.24696	0.00216
152	Brown Shrike	<i>Lanius cristatus</i>	1	0.000262055	-	-
153	Rufous-tailed Shrike	<i>Lanius isablinus</i>	1	0.000262055	8.24696	0.00216
154	Bay-backed Shrike	<i>Lanius vittatus</i>	1	0.000262055	-	-
	<b>Corvidae</b>			0		
155	Red-billed Blue Magpie	<i>Urocissa erythrorthyncha</i>	28	0.007337526	-	-
156	Rufous Treepie	<i>Dendrocitta vagabunda</i>	4	0.001048218	6.86066	0.00719
157	House Crow	<i>Corvus splendens</i>	11	0.0028826	-	-
158	Large-billed Crow	<i>Corvus macrorhynchos</i>	76	0.019916143	5.84906	0.01686
					-	-0.078

					3.91622	
159	Maroon Oriole	<i>Oriolus traillii</i>	2	0.000524109	-	-
160	Small Minivet	<i>Pericrocotus cinnamomeus</i>	8	0.002096436	-	-
161	Rosy Minivet	<i>Pericrocotus roseus</i>	6	0.001572327	-6.4552	0.01015
162	Scarlet Minivet	<i>Pericrocotus flammeus</i>	3	0.000786164	-	-
163	Long-tailed Minivet	<i>Pericrocotus ethologus</i>	19	0.004979036	-	-
164	Bar-winged Flycatcher-shrike	<i>Hemipus picatus</i>	1	0.000262055	-	-
165	White-throated Fantail	<i>Rhipidura albicollis</i>	11	0.0028826	-	-
166	Yellow-bellied Fantail	<i>Rhipidura hypoxantha</i>	2	0.000524109	-	-
167	White-bellied Drongo	<i>Dicrurus caerulescens</i>	7	0.001834382	-	-
168	Bronzed Drongo	<i>Dicrurus aeneus</i>	9	0.002358491	-	-
169	Spangled Drongo	<i>Dicrurus hottentottus</i>	1	0.000262055	-	-

					8.24696	0.00216
170	Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>	5	0.001310273	- 6.63752	- -0.0087
171	Common Iora	<i>Aegithina tiphia</i>	1	0.000262055	- 8.24696	- 0.00216
172	Common Woodshrike	<i>Tephrodomis pondicenanus</i>	4	0.001048218	- 6.86066	- 0.00719
	<b>Muscicapidae</b>			0		
173	Blue Whistling Thrush	<i>Myophonus caeruleus</i>	18	0.004716981	- 5.35659	- 0.02527
174	Chestnut-bellied Rock Thrush	<i>Monticola rufiventris</i>	2	0.000524109	- 7.55381	- 0.00396
175	Blue-capped Rock Thrush	<i>Monticola cinclorhynchus</i>	5	0.001310273	- 6.63752	- -0.0087
176	Tickell's Thrush	<i>Turdus unicolor</i>	8	0.002096436	- 6.16752	- 0.01293
177	Dark-throated Thrush	<i>Turdus ruficollis</i>	2	0.000524109	- 7.55381	- 0.00396
178	Rufous-gorgeted Flycatcher	<i>Ficedula strophciata</i>	1	0.000262055	- 8.24696	- 0.00216
179	Pale-chinned Flycatcher	<i>Cyornis poliogenys</i>	2	0.000524109	- 7.55381	- 0.00396

180	Grey-headed Flycatcher	Canary <i>Culicicapa ceylonensis</i>	6	0.001572327	-6.4552	- 0.01015
181	Rusty-tailed Flycatcher	<i>Musciapaga rufiauda</i>	3	0.000786164	- 7.14835	- 0.00562
182	Slaty-backed Flycatcher	<i>Ficedula hodgsonii</i>	1	0.000262055	- 8.24696	- 0.00216
183	Pale-Blue Flycatcher	<i>Cyornis unicolor</i>	3	0.000786164	- 7.14835	- 0.00562
184	Asian-Brown Flycatcher	<i>Musciapaga dauurica</i>	2	0.000524109	- 7.55381	- 0.00396
185	Ultramarine Flycatcher	<i>Ficedula superciliaris</i>	8	0.002096436	- 6.16752	- 0.01293
186	Verditer Flycatcher	<i>Eumyias thalassina</i>	28	0.007337526	- 4.91475	- 0.03606
187	Blue-throated Flycatcher	<i>Cyornis rubeculoides</i>	4	0.001048218	- 6.86066	- 0.00719
188	Oriental Magpie Robin	<i>Copsychus saularis</i>	2	0.000524109	- 7.55381	- 0.00396
189	White-rumped Shama	<i>Copsychus malabaricus</i>	2	0.000524109	- 7.55381	- 0.00396
190	White-capped Redstart	Water <i>Chaimarrornis leucocephalus</i>	1	0.000262055	- 8.24696	- 0.00216

191	Black Redstart	<i>Phoenicurus ochruros</i>	16	0.004192872	- 5.47437	- 0.02295
192	Common Stonechat	<i>Saxicola torquata</i>	10	0.002620545	- 5.94437	- 0.01558
193	White-tailed Stonechat	<i>Saxicola leucura</i>	2	0.000524109	- 7.55381	- 0.00396
194	Pied Bushcaht	<i>Saxicola caprata</i>	4	0.001048218	- 6.86066	- 0.00719
195	Eurasian Blackbird	<i>Turdus merula</i>	2	0.000524109	- 7.55381	- 0.00396
196	Siberian Rubythroat	<i>Luscinia colliope</i>	11	0.0028826	- 5.84906	- 0.01686
197	White-tailed Rubythroat	<i>Luscinia pect oralis</i>	16	0.004192872	- 5.47437	- 0.02295
198	Bluethroat	<i>Luscinia svecica</i>	15	0.003930818	- 5.53891	- 0.02177
199	Indian Blue Robin	<i>Luscinia brunnea</i>	4	0.001048218	- 6.86066	- 0.00719
200	Plumbeous Water Redstart	<i>Rhyacornis fuliginosus</i>	2	0.000524109	- 7.55381	- 0.00396
201	Grey-winged Blackbird	<i>Turdus bouboul</i>		0		
	<b>Sturnidae</b>			0		

202	Brahminy Starling	<i>Sturnus pagodarum</i>	4	0.001048218	- 6.86066	- 0.00719
203	Asian Pied Starling	<i>Sturnus contra</i>	4	0.001048218	- 6.86066	- 0.00719
204	Common Myna	<i>Acridotheres tristis</i>	6	0.001572327	-6.4552	- 0.01015
205	Jungle Myna	<i>Acridotheres fuscus</i>	4	0.001048218	- 6.86066	- 0.00719
	<b>Sittidae</b>			0		
206	Chestnut-bellied Nuthatch	<i>Sitta castanea</i>	7	0.001834382	- 6.30105	- 0.01156
207	Velvet-fronted Nuthatch	<i>Sitta frontalis</i>	10	0.002620545	- 5.94437	- 0.01558
208	Wallcreeper	<i>Tichodroma muraria</i>	1	0.000262055	- 8.24696	- 0.00216
	<b>Paridae</b>			0		
209	Great Tit	<i>Parus major</i>	16	0.004192872	- 5.47437	- 0.02295
	<b>Hirundinidae</b>			0		
210	Barn Swallow	<i>Hirundo rustica</i>	2	0.000524109	- 7.55381	- 0.00396
211	Red-rumped Swallow	<i>Hirundo daurica</i>	2	0.000524109	-	-

					7.55381	0.00396
	<b>Pyconotidae</b>			0		
212	Black Bulbul	<i>Hysipetes leucocephalus</i>	87	0.022798742	- 3.78105	- -0.0862
213	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	4	0.001048218	- 6.86066	- 0.00719
214	Himalayan Bulbul	<i>Pycnonotus leucogenys</i>	67	0.017557652	- 4.04227	- 0.07097
215	Red-vented Bulbul	<i>Pycnonotus cafer</i>	5	0.001310273	- 6.63752	- -0.0087
	<b>Cisticolidae</b>			0		
216	Zitting Cisticola	<i>Cisticola juncidis</i>	11	0.0028826	- 5.84906	- 0.01686
217	Striated Prinia	<i>Prinia criniger</i>	6	0.001572327	- -6.4552	- 0.01015
218	Grey-crowned Prinia	<i>Prinia cinereocapilla</i>	4	0.001048218	- 6.86066	- 0.00719
219	Yellow-bellied Prinia	<i>Prinia flaviventris</i>	10	0.002620545	- 5.94437	- 0.01558
220	Plain Prinia	<i>Prinia inornata</i>	3	0.000786164	- 7.14835	- 0.00562
	<b>Zosteropidae</b>			0		



221	Oriental White-eye	<i>Zosterops paepobrosus</i>	81	0.021226415	-	-
	<b>Sylviidae</b>			0		
222	Blyth's Leaf Warbler	<i>Phylloscapus reguloides</i>	19	0.004979036	-	-
223	Chestnut-crowned Bush Warbler	<i>Cettia major</i>	1	0.000262055	-	-
224	Grey-sided Bush Warbler	<i>Cettia brunnifrons</i>	3	0.000786164	-	-
225	Spotted Bush Warbler	<i>Bradypterus tharacicus</i>	3	0.000786164	-	-
226	Paddyfield Warbler	<i>Acrocephalus agricola</i>	14	0.003668763	-	-
227	Thick-bellied Warbler	<i>Acrocephalus aedon</i>	1	0.000262055	-	-
228	Smoky Warbler	<i>Phylloscapus fuligiventer</i>	14	0.003668763	-	-
229	Western Crowned Warbler	<i>Phylloscapus occipitalis</i>	2	0.000524109	-	-
230	Large-billed Leaf Warbler	<i>Phylloscapus magnirostris</i>	3	0.000786164	-	-
231	Yellow-bellied Warbler	<i>Abroscopus superciliaris</i>	2	0.000524109	-	-

					7.55381	0.00396
232	Aberrant Bush Warbler	<i>Cettia flavolivacea</i>	17	0.004454927	-	-
					5.41374	0.02412
233	Blyth's Reed Warbler	<i>Acrocephalus dumetorum</i>	15	0.003930818	-	-
					5.53891	0.02177
234	Clamorous Reed Warbler	<i>Acrocephalus stentoreus</i>	1	0.000262055	-	-
					8.24696	0.00216
235	Tickell's Leaf Warbler	<i>Phylloscopus affinis</i>	21	0.005503145	-	-
					5.20244	0.02863
236	Lemon-rumped Warbler	<i>Phylloscopus chloronotus</i>	15	0.003930818	-	-
					5.53891	0.02177
237	Hume's Warbler	<i>Phylloscopus humei</i>	2	0.000524109	-	-
					7.55381	0.00396
238	Greenish Warbler	<i>Phylloscopus trochiloides</i>	16	0.004192872	-	-
					5.47437	0.02295
239	Golden-spectacled Warbler	<i>Seicercus burkii</i>	2	0.000524109	-	-
					7.55381	0.00396
240	Whistler's Warbler	<i>Seicercus whistleri</i>	4	0.001048218	-	-
					6.86066	0.00719
241	Grey-hooded Warbler	<i>Seicercus xanthachistos</i>	36	0.009433962	-	-
					4.66344	0.04399
242	Chestnut-crowned Warbler	<i>Seicercus castaniceps</i>	28	0.007337526	-	-

					4.91475	0.03606
243	Sulphur-bellied Warbler	<i>Phylloscapus griseolus</i>	2	0.000524109	-	-
244	Common Chiffchaff	<i>Phylloscapus collybita</i>	10	0.002620545	7.55381	0.00396
245	Common Tailorbird	<i>Orthotomus sutorius</i>	8	0.002096436	-	-
246	Dusky Warbler	<i>Phylloscapus fuscatus</i>	4	0.001048218	5.94437	0.01558
247	White-crested Laughingthrush	<i>Garrulax leucolophus</i>	7	0.001834382	-	-
248	Lesser Necklaced Laughingthrush	<i>Garrulax monileger</i>	5	0.001310273	6.16752	0.01293
249	Greater Necklaced Laughingthrush	<i>Garrulax pectoralis</i>	12	0.003144654	-	-
250	Puff-throated Babbler	<i>Pellorneum ruficeps</i>	19	0.004979036	6.30105	0.01156
251	White-browed Scimitar Babbler	<i>Pamatorhinus schisticeps</i>	5	0.001310273	-	-
252	Striped Tit Babbler	<i>Macronous gularis</i>	2	0.000524109	6.63752	-0.0087
253	Chestnut-capped Babbler	<i>Timalia pileata</i>	11	0.0028826	-	-

					5.84906	0.01686
254	Striated Babbler	<i>Turdoides earlei</i>	5	0.001310273	-	-0.0087
255	Jungle Babbler	<i>Turdoides striatus</i>	15	0.003930818	-	-
256	Himalayan Cutia	<i>Cutia nipalensis</i>	4	0.001048218	-	-
257	White-bellied Yuhina	<i>Yuhina zantholeuca</i>	4	0.001048218	-	-
258	Nepal Fulvetta	<i>Alcippe nipalensis</i>	7	0.001834382	-	-
	<b>Alaudidae</b>			0		
259	Rufous-winged Bushlark	<i>Mirafra assamica</i>	4	0.001048218	-	-
260	Ashy-crowned Sparrow Lark	<i>Eremopterix grisea</i>	4	0.001048218	-	-
261	Sand Lark	<i>Calandrella roytal</i>	6	0.001572327	-6.4552	-
	<b>Nectariniidae</b>			0		
262	Pale-billed Flowerpecker	<i>Dicaeum erythrorhynchos</i>	5	0.001310273	-	-0.0087
263	Crimson Sunbird	<i>Anthreptes siparaja</i>	1	0.000262055	-	-

					8.24696	0.00216
264	Purple Sunbird	<i>Anthreptes asiatica</i>	5	0.001310273	- 6.63752	-0.0087
	<b>Passeridae</b>			0		
265	House Sparrow	<i>Passer domesticus</i>	8	0.002096436	- 6.16752	- 0.01293
266	Eurasian Tree Sparrow	<i>Passer montanus</i>	12	0.003144654	- 5.76205	- 0.01812
267	White Wagtail	<i>Motacilla alba</i>	5	0.001310273	- 6.63752	-0.0087
268	Citrine Wagtail	<i>Motacilla citreola</i>	8	0.002096436	- 6.16752	- 0.01293
269	Yellow Wagtail	<i>Motacilla flava</i>	14	0.003668763	-5.6079	- 0.02057
270	Grey Wagtail	<i>Motacilla cinerea</i>	19	0.004979036	- 5.30252	-0.0264
271	Paddyfield Pipit	<i>Anthus rufulus</i>	8	0.002096436	- 6.16752	- 0.01293
272	Richard's Pipit	<i>Anthus richardi</i>	5	0.001310273	- 6.63752	-0.0087
273	Olive-backed Pipit	<i>Anthus hodgsoni</i>	19	0.004979036	- 5.30252	-0.0264

274	Rosy Pipit	<i>Anthus roseatus</i>	9	0.002358491	-	-
275	Baya Weaver	<i>Ploceus philippinus</i>	3	0.000786164	-	-
276	Red Avadavat	<i>Amandava amandava</i>	8	0.002096436	-	-
277	White-rumped Munia	<i>Lonchura striata</i>	18	0.004716981	-	-
278	Scaly-breasted Munia	<i>Lonchura punctulata</i>	25	0.006551363	-	-
	<b>Fringillidae</b>			0		
279	Crested Bunting	<i>Melophus Iothami</i>	4	0.001048218	-	-
280	Common Rosefinch	<i>Carpodacus erythrinus</i>	36	0.009433962	-	-
281	Yellow-breasted Bunting	<i>Emberiza aureola</i>	1	0.000262055	-	-
	<b>Total</b>		<b>3816</b>	<b>1</b>	-	-
					<b>1838.39</b>	<b>4.49764</b>
<b>Birds of Spring Season</b>						
S.no.	<b>Order/Family/Common Name/Scientific Name</b>		<b>No.</b>			

			<b>of Birds</b>			
	<b>GALLIFORMES</b>					
	<b>Phasianidae</b>			Pi	lnPi	Pi* lnPi
1	Black Francolin	<i>Francolinus francolinus</i>	6	0.00278 6	-5.88332	-0.01639
2	Indian Peafowl	<i>Pavo cristatus</i>	19	0.00882 1	-4.73064	-0.04173
3	Kalij Pheasant	<i>Lophura leucomelanos</i>	2	0.00092 9	-6.98193	-0.00648
4	Red Junglefowl	<i>Gallus gallus</i>	1	0.00046 4	-7.67508	-0.00356
	<b>ANSERIFORMES</b>					
	<b>Dendrocygnidae</b>					
5	Lesser Whistling Duck	<i>Dendrocygna javanica</i>	20	0.00928 5	-4.67935	-0.04345
	<b>PICIFORMES</b>					
	<b>Picidae</b>					
6	Grey-capped Pygmy Woodpecker	<i>Dendrocopos canicapillus</i>	1	0.00046 4	-7.67508	-0.00356
7	Fulvous-breasted Woodpecker	<i>Dendrocopos macei</i>	4	0.00185	-6.28879	-0.01168

				7		
8	Rufous Woodpecker	<i>Celeus brachyurus</i>	7	0.00325	-5.72917	-0.01862
9	Lesser Yellownape	<i>Picus chlorolophus</i>	10	0.00464		
				3	-5.3725	-0.02494
10	Streak-throated Woodpecker	<i>Picus xanthopygaeus</i>	1	0.00046		
				4	-7.67508	-0.00356
11	Grey-headed Woodpecker	<i>Picus canus</i>	3	0.00139		
				3	-6.57647	-0.00916
12	Himalayan Flameback	<i>Dinopium shorii</i>	11	0.00510		
				7	-5.27719	-0.02695
13	Greater Flameback	<i>Chrysocolaptes lucidus</i>	1	0.00046		
				4	-7.67508	-0.00356
14	Black-rumped Flameback	<i>Dinopium benghalense</i>	9	0.00417		
				8	-5.47786	-0.02289
15	Great Slaty Woodpecker	<i>Mulleripicus pulverulentus</i>	2	0.00092		
				9	-6.98193	-0.00648
	<b>Megalaimidae</b>					
16	Lineated Barbet	<i>Megalaima lineate</i>	2	0.00092		
				9	-6.98193	-0.00648
17	Blue-throated Barbet	<i>Megalaima asiatica</i>	6	0.00278		
				6	-5.88332	-0.01639
18	Coppersmith Barbet	<i>Megalaima</i>	4	0.00185	-6.28879	-0.01168



		<i>haemacephala</i>		7		
	<b>BUCEROTIFORMES</b>					
	<b>Bucerotidae</b>					
19	Oriental Pied-Hornbill	<i>Anthracoceros albirostris</i>	8	0.00371		
				4	-5.59564	-0.02078
	<b>UPUPIFORMES</b>			0		
	<b>Upupidae</b>			0		
20	Common Hoopoe	<i>Upupa epos</i>	1	0.00046		
				4	-7.67508	-0.00356
	<b>TROGONIFORMES</b>			0		
	<b>Trogonidae</b>			0		
21	Red-headed Trogon	<i>Harpactes erythrocephalus</i>	7			
				0.00325	-5.72917	-0.01862
	<b>CORACIFORMES</b>			0		
	<b>Coraciidae</b>			0		
22	Indian Roller	<i>Coracias benghalensis</i>	5	0.00232		
				1	-6.06564	-0.01408
	<b>Alcedinidae</b>			0		
23	Common Kingfisher	<i>Alcedo atthis</i>	1	0.00046		
				4	-7.67508	-0.00356
	<b>Hylcyonidae</b>			0		
24	Stork-billed Kingfisher	<i>Halcyon capensis</i>	1	0.00046	-7.67508	-0.00356

				4		
	<b>Meropidae</b>			0		
25	Blue-bearded Bee-eater	<i>Myctornis athertoni</i>	6	0.00278		
				6	-5.88332	-0.01639
26	Green Bee-eater	<i>Merops orientalis</i>	2	0.00092		
				9	-6.98193	-0.00648
27	Chestnut-headed Bee-eater	<i>Merops leschenaulti</i>	2	0.00092		
				9	-6.98193	-0.00648
	<b>CUCULIFORMES</b>			0		
	<b>Cuculidae</b>			0		
28	Common Hawk Cuckoo	<i>Hierococcyx varius</i>	2	0.00092		
				9	-6.98193	-0.00648
	<b>Centropodidae</b>			0		
29	Greater Coucal	<i>Centropus sinensis</i>	9	0.00417		
				8	-5.47786	-0.02289
30	Lesser Coucal	<i>Centropus bengalensis</i>	8	0.00371		
				4	-5.59564	-0.02078
	<b>PSITTACEFORMES</b>			0		
	<b>Psittacidae</b>			0		
31	Alexandrine Parakeet	<i>Psittacula eupatria</i>	14	0.0065	-5.03602	-0.03273
32	Rose-ringed Parakeet	<i>Psittacula krameri</i>	11	0.00510		
				7	-5.27719	-0.02695

33	Slaty-headed Parakeet	<i>Psittacula himalayana</i>	298	0.13834	7	-1.97799	-0.27365
34	Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	18	0.00835	7	-4.78471	-0.03998
35	Red-breasted Parakeet	<i>Psittacula alexandri</i>	12	0.00557	1	-5.19018	-0.02891
	<b>APODIFORMES</b>			0			
	<b>Apodidae</b>			0			
36	White-rumped Spinetail	<i>Zoonavena sylvatica</i>	9	0.00417	8	-5.47786	-0.02289
37	House Swift	<i>Apus affinis</i>	2	0.00092	9	-6.98193	-0.00648
38	Fork-tailed Swift	<i>Apus pacificus</i>	1	0.00046	4	-7.67508	-0.00356
	<b>Hemiprocynidae</b>			0			
39	Crested Treeswift	<i>Hemiprocne coronate</i>	18	0.00835	7	-4.78471	-0.03998
	<b>STRIGIFORMES</b>			0			
	<b>Strigidae</b>			0			
40	Oriental Scops Owl	<i>Otus sunia</i>	8	0.00371	4	-5.59564	-0.02078
41	Brown Hawk-Owl	<i>Ninox scutulata</i>	11	0.00510	5	-5.27719	-0.02695

				7		
42	Jungle Owlet	<i>Glaucidium radiatum</i>	9	0.00417	-5.47786	-0.02289
				8		
43	Spotted Owlet	<i>Athene brama</i>	2	0.00092	-6.98193	-0.00648
				9		
	<b>Caprimulgidae</b>			0		
44	Large-tailed Nightjar	<i>Caprimulgus macrurus</i>	10	0.00464	-5.3725	-0.02494
				3		
45	Savanna Nightjar	<i>Caprimulgus affinis</i>	8	0.00371	-5.59564	-0.02078
				4		
	<b>COLUMBIFORMES</b>			0		
	<b>Columbidae</b>			0		
46	Rock Pigeon	<i>Columba livia</i>	34	0.01578	-4.14872	-0.06549
				5		
47	Common Wood Pigeon	<i>Columba palumbus</i>	1	0.00046	-7.67508	-0.00356
				4		
48	Orange-breasted Green Pigeon	<i>Treron bicincta</i>	5	0.00232	-6.06564	-0.01408
				1		
49	Yellow-footed Green Pigeon	<i>Treron phoenicoptera</i>	9	0.00417	-5.47786	-0.02289
				8		
50	Oriental Turtle Dove	<i>Streptopelia orientalis</i>	33	0.01532	-4.17857	-0.06402
51	Spotted Dove	<i>Streptopelia chinensis</i>	10	0.00464	-5.3725	-0.02494

				3		
52	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	6	0.00278 6	-5.88332	-0.01639
53	Emerald Dove	<i>Chalcophaps indica</i>	9	0.00417 8	-5.47786	-0.02289
54	Red Collared Dove	<i>Streptopelia tranquebarica</i>	2	0.00092 9	-6.98193	-0.00648
	<b>GRUIFORMES</b>			0		
	<b>Otididae</b>			0		
55	Bengal Florican	<i>Houbaropsis bengalensis</i>	1	0.00046 4	-7.67508	-0.00356
	<b>Gruidae</b>			0		
56	Demoiselle Crane	<i>Grus virgo</i>	5	0.00232 1	-6.06564	-0.01408
	<b>Rallidae</b>			0		
57	Brown Crake	<i>Amaurornis akool</i>	9	0.00417 8	-5.47786	-0.02289
58	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	1	0.00046 4	-7.67508	-0.00356
59	Ruddy-breasted Crake	<i>Porzana fusca</i>	2	0.00092 9	-6.98193	-0.00648
60	Slaty-breasted Rail	<i>Gallirallus siriatus</i>	1	0.00046	-7.67508	-0.00356

				4		
	<b>CICONIFORMES</b>			0		
	<b>Scolopacidae</b>			0		
61	Common Snipe	<i>Gallinago gallinago</i>	2	0.00092		
				9	-6.98193	-0.00648
62	Common Greenshank	<i>Tringa nebularia</i>	7	0.00325	-5.72917	-0.01862
63	Green Sandpiper	<i>Tringa ochropus</i>	4	0.00185		
				7	-6.28879	-0.01168
64	Common Sandpiper	<i>Actitis hypoleucos</i>	1	0.00046		
				4	-7.67508	-0.00356
65	Pintail Snipe	<i>Gallinago stenura</i>	3	0.00139		
				3	-6.57647	-0.00916
66	Wood Sandpiper	<i>Tringa glareola</i>	7	0.00325	-5.72917	-0.01862
67	Little Stint	<i>Calidris minuta</i>	11	0.00510		
				7	-5.27719	-0.02695
68	Temminck's Stint	<i>Calidris temminckii</i>	45	0.02089		
				1	-3.86842	-0.08082
	<b>Jacaniidae</b>			0		
69	Bronze-winged Jacona	<i>Metapidus indicus</i>	1	0.00046		
				4	-7.67508	-0.00356
	<b>Burhimidae</b>			0		
70	Eurasian Thick-knee	<i>Burhinus oedicnemus</i>	3	0.00139	-6.57647	-0.00916

				3		
	<b>Charadriidae</b>			0		
71	Little Ringed Plover	<i>Charadrius dubius</i>	6	0.00278		
				6	-5.88332	-0.01639
72	River Lapwing	<i>Vanellus duvaucelli</i>	3	0.00139		
				3	-6.57647	-0.00916
73	Red-wattled Lapwing	<i>Vanellus indicus</i>	2	0.00092		
				9	-6.98193	-0.00648
	<b>Glareolidae</b>			0		
74	Little Pratincole	<i>Glareola lactea</i>	4	0.00185		
				7	-6.28879	-0.01168
	<b>Laridae</b>			0		
75	Black-headed Gull	<i>Larus ridibundus</i>	1	0.00046		
				4	-7.67508	-0.00356
76	Brown-headed Gull	<i>Larus brunnicephalus</i>	1	0.00046		
				4	-7.67508	-0.00356
77	White-winged Tern	<i>Chlidonias leucopterus</i>	1	0.00046		
				4	-7.67508	-0.00356
	<b>Accipitridae</b>			0		
78	Osprey	<i>Pandion haliaetus</i>	2	0.00092		
				9	-6.98193	-0.00648
79	Oriental Honey-buzzard	<i>Pernis ptilorhyncus</i>	2	0.00092		
				9	-6.98193	-0.00648

				9		
80	Common Buzzard	<i>Buteo buteo</i>	1	0.00046 4	-7.67508	-0.00356
81	Black-shouldered Kite	<i>Elanus caeruleus</i>	9	0.00417 8	-5.47786	-0.02289
82	Black Kite	<i>Milvus migrans</i>	2	0.00092 9	-6.98193	-0.00648
83	Grey-headed Fish Eagle	<i>Ichthyophaga ichthyaetus</i>	2	0.00092 9	-6.98193	-0.00648
84	Crested Serpent Eagle	<i>Spilornis cheela</i>	3	0.00139 3	-6.57647	-0.00916
85	Black Eagle	<i>Ictinaetus malayensis</i>	2	0.00092 9	-6.98193	-0.00648
86	Changeable Hawk Eagle	<i>Spizaetus nepalensis</i>	4	0.00185 7	-6.28879	-0.01168
87	Crested Goshawk	<i>Accipiter trivirgatus</i>	2	0.00092 9	-6.98193	-0.00648
88	Shikra	<i>Acceipiter badius</i>	4	0.00185 7	-6.28879	-0.01168
89	Himalayan Griffon	<i>Gyps himalayensis</i>	2	0.00092 9	-6.98193	-0.00648
90	Upland Buzzard	<i>Buteo hemilasius</i>	1	0.00046	-7.67508	-0.00356



				4		
	<b>Falconidae</b>			0		
91	Collared Falconer	<i>Microhierax caerulescens</i>	8	0.00371 4	-5.59564	-0.02078
92	Common Kestrel	<i>Falco tinnunculus</i>	4	0.00185 7	-6.28879	-0.01168
	<b>Anhingidae</b>			0		
93	Oriental Darter	<i>Anhinga melanogaster</i>	9	0.00417 8	-5.47786	-0.02289
	<b>Phalacrocoracidae</b>			0		
94	Great Cormorant	<i>Phalacrocorax carbo</i>	75	0.03481 9	-3.35759	-0.11691
	<b>Ardeidae</b>			0		
95	Little Egret	<i>Egretta garzetta</i>	9	0.00417 8	-5.47786	-0.02289
96	Grey Heron	<i>Ardea cinerea</i>	5	0.00232 1	-6.06564	-0.01408
97	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	5	0.00232 1	-6.06564	-0.01408
98	Indian Pond Heron	<i>Ardeola grayii</i>	2	0.00092 9	-6.98193	-0.00648
99	Great Egret	<i>Casmerodius albus</i>	3	0.00139	-6.57647	-0.00916

				3		
100	Intermediate Egret	<i>Mesophoyx intermedia</i>	4	0.00185 7	-6.28879	-0.01168
101	Cattle Egret	<i>Bubulcus ibis</i>	4	0.00185 7	-6.28879	-0.01168
102	Little Heron	<i>Butorides striatus</i>	1	0.00046 4	-7.67508	-0.00356
103	Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i>	2	0.00092 9	-6.98193	-0.00648
	<b>Threskiornithidae</b>			0		
104	Black Ibis	<i>Pseudibis papillosa</i>	6	0.00278 6	-5.88332	-0.01639
	<b>Ciconidae</b>			0		
106	Asian Openbill	<i>Anastomus oscitans</i>	5	0.00232 1	-6.06564	-0.01408
107	Black Stork	<i>Ciconia nigra</i>	16	0.00742 8	-4.90249	-0.03642
108	White Stork	<i>Ciconia ciconia</i>	1	0.00046 4	-7.67508	-0.00356
109	Woolly-necked Stork	<i>Ciconia episcopus</i>	2	0.00092 9	-6.98193	-0.00648
110	Lesser Adjutant	<i>Leptoptilos javanicus</i>	2	0.00092	-6.98193	-0.00648

				9		
	<b>PASSERIFORMES</b>			0		
	<b>Irenidae</b>			0		
111	Golden-fronted Leaf bird	<i>Chloropsis auriformes</i>	2	0.00092		
				9	-6.98193	-0.00648
112	Orange-bellied Leaf bird	<i>Chloropsis hardwickii</i>	8	0.00371		
				4	-5.59564	-0.02078
	<b>Laniidae</b>			0		
113	Long-tailed Shrike	<i>Lanius schach</i>	11	0.00510		
				7	-5.27719	-0.02695
	<b>Corvidae</b>			0		
114	Red-billed Blue Magpie	<i>Urocissa erythrorthyncha</i>	8	0.00371		
				4	-5.59564	-0.02078
115	Rufous Treepie	<i>Dendrocitta vagabunda</i>	4	0.00185		
				7	-6.28879	-0.01168
116	House Crow	<i>Corvus splendens</i>	3	0.00139		
				3	-6.57647	-0.00916
117	Large-billed Crow	<i>Corvus macrorhynchos</i>	110	0.05106		
				8	-2.9746	-0.15191
118	Ashy Woodswallow	<i>Artamus fuscus</i>	9	0.00417		
				8	-5.47786	-0.02289
119	Maroon Oriole	<i>Oriolus traillii</i>	2	0.00092		
					-6.98193	-0.00648

				9		
120	Eurasian Golden Oriole	<i>Oriolus oriolus</i>	5	0.00232		
				1	-6.06564	-0.01408
121	Black-hooded Oriole	<i>Oriolus xanthornus</i>	6	0.00278		
				6	-5.88332	-0.01639
122	Small Minivet	<i>Pericrocotus cinnamomeus</i>	11	0.00510		
				7	-5.27719	-0.02695
123	Rosy Minivet	<i>Pericrocotus roseus</i>	5	0.00232		
				1	-6.06564	-0.01408
124	Scarlet Minivet	<i>Pericrocotus flammeus</i>	1	0.00046		
				4	-7.67508	-0.00356
125	Long-tailed Minivet	<i>Pericrocotus ethologus</i>	16	0.00742		
				8	-4.90249	-0.03642
126	Bar-winged Flycatcher-shrike	<i>Hemipus picatus</i>	4	0.00185		
				7	-6.28879	-0.01168
127	White-throated Fantail	<i>Rhipidura albicollis</i>	6	0.00278		
				6	-5.88332	-0.01639
128	Black Drongo	<i>Dicrurus macrocercus</i>	12	0.00557		
				1	-5.19018	-0.02891
129	Ashy Drongo	<i>Dicrurus leucophaeus</i>	46	0.02135		
				6	-3.84644	-0.08214
130	White-bellied Drongo	<i>Dicrurus caerulescens</i>	2	0.00092		
					-6.98193	-0.00648

				9		
131	Bronzed Drongo	<i>Dicrurus aeneus</i>	15	0.00696		
				4	-4.96703	-0.03459
132	Lesser Racket-tailed Drongo	<i>Dicrurus remifer</i>	2	0.00092		
				9	-6.98193	-0.00648
133	Spangled Drongo	<i>Dicrurus hottentottus</i>	2	0.00092		
				9	-6.98193	-0.00648
134	Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>	2	0.00092		
				9	-6.98193	-0.00648
135	Common Iora	<i>Aegithina tiphia</i>	2	0.00092		
				9	-6.98193	-0.00648
136	Common Woodshrike	<i>Tephrodomis pondicenanus</i>	7			
				0.00325	-5.72917	-0.01862
	<b>Muscicapidae</b>			0		
137	Blue Whistling Thrush	<i>Myophonus caeruleus</i>	17	0.00789		
				2	-4.84187	-0.03821
138	Blue-capped Rock Thrush	<i>Monticola cinclorhynchus</i>	2	0.00092		
				9	-6.98193	-0.00648
139	Rufous-gorgeted Flycatcher	<i>Ficedula strophciata</i>	2	0.00092		
				9	-6.98193	-0.00648
140	Pale-chinned Flycatcher	<i>Cyornis poliogenys</i>	15	0.00696		
				4	-4.96703	-0.03459

141	Grey-headed Canary Flycatcher	<i>Culicicapa ceylonensis</i>	25	0.01160 6	-4.45621	-0.05172
142	Pale-Blue Flycatcher	<i>Cyornis unicolor</i>	3	0.00139 3	-6.57647	-0.00916
143	Asian-Brown Flycatcher	<i>Muscicapaga dauurica</i>	2	0.00092 9	-6.98193	-0.00648
144	Verditer Flycatcher	<i>Eumyias thalassina</i>	8	0.00371 4	-5.59564	-0.02078
145	Blue-throated Flycatcher	<i>Cyornis rubeculoides</i>	5	0.00232 1	-6.06564	-0.01408
146	Oriental Magpie Robin	<i>Copsychus saularis</i>	4	0.00185 7	-6.28879	-0.01168
147	White-rumped Shama	<i>Copsychus malabaricus</i>	11	0.00510 7	-5.27719	-0.02695
148	Black Redstart	<i>Phoenicurus ochruros</i>	6	0.00278 6	-5.88332	-0.01639
149	White-tailed Stonechat	<i>Saxicola leucura</i>	9	0.00417 8	-5.47786	-0.02289
150	Pied Bushcaht	<i>Saxicola caprata</i>	11	0.00510 7	-5.27719	-0.02695
151	Grey Bushchat	<i>Saxicola ferrea</i>	2	0.00092 9	-6.98193	-0.00648

152	Siberian Rubythroat	<i>Luscinia colliope</i>	5	0.00232		
				1	-6.06564	-0.01408
153	White-tailed Rubythroat	<i>Luscinia pect oralis</i>	8	0.00371		
				4	-5.59564	-0.02078
154	Bluethroat	<i>Luscinia svecica</i>	7	0.00325	-5.72917	-0.01862
	<b>Sturnidae</b>			0		
156	Brahminy Starling	<i>Sturnus pagodarum</i>	3	0.00139		
				3	-6.57647	-0.00916
157	Asian Pied Starling	<i>Sturnus contra</i>	9	0.00417		
				8	-5.47786	-0.02289
158	Chestnut-tailed Starling	<i>Sturnus malabaricus</i>	7	0.00325	-5.72917	-0.01862
159	Common Myna	<i>Acridotheres tristis</i>	6	0.00278		
				6	-5.88332	-0.01639
160	Jungle Myna	<i>Acridotheres fuscus</i>	4	0.00185		
				7	-6.28879	-0.01168
	<b>Sittidae</b>			0		
161	Chestnut-bellied Nuthatch	<i>Sitta castanea</i>	1	0.00046		
				4	-7.67508	-0.00356
162	Velvet-fronted Nuthatch	<i>Sitta frontalis</i>	4	0.00185		
				7	-6.28879	-0.01168
	<b>Paridae</b>			0		
163	Great Tit	<i>Parus major</i>	1	0.00046	-7.67508	-0.00356

				4		
	<b>Hirundinidae</b>			0		
164	Plain Martin	<i>Ripuria paludicola</i>	18	0.00835		
				7	-4.78471	-0.03998
165	Barn Swallow	<i>Hirundo rustica</i>	8	0.00371		
				4	-5.59564	-0.02078
166	Sand Martin	<i>Riparia riapria</i>	1	0.00046		
				4	-7.67508	-0.00356
167	Red-rumped Swallow	<i>Hirundo daurica</i>	10	0.00464		
				3	-5.3725	-0.02494
	<b>Pyconotidae</b>			0		
168	Black-crested Bulbul	<i>Pycnonotus melanicterus</i>	9	0.00417		
				8	-5.47786	-0.02289
169	Black Bulbul	<i>Hysipetes leucocephalus</i>	118	0.05478		
				2	-2.9044	-0.15911
170	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	14	0.0065		
					-5.03602	-0.03273
171	Himalayan Bulbul	<i>Pycnonotus leucogenys</i>	98	0.04549		
				7	-3.09011	-0.14059
172	Red-vented Bulbul	<i>Pycnonotus cafer</i>	4	0.00185		
				7	-6.28879	-0.01168
	<b>Cisticolidae</b>			0		
173	Zitting Cisticola	<i>Cisticola juncidis</i>	2	0.00092		
					-6.98193	-0.00648



				9		
174	Striated Prinia	<i>Prinia criniger</i>	7	0.00325	-5.72917	-0.01862
175	Grey-crowned Prinia	<i>Prinia cinereocapilla</i>	5	0.00232		
				1	-6.06564	-0.01408
176	Grey-breasted Prinia	<i>Prinia hodgsonii</i>	14	0.0065	-5.03602	-0.03273
177	Jungle Prinia	<i>Prinia sylvatica</i>	1	0.00046		
				4	-7.67508	-0.00356
178	Yellow-bellied Prinia	<i>Prinia flaviventris</i>	4	0.00185		
				7	-6.28879	-0.01168
179	Plain Prinia	<i>Prinia inornata</i>	2	0.00092		
				9	-6.98193	-0.00648
	<b>Zosteropidae</b>			0		
180	Oriental White-eye	<i>Zosterops paepobrosus</i>	51	0.02367		
				7	-3.74326	-0.08863
	<b>Sylviidae</b>			0		
181	Blyth's Leaf Warbler	<i>Phylloscapus reguloides</i>	1	0.00046		
				4	-7.67508	-0.00356
182	Paddyfield Warbler	<i>Acrocephalus agricola</i>	4	0.00185		
				7	-6.28879	-0.01168
183	Smoky Warbler	<i>Phylloscapus fuligiventer</i>	5	0.00232		
				1	-6.06564	-0.01408
184	Pale-footed Bush Warbler	<i>Cettia pallidipes</i>	1	0.00046	-7.67508	-0.00356

				4			
185	Aberrant Bush Warbler	<i>Cettia flavolivacea</i>	6	0.00278	6	-5.88332	-0.01639
186	Blyth's Reed Warbler	<i>Acrocephalus dumetorum</i>	1	0.00046	4	-7.67508	-0.00356
187	Tickell's Leaf Warbler	<i>Phylloscapus affinis</i>	4	0.00185	7	-6.28879	-0.01168
188	Lemon-rumped Warbler	<i>Phylloscapus chloronotus</i>	5	0.00232	1	-6.06564	-0.01408
189	Greenish Warbler	<i>Phylloscapus trochiloides</i>	5	0.00232	1	-6.06564	-0.01408
190	Whistler's Warbler	<i>Seicercus whistleri</i>	4	0.00185	7	-6.28879	-0.01168
191	Grey-hooded Warbler	<i>Seicercus xanthachistos</i>	14	0.0065		-5.03602	-0.03273
192	Chestnut-crowned Warbler	<i>Seicercus castaniceps</i>	9	0.00417	8	-5.47786	-0.02289
193	Common Tailorbird	<i>Orthotomus sutorius</i>	7	0.00325		-5.72917	-0.01862
194	Bristled Grassbird	<i>Chaetornis striatus</i>	1	0.00046	4	-7.67508	-0.00356
195	Rufous-rumped Grassbird	<i>Graminicola bengalensis</i>	4	0.00185	7	-6.28879	-0.01168
196	White-throated Laughingthrush	<i>Garrulax albogularis</i>	1	0.00046		-7.67508	-0.00356

				4		
197	White-crested Laughingthrush	<i>Garrulax leucolophus</i>	3	0.00139 3	-6.57647	-0.00916
198	Lesser Necklaced Laughingthrush	<i>Garrulax monileger</i>	12	0.00557 1	-5.19018	-0.02891
199	Greater Necklaced Laughingthrush	<i>Garrulax pectoralis</i>	3	0.00139 3	-6.57647	-0.00916
200	Puff-throated Babbler	<i>Pellorneum ruficeps</i>	19	0.00882 1	-4.73064	-0.04173
201	White-browed Scimitar Babbler	<i>Pamatorhinus schisticeps</i>	3	0.00139 3	-6.57647	-0.00916
202	Striped Tit Babbler	<i>Macronous gularis</i>	18	0.00835 7	-4.78471	-0.03998
203	Chestnut-capped Babbler	<i>Timalia pileata</i>	4	0.00185 7	-6.28879	-0.01168
204	Yellow-eyed Babbler	<i>Chrysomma sinense</i>	4	0.00185 7	-6.28879	-0.01168
205	Spiny Babbler	<i>Turdoides nipalensis</i>	1	0.00046 4	-7.67508	-0.00356
206	Striated Babbler	<i>Turdoides earlei</i>	15	0.00696 4	-4.96703	-0.03459
207	Jungle Babbler	<i>Turdoides striatus</i>	8	0.00371	-5.59564	-0.02078

				4		
208	Eurasian Woodcock	<i>Scolopax rusticola</i>	1	0.00046		
				4	-7.67508	-0.00356
209	Himalayan Cutia	<i>Cutia nipalensis</i>	1	0.00046		
				4	-7.67508	-0.00356
	<b>Alaudidae</b>			0		
210	Rufous-winged Bushlark	<i>Mirafra assamica</i>	9	0.00417		
				8	-5.47786	-0.02289
211	Ashy-crowned Sparrow Lark	<i>Eremopterix grisea</i>	3	0.00139		
				3	-6.57647	-0.00916
212	Sand Lark	<i>Calandrella roytal</i>	3	0.00139		
				3	-6.57647	-0.00916
	<b>Nectariniidae</b>			0		
213	Pale-billed Flowerpecker	<i>Dicaeum erythrorhynchos</i>	5	0.00232		
				1	-6.06564	-0.01408
214	Crimson Sunbird	<i>Anthreptes siparaja</i>	2	0.00092		
				9	-6.98193	-0.00648
215	Purple Sunbird	<i>Anthreptes asiatica</i>	4	0.00185		
				7	-6.28879	-0.01168
216	Streaked Spiderhunter	<i>Archnothera magna</i>	8	0.00371		
				4	-5.59564	-0.02078
	<b>Passeridae</b>					

217	House Sparrow	<i>Passer domesticus</i>	10	0.00464	3	-5.3725	-0.02494
218	Eurasian Tree Sparrow	<i>Passer montanus</i>	24	0.01114	2	-4.49703	-0.05011
219	Chestnut-shouldered Petronia	<i>Petronia xanthocollis</i>	4	0.00185	7	-6.28879	-0.01168
220	Citrine Wagtail	<i>Motacilla citreola</i>	1	0.00046	4	-7.67508	-0.00356
221	Yellow Wagtail	<i>Motacilla flava</i>	4	0.00185	7	-6.28879	-0.01168
222	Grey Wagtail	<i>Motacilla cinerea</i>	5	0.00232	1	-6.06564	-0.01408
223	Paddyfield Pipit	<i>Anthus rufulus</i>	7	0.00325	7	-5.72917	-0.01862
224	Richard's Pipit	<i>Anthus richardi</i>	4	0.00185	7	-6.28879	-0.01168
225	Olive-backed Pipit	<i>Anthus hodgsoni</i>	4	0.00185	7	-6.28879	-0.01168
226	Black-breasted Weaver	<i>Ploceus benghalensis</i>	3	0.00139	3	-6.57647	-0.00916
227	Tawny Pipit	<i>Anthus campestris</i>	2	0.00092	9	-6.98193	-0.00648
228	Baya Weaver	<i>Ploceus philippinus</i>	7	0.00325	7	-5.72917	-0.01862

229	Scaly-breasted Munia	<i>Lonchura punctulata</i>	8	0.00371		
				4	-5.59564	-0.02078
230	Black-headed Munia	<i>Lonchura Malacca</i>	1	0.00046		
				4	-7.67508	-0.00356
	<b>Fringillidae</b>					
231	Common Rosefinch	<i>Carpodacus erythrinus</i>	7	0.00325	-5.72917	-0.01862
	<b>Total</b>		<b>2154</b>	<b>1</b>	<b>-1411.63</b>	<b>-4.47738</b>
<b>Birds of Summer season</b>						
	<b>Order/Family/Common Name/Scientific Name</b>		<b>No.O f Birds</b>			
	<b>GALLIFORMES</b>					
	<b>Phasianidae</b>			Pi	lnPi	Pi*lnPi
1	Black Francolin	<i>Francolinus francolinus</i>	12	0.009615	-4.64439	-0.04466
2	Indian Peafowl	<i>Pavo cristatus</i>	3	0.002404	-6.03069	-0.0145
3	Kalij Pheasant	<i>Lophura leucomelanos</i>	5	0.004006	-5.51986	-0.02211
4	Red Junglefowl	<i>Gallus gallus</i>	3	0.002404	-6.03069	-0.0145
	<b>ANSERIFORMES</b>			0		
	<b>Dendrocygnidae</b>			0		
5	Lesser Whistling Duck	<i>Dendrocygna javanica</i>	18	0.014423	-4.23893	-0.06114

	<b>PICIFORMES</b>			0		
	<b>Picidae</b>			0		
6	Grey-capped Pygmy Woodpecker	<i>Dendrocopos canicapillus</i>	2	0.001603	-6.43615	-0.01031
7	Fulvous-breasted Woodpecker	<i>Dendrocopos macei</i>	3	0.002404	-6.03069	-0.0145
8	Lesser Yellownape	<i>Picus chlorolophus</i>	3	0.002404	-6.03069	-0.0145
9	Streak-throated Woodpecker	<i>Picus xanthopygaeus</i>	3	0.002404	-6.03069	-0.0145
10	Grey-headed Woodpecker	<i>Picus canus</i>	2	0.001603	-6.43615	-0.01031
11	Himalayan Flameback	<i>Dinopium shorii</i>	1	0.000801	-7.1293	-0.00571
12	Greater Flameback	<i>Chrysocolaptes lucidus</i>	1	0.000801	-7.1293	-0.00571
13	Black-rumped Flameback	<i>Dinopium benghalense</i>	2	0.001603	-6.43615	-0.01031
	<b>Megalaimidae</b>			0		
14	Lineated Barbet	<i>Megalaima lineate</i>	1	0.000801	-7.1293	-0.00571
15	Blue-throated Barbet	<i>Megalaima asiatica</i>	5	0.004006	-5.51986	-0.02211
16	Coppersmith Barbet	<i>Megalaima haemacephala</i>	2	0.001603	-6.43615	-0.01031
	<b>BUCEROTIFORMES</b>			0		
	<b>Bucerotidae</b>			0		
17	Oriental Pied-Hornbill	<i>Anthracoceros albirostris</i>	2	0.001603	-6.43615	-0.01031
	<b>UPUPIFORMS</b>			0		
	<b>Upupidae</b>			0		
18	Common Hoopoe	<i>Upupa epos</i>	5	0.004006	-5.51986	-0.02211
	<b>TROGONIFORMES</b>			0		

	<b>Trogonidae</b>			0		
19	Red-headed Trogon	<i>Harpactes erythrocephalus</i>	1	0.000801	-7.1293	-0.00571
	<b>CORACIFORMES</b>			0		
	<b>Coraciidae</b>			0		
20	Indian Roller	<i>Coracias benghalensis</i>	1	0.000801	-7.1293	-0.00571
21	Dollar bird	<i>Eurystomus orientalis</i>	9	0.007212	-4.93207	-0.03557
	<b>Alcedinidae</b>			0		
22	Common Kingfisher	<i>Alcedo atthis</i>	3	0.002404	-6.03069	-0.0145
	<b>Hylecyonidae</b>			0		
23	Stork-billed Kingfisher	<i>Halcyon capensis</i>	2	0.001603	-6.43615	-0.01031
	<b>Meropidae</b>			0		
24	Blue-bearded Bee-eater	<i>Myctyornis athertoni</i>	9	0.007212	-4.93207	-0.03557
25	Green Bee-eater	<i>Merops orientalis</i>	12	0.009615	-4.64439	-0.04466
26	Blue-tailed Bee-eater	<i>Merops philippinus</i>	8	0.00641	-5.04986	-0.03237
27	Chestnut-headed Bee-eater	<i>Merops leschenaulti</i>	13	0.010417	-4.56435	-0.04755
	<b>CUCULIFORMES</b>			0		
	<b>Cuculidae</b>			0		
28	Pied Cuckoo	<i>Clamator jacobinus</i>	18	0.014423	-4.23893	-0.06114
29	Plaintive Cuckoo	<i>Cacomantis merulinus</i>	1	0.000801	-7.1293	-0.00571
30	Chestnut-winged Cuckoo	<i>Clamator coromandus</i>	18	0.014423	-4.23893	-0.06114
31	Common Hawk Cuckoo	<i>Hierococcyx varius</i>	1	0.000801	-7.1293	-0.00571
32	Grey-bellied Cuckoo	<i>Cacomantis passerinus</i>	2	0.001603	-6.43615	-0.01031



33	Indian Cuckoo	<i>Cuculus micropterus</i>	25	0.020032	-3.91042	-0.07833
34	Eurasian Cuckoo	<i>Cuculus canorus</i>	18	0.014423	-4.23893	-0.06114
35	Drongo Cuckoo	<i>Surniculus lugubris</i>	23	0.018429	-3.9938	-0.0736
36	Asian Koel	<i>Eudynamys scolopacea</i>	15	0.012019	-4.42125	-0.05314
37	Green-billed Malkoha	<i>Phaenicophaeus tristis</i>	2	0.001603	-6.43615	-0.01031
	<b>Centropodidae</b>			0		
38	Greater Coucal	<i>Centropus sinesis</i>	2	0.001603	-6.43615	-0.01031
39	Lesser Coucal	<i>Centropus bengalensis</i>	2	0.001603	-6.43615	-0.01031
	<b>PSITTACEFORMES</b>			0		
	<b>Psittacidae</b>			0		
40	Alexandrine Parakeet	<i>Psittacula eupatria</i>	2	0.001603	-6.43615	-0.01031
41	Rose-ringed Parakeet	<i>Psittacula krameri</i>	2	0.001603	-6.43615	-0.01031
42	Slaty-headed Parakeet	<i>Psittacula himalayana</i>	78	0.0625	-2.77259	-0.17329
43	Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	1	0.000801	-7.1293	-0.00571
44	Red-breasted Parakeet	<i>Psittacula alexandri</i>	2	0.001603	-6.43615	-0.01031
	<b>APODIFORMES</b>			0		
	<b>Apodidae</b>			0		
45	White-throated Needletail	<i>Hirundapus caudacutus</i>	2	0.001603	-6.43615	-0.01031
46	House Swift	<i>Apus affinis</i>	1	0.000801	-7.1293	-0.00571
47	Crested Treeswift	<i>Hemiprocne coronate</i>	14	0.011218	-4.49024	-0.05037
	<b>STRIGIFORMES</b>			0		
	<b>Strigidae</b>			0		

48	Brown Fish Owl	<i>Ketupa zeylonensis</i>	7	0.005609	-5.18339	-0.02907
49	Jungle Owlet	<i>Glaucidium radiatum</i>	1	0.000801	-7.1293	-0.00571
50	Spotted Owlet	<i>Athene brama</i>	1	0.000801	-7.1293	-0.00571
	<b>Caprimulgidae</b>			0		
51	Large-tailed Nightjar	<i>Caprimulgus macrurus</i>	2	0.001603	-6.43615	-0.01031
52	Grey Nightjar	<i>Caprimulgus indicus</i>	1	0.000801	-7.1293	-0.00571
53	Indian Nightjar	<i>Caprimulgus asiaticus</i>	2	0.001603	-6.43615	-0.01031
54	Savanna Nightjar	<i>Caprimulgus affinis</i>	2	0.001603	-6.43615	-0.01031
	<b>COLUMBIFORMES</b>			0		
	<b>Columbidae</b>			0		
55	Rock Pigeon	<i>Columba livia</i>	42	0.033654	-3.39163	-0.11414
56	Orange-breasted Green Pigeon	<i>Treron bicincta</i>	3	0.002404	-6.03069	-0.0145
57	Yellow-footed Green Pigeon	<i>Treron phoenicoptera</i>	5	0.004006	-5.51986	-0.02211
58	Oriental Turtle Dove	<i>Streptopelia orientalis</i>	4	0.003205	-5.743	-0.01841
59	Spotted Dove	<i>Streptopelia chinensis</i>	2	0.001603	-6.43615	-0.01031
60	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	2	0.001603	-6.43615	-0.01031
61	Emerald Dove	<i>Chalcophaps indica</i>	2	0.001603	-6.43615	-0.01031
62	Red Collared Dove	<i>Streptopelia tranquebarica</i>	4	0.003205	-5.743	-0.01841
	<b>GRUIFORMES</b>			0		
	<b>Rallidae</b>			0		
63	Brown Crake	<i>Amaurornis akool</i>	2	0.001603	-6.43615	-0.01031

64	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	2	0.001603	-6.43615	-0.01031
65	Ruddy-breasted Crake	<i>Porzana fusca</i>	2	0.001603	-6.43615	-0.01031
66	Watercock	<i>Gallixrex cinerea</i>	2	0.001603	-6.43615	-0.01031
	<b>CICONIFORMES</b>			0		
	<b>Scolopacidae</b>			0		
67	Common Snipe	<i>Gallinago gallinago</i>	1	0.000801	-7.1293	-0.00571
68	Common Greenshank	<i>Tringa nebularia</i>	2	0.001603	-6.43615	-0.01031
69	Common Sandpiper	<i>Actitis hypoleucos</i>	2	0.001603	-6.43615	-0.01031
70	Pheasant-tailed Jacana	<i>Hydrophasianus chirugus</i>	1	0.000801	-7.1293	-0.00571
71	Bronze-winged Jacana	<i>Metapides indicus</i>	10	0.008013	-4.82671	-0.03868
	<b>Burhimidae</b>			0		
72	Eurasian Thick-knee	<i>Burhinus oedicephalus</i>	4	0.003205	-5.743	-0.01841
	<b>Charadriidae</b>			0		
73	Little Ringed Plover	<i>Charadrius dubius</i>	4	0.003205	-5.743	-0.01841
74	River Lapwing	<i>Vanellus duvaucelli</i>	2	0.001603	-6.43615	-0.01031
75	Red-wattled Lapwing	<i>Vanellus indicus</i>	2	0.001603	-6.43615	-0.01031
76	Little Pratincole	<i>Glareola lactea</i>	6	0.004808	-5.33754	-0.02566
	<b>Laridae</b>			0		
77	Little Tern	<i>Sterna albifrons</i>	1	0.000801	-7.1293	-0.00571
	<b>Accipitridae</b>			0		
78	Osprey	<i>Pandion haliaetus</i>	2	0.001603	-6.43615	-0.01031
79	Oriental Honey-buzzard	<i>Pernis ptilorhynchus</i>	1	0.000801	-7.1293	-0.00571

80	Black Kite	<i>Milvus migrans</i>	7	0.005609	-5.18339	-0.02907
81	Grey-headed Fish Eagle	<i>Ichthyophaga ichthyaetus</i>	1	0.000801	-7.1293	-0.00571
82	Crested Goshawk	<i>Accipiter trivirgatus</i>	2	0.001603	-6.43615	-0.01031
	<b>Falconidae</b>			0		
83	Collared Falconet	<i>Microhierax caerulescens</i>	4	0.003205	-5.743	-0.01841
	<b>Anhingidae</b>			0		
84	Oriental Darter	<i>Anhinga melanogaster</i>	2	0.001603	-6.43615	-0.01031
	<b>Ardeidae</b>			0		
85	Little Egret	<i>Egretta garzetta</i>	2	0.001603	-6.43615	-0.01031
86	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	1	0.000801	-7.1293	-0.00571
87	Indian Pond Heron	<i>Ardeola grayii</i>	1	0.000801	-7.1293	-0.00571
88	Great Egret	<i>Casmerodius albus</i>	4	0.003205	-5.743	-0.01841
89	Intermediate Egret	<i>Mesophoyx intermedia</i>	2	0.001603	-6.43615	-0.01031
90	Cattle Egret	<i>Bubulcus ibis</i>	3	0.002404	-6.03069	-0.0145
91	Yellow Bittern	<i>Ixobrychus sinensis</i>	2	0.001603	-6.43615	-0.01031
92	Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i>	2	0.001603	-6.43615	-0.01031
	<b>Threskiornithidae</b>			0		
93	Black Ibis	<i>Pseudibis papillosa</i>	1	0.000801	-7.1293	-0.00571
	<b>Ciconidae</b>			0		
94	Woolly-necked Stork	<i>Ciconia episcopus</i>	1	0.000801	-7.1293	-0.00571
95	Lesser Adjutant	<i>Leptoptilos javanicus</i>	1	0.000801	-7.1293	-0.00571
	<b>PASSERIFORMES</b>			0		

	<b>Pittidae</b>			0		
96	Hooded Pitta	<i>Pitta sordid</i>	16	0.012821	-4.35671	-0.05586
97	Indian Pitta	<i>Pitta brahyura</i>	14	0.011218	-4.49024	-0.05037
	<b>Irenidae</b>			0		
98	Golden-fronted Leaf bird	<i>Chloropsis auriformes</i>	4	0.003205	-5.743	-0.01841
99	Orange-bellied Leaf bird	<i>Chloropsis hardwickii</i>	5	0.004006	-5.51986	-0.02211
	<b>Corvidae</b>			0		
100	Red-billed Blue Magpie	<i>Urocissa erythrorthyncha</i>	12	0.009615	-4.64439	-0.04466
101	Rufous Treepie	<i>Dendrocitta vagabunda</i>	1	0.000801	-7.1293	-0.00571
102	House Crow	<i>Corvus splendens</i>	5	0.004006	-5.51986	-0.02211
103	Large-billed Crow	<i>Corvus macrorhynchos</i>	74	0.059295	-2.82523	-0.16752
104	Eurasian Golden Oriole	<i>Oriolus oriolus</i>	10	0.008013	-4.82671	-0.03868
105	Large Cuckooshrike	<i>Coracina macei</i>	2	0.001603	-6.43615	-0.01031
106	Rosy Minivet	<i>Pericrocotus roseus</i>	4	0.003205	-5.743	-0.01841
107	Scarlet Minivet	<i>Pericrocotus flammeus</i>	2	0.001603	-6.43615	-0.01031

7						
10		<i>Hemipus picatus</i>	9			
8	Bar-winged Flycatcher-shrike			0.007212	-4.93207	-0.03557
10			7			
9	White-throated Fantail	<i>Rhipidura albicollis</i>		0.005609	-5.18339	-0.02907
11			31			
0	Ashy Drongo	<i>Dicrurus leucophaeus</i>		0.02484	-3.69531	-0.09179
11			2			
1	White-bellied Drongo	<i>Dicrurus caerulescens</i>		0.001603	-6.43615	-0.01031
11			14			
2	Crow-billed Drongo	<i>Dicrurus annectans</i>		0.011218	-4.49024	-0.05037
11			6			
3	Bronzed Drongo	<i>Dicrurus aeneus</i>		0.004808	-5.33754	-0.02566
11			2			
4	Spangled Drongo	<i>Dicrurus hottentottus</i>		0.001603	-6.43615	-0.01031
11			13			
5	Asian Paradise-flycatcher	<i>Terpsiphone paradisi</i>		0.010417	-4.56435	-0.04755
11			7			
6	Common Iora	<i>Aegithina tiphia</i>		0.005609	-5.18339	-0.02907
11			3			
7	Common Woodshrike	<i>Tephrodomis pondicenanus</i>		0.002404	-6.03069	-0.0145
	<b>Muscicapidae</b>			0		

11			4			
8	Orange-headed Thrush	<i>Zoothera citrine</i>		0.003205	-5.743	-0.01841
11			21			
9	Blue Whistling Thrush	<i>Myophonus caeruleus</i>		0.016827	-4.08478	-0.06873
12			2			
0	Rufous-gorgeted Flycatcher	<i>Ficedula strophiatea</i>		0.001603	-6.43615	-0.01031
12			2			
1	Pale-chinned Flycatcher	<i>Cyornis poliogenys</i>		0.001603	-6.43615	-0.01031
12			20			
2	Grey-headed Canary Flycatcher	<i>Culicicapa ceylonensis</i>		0.016026	-4.13357	-0.06624
12			7			
3	Oriental Magpie Robin	<i>Copsychus saularis</i>		0.005609	-5.18339	-0.02907
12			2			
4	White-rumped Shama	<i>Copsychus malabaricus</i>		0.001603	-6.43615	-0.01031
12			1			
5	White-tailed Stonechat	<i>Saxicola leucura</i>		0.000801	-7.1293	-0.00571
12			2			
6	Pied Bushcaht	<i>Saxicola caprata</i>		0.001603	-6.43615	-0.01031
	<b>Sturnidae</b>			0		
12			2			
7	Brahminy Starling	<i>Sturnus pagodarum</i>		0.001603	-6.43615	-0.01031
12			1			
	Asian Pied Starling	<i>Sturnus contra</i>		0.000801	-7.1293	-0.00571

8						
12			5			
9	Common Myna	<i>Acridotheres tristis</i>		0.004006	-5.51986	-0.02211
13			2			
0	Jungle Myna	<i>Acridotheres fuscus</i>		0.001603	-6.43615	-0.01031
	<b>Sittidae</b>			0		
13			1			
1	Chestnut-bellied Nuthatch	<i>Sitta castanea</i>		0.000801	-7.1293	-0.00571
13			2			
2	Velvet-fronted Nuthatch	<i>Sitta frontalis</i>		0.001603	-6.43615	-0.01031
	<b>Paridae</b>			0		
13			4			
3	Great Tit	<i>Parus major</i>		0.003205	-5.743	-0.01841
	<b>Hirundinidae</b>			0		
13			2			
4	Barn Swallow	<i>Hirundo rustica</i>		0.001603	-6.43615	-0.01031
13			4			
5	Red-rumped Swallow	<i>Hirundo daurica</i>		0.003205	-5.743	-0.01841
	<b>Pyconotidae</b>			0		
13			76			
6	Black Bulbul	<i>Hysipetes leucocephalus</i>		0.060897	-2.79856	-0.17043
13			4			
	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>		0.003205	-5.743	-0.01841



7						
13			84			
8	Himalayan Bulbul	<i>Pycnonotus leucogenys</i>		0.067308	-2.69848	-0.18163
13			18			
9	Red-vented Bulbul	<i>Pycnonotus cafer</i>		0.014423	-4.23893	-0.06114
	<b>Cisticolidae</b>			0		
14			2			
0	Zitting Cisticola	<i>Cisticola juncidis</i>		0.001603	-6.43615	-0.01031
14			2			
1	Striated Prinia	<i>Prinia criniger</i>		0.001603	-6.43615	-0.01031
14			2			
2	Grey-crowned Prinia	<i>Prinia cinereocapilla</i>		0.001603	-6.43615	-0.01031
14			2			
3	Yellow-bellied Prinia	<i>Prinia flaviventris</i>		0.001603	-6.43615	-0.01031
14			2			
4	Plain Prinia	<i>Prinia inornata</i>		0.001603	-6.43615	-0.01031
	<b>Zosteropidae</b>			0		
14			36			
5	Oriental White-eye	<i>Zosterops paepobrosus</i>		0.028846	-3.54578	-0.10228
	<b>Sylviidae</b>			0		
14			10			
6	Common Tailorbird	<i>Orthotomus sutorius</i>		0.008013	-4.82671	-0.03868

14 7	Rufous-rumped Grassbird	<i>Graminicola bengalensis</i>	3	0.002404	-6.03069	-0.0145
14 8	White-crested Laughingthrush	<i>Garrulax leucolophus</i>	6	0.004808	-5.33754	-0.02566
14 9	Lesser Necklaced Laughingthrush	<i>Garrulax monileger</i>	5	0.004006	-5.51986	-0.02211
15 0	Greater Necklaced Laughingthrush	<i>Garrulax pectoralis</i>	6	0.004808	-5.33754	-0.02566
15 1	Puff-throated Babbler	<i>Pellorneum ruficeps</i>	20	0.016026	-4.13357	-0.06624
15 2	White-browed Scimitar Babbler	<i>Pamatorhinus schisticeps</i>	4	0.003205	-5.743	-0.01841
15 3	Striped Tit Babbler	<i>Macronous gularis</i>	6	0.004808	-5.33754	-0.02566
15 4	Chestnut-capped Babbler	<i>Timalia pileata</i>	2	0.001603	-6.43615	-0.01031
15 5	Yellow-eyed Babbler	<i>Chrysomma sinense</i>	5	0.004006	-5.51986	-0.02211
15 6	Striated Babbler	<i>Turdoides earlei</i>	7	0.005609	-5.18339	-0.02907
15 7	Jungle Babbler	<i>Turdoides striatus</i>	6	0.004808	-5.33754	-0.02566

15			1			
8	Himalayan Cutia	<i>Cutia nipalensis</i>		0.000801	-7.1293	-0.00571
15			2			
9	White-bellied Yuhina	<i>Yuhina zantholeuca</i>		0.001603	-6.43615	-0.01031
16			4			
0	Nepal Fulvetta	<i>Alcippe nipalensis</i>		0.003205	-5.743	-0.01841
	<b>Alaudidae</b>			0		
16			5			
1	Rufous-winged Bushlark	<i>Mirafra assamica</i>		0.004006	-5.51986	-0.02211
16			2			
2	Sand Lark	<i>Calandrella roytal</i>		0.001603	-6.43615	-0.01031
16			1			
3	Oriental Skylark	<i>Alauda gulgula</i>		0.000801	-7.1293	-0.00571
	<b>Nectariniidae</b>			0		
16			8			
4	Pale-billed Flowerpecker	<i>Dicaeum erythrorhynchos</i>		0.00641	-5.04986	-0.03237
16			2			
5	Crimson Sunbird	<i>Anthreptes siparaja</i>		0.001603	-6.43615	-0.01031
16			5			
6	Purple Sunbird	<i>Anthreptes asiatica</i>		0.004006	-5.51986	-0.02211
	<b>Passeridae</b>			0		
16	House Sparrow	<i>Passer domesticus</i>	15	0.012019	-4.42125	-0.05314

7						
16			17			
8	Eurasian Tree Sparrow	<i>Passer montanus</i>		0.013622	-4.29608	-0.05852
16		<i>Petronia xanthocollis</i>	7			
9	Chestnut-shouldered Petronia			0.005609	-5.18339	-0.02907
17			10			
0	Paddyfield Pipit	<i>Anthus rufulus</i>		0.008013	-4.82671	-0.03868
17			4			
1	Black-breasted Weaver	<i>Ploceus benghalensis</i>		0.003205	-5.743	-0.01841
17			3			
2	Baya Weaver	<i>Ploceus philippinus</i>		0.002404	-6.03069	-0.0145
17			5			
3	Scaly-breasted Munia	<i>Lonchura punctulata</i>		0.004006	-5.51986	-0.02211
	<b>Total</b>		<b>1248</b>	<b>1</b>	<b>-1008.48</b>	<b>-4.38289</b>

## Appendix V

### Shannon - Weiner diversity index (four sites)

#### Site-I (Balmiki Ashram to Temple Tiger)

Order	Number of Individuals	n/N	p <sub>i</sub>	ln p <sub>i</sub>	p <sub>i</sub> ln p <sub>i</sub>
GALLIFORMES	3	3/164	0.018	-4.017	-0.072
ANSERIFORMES	3	3/164	0.018	-4.017	-0.072
PICIFORMES	12	12/164	0.073	-2.617	-0.191
BUCEROTIFORMES	1	1/164	0.006	-5.115	-0.030
TROGONIFORMES	1	1/164	0.006	-5.115	-0.030
CORACIFORMES	6	6/164	0.036	-3.324	-0.119
CUCULIFORMES	8	8/164	0.048	-3.036	-0.145
APODIFORMES	1	1/164	0.006	-5.115	-0.030
STRIGIFORMES	4	4/164	0.024	-3.729	-0.089
COLUMBIFORMES	5	5/164	0.030	-3.506	-0.105
GRUIFORMES	5	5/164	0.030	-3.506	-0.105
CICONIFORMES	29	29/164	0.017	-4.074	-0.069
PASSERIFORMES	86	86/164	0.274	-0.646	-0.338

**S** (number of order)= 13

**N** (total number of individuals) = 164

(sum) of p<sub>i</sub>\*lnp<sub>i</sub> = -1.395

**H = -SUM[(p<sub>i</sub>) \* ln(p<sub>i</sub>)] = -(-0.072 + -0.072 + -0.191 + -0.030 + -0.030 + -0.119 + -0.145 + -0.030 + -0.089 + -0.105 + -0.105 + -0.105 + -0.069 + -0.338) = **1.395****

**Site- II (Temple Tiger to Kasara)**

<b>Order</b>	<b>Number of individuals (n)</b>	<b>n/N</b>	<b>Pi</b>	<b>Lnpi</b>	<b>Pi ln pi</b>
GALLIFORMES	4	4/258	0.015	-4.199	-0.062
ANSERIFORMES	7	7/258	0.027	-3.611	-0.097
PICIFORMES	14	14/258	0.054	-2.918	-0.157
BUCEROTIFORMES	1	1/258	0.003	-5.809	-0.017
UPUIFORMES	1	1/258	0.003	-5.809	-0.017
TROGONIFORMES	1	1/258	0.003	-5.809	-0.017
CORACIFORMES	6	6/258	0.023	-3.772	-0.086
CUCULIFORMES	10	10/258	0.038	-3.270	-0.124
PSITTACIFORMES	5	5/258	0.019	-3.963	-0.075
APODIFORMES	5	5/258	0.019	-3.963	-0.075
STRIGIFORMES	5	5/258	0.019	-3.963	-0.075
COLUMBIFORMES	8	8/258	0.031	-3.473	-0.107
GRUIFORMES	4	4/258	0.015	-4.199	-0.062
CICONIFORMES	52	52/258	0.201	-1.604	-0.322
PASSERIFORMES	135	135/258	0.523	-0.648	-0.338

**S** (number of order) = 15

**N** (total number of individuals) = 258

(sum) of **pi \* ln pi** = -1.631

**H** = **-SUM[(pi) \* ln(pi)]**= - (-0.062 + -0.097 + -0.157 + -0.017 + -0.017 + -0.017 + -0.086 + -0.124 + -0.075 + -0.075 + -0.075 + -0.107 + -0.062 + -0.322 + -0.338) = **1.631**

**Site- III (Kasara to Sauraha)**

<b>Order</b>	<b>Number of Individuals(n)</b>	<b>n/N</b>	<b>pi</b>	<b>ln pi</b>	<b>Pi ln pi</b>
GALLIFORMES	4	4/271	0.014	-4.268	-0.059
ANSERIFORMES	13	13/271	0.047	-3.057	-0.143
UPUIFORMES	1	1/271	0.003	-5.809	-0.017
CORACIFORMES	7	7/271	0.025	-3.688	-0.092
CUCULIFORMES	6	6/271	0.022	-3.816	-0.083
PSITTACIFORMES	1	1/271	0.003	-5.809	-0.017
APODIFORMES	5	5/271	0.018	-4.017	-0.072
STRIGIFORMES	8	8/271	0.029	-3.540	-0.102
COLUMBIFORMES	9	9/271	0.033	-3.411	-0.112
GRUIFORMES	5	5/271	0.018	-4.017	-0.072
CICONIFORMES	59	59/271	0.217	-1.527	-0.331
PASSERIFORMES	144	144/271	0.531	-0.632	-0.335
PICIFORMES	9	9/271	0.033	-3.411	-0.112

**S** (number of order) = 13

**N** (total number of individuals) = 271

(sum) of  $\pi \cdot \ln \pi = -1.547$

**H** = **-SUM[( $\pi$ ) \*  $\ln(\pi)$ ]** = **-(-0.059 + -0.143 + -0.017 + -0.092 + -0.083 + -0.017 + -0.072 + -0.102 + -0.112 + -0.072 + -0.331 + -0.335 + -0.112) = 1.547**

**Site –IV (Sauraha to Sunachari)**

<b>Order</b>	<b>Number of Individuals (n)</b>	<b>n/N</b>	<b>pi</b>	<b>ln pi</b>	<b>Pi ln pi</b>
ANSERIFORMES	3	3/66	0.045	-3.101	-0.139
PICIFORMES	6	6/66	0.090	-2.407	-0.216
CORACIFORMES	2	2/66	0.030	-3.506	-0.105
CUCULIFORMES	2	2/66	0.030	-3.506	-0.105
PSITTACIFORMES	2	2/66	0.030	-3.506	-0.105
COLUMBIFORMES	5	5/66	0.075	-2.590	-0.194
CICONIFORMES	12	12/66	0.181	-1.709	-0.309
PASSERIFORMES	34	34/66	0.515	-0.663	-0.341

**S** (number of order) = 8

**N** (total number of individuals) = 66

(sum) of  $pi * \ln pi = -1.514$

**H** = **-SUM[(pi) \* ln(pi)]** = - (-0.139 + -0.216 + -0.105 + -0.105 + -0.105 + -0.194 + -0.309 + -0.341) = **1.514**



## Appendix – VI

### One way ANOVA order diversity

#### Descriptives

No

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Site-1	13	3.62	4.700	1.304	.78	6.46	1	15
Site-2	15	3.33	4.821	1.245	.66	6.00	1	17
Site-3	13	3.62	4.976	1.380	.61	6.62	1	17
Site-4	8	3.38	3.662	1.295	.31	6.44	1	11
Total	49	3.49	4.524	.646	2.19	4.79	1	17

#### Test of Homogeneity of Variances

No

Levene Statistic	df1	df2	Sig.
.048	3	45	.986

## ANOVA

Family

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.883	3	.294	.013	.998
Within Groups	981.362	45	21.808		
Total	982.245	48			

## Multiple Comparisons

Dependent Variable: No

	(I) Family	(J) Family	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Games-Howell	Site-1	Site-2	.282	1.802	.999	-4.67	5.23
		Site-3	.000	1.898	1.000	-5.24	5.24
		Site-4	.240	1.837	.999	-4.96	5.44
	Site-2	Site-1	-.282	1.802	.999	-5.23	4.67
		Site-3	-.282	1.858	.999	-5.39	4.83
		Site-4	-.042	1.796	1.000	-5.11	5.03
	Site-3	Site-1	.000	1.898	1.000	-5.24	5.24
		Site-2	.282	1.858	.999	-4.83	5.39
		Site-4	.240	1.892	.999	-5.10	5.58
	Site-4	Site-1	-.240	1.837	.999	-5.44	4.96
		Site-2	.042	1.796	1.000	-5.03	5.11
		Site-3	-.240	1.892	.999	-5.58	5.10

## One way ANOVA (species diversity)

### Descriptives

species

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
					site-1	13		
site-2	15	17.20	34.894	9.010	-2.12	36.52	1	135
site-3	13	20.85	39.912	11.070	-3.27	44.96	1	144
site-4	8	8.25	10.938	3.867	-.89	17.39	2	34
Total	48	15.75	30.695	4.430	6.84	24.66	1	144

### Test of Homogeneity of Variances

species

Levene Statistic	df1	df2	Sig.
.965	3	44	.417

## ANOVA

Species

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	884.491	3	294.830	.299	.824
Within Groups	43398.509	44	986.330		
Total	44283.000	47			

## Post Hoc Tests

### Multiple Comparisons

Dependent Variable: species

Games-Howell

(I) order vs species	(J) order vs species	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
site-1	site-2	-3.783	11.386	.987	-35.14	27.58
	site-3	-7.429	13.077	.940	-44.04	29.18
	site-4	5.167	7.964	.914	-17.56	27.89
site-2	site-1	3.783	11.386	.987	-27.58	35.14
	site-3	-3.646	14.273	.994	-43.01	35.71
	site-4	8.950	9.805	.798	-18.70	36.60
site-3	site-1	7.429	13.077	.940	-29.18	44.04
	site-2	3.646	14.273	.994	-35.71	43.01
	site-4	12.596	11.726	.710	-21.27	46.46
site-4	site-1	-5.167	7.964	.914	-27.89	17.56
	site-2	-8.950	9.805	.798	-36.60	18.70
	site-3	-12.596	11.726	.710	-46.46	21.27

## Appendix-VII

### A. Birds seen after 10-15 years in Chitwan National Park

#### Kashmir Flycatcher

Phylum – Chordata  
Class – Aves  
Order – Passeriformes  
Family – Muscicapidae  
Genus – *Ficedula*  
Species – *subrubra*



#### Ashy Minivet

Phylum – Chordata  
Class – Aves  
Order – Passeriformes  
Family – Corvidae  
Genus – *Pericrocotus*  
Species – *divaricatus*



#### Nepal Wren Babbler

Phylum – Chordata  
Class – Aves  
Order – Passeriformes  
Family – Sylviidae  
Genus – *Pnoepyga*  
Species – *immaculata*



#### Hoary Throated Barwing

Phylum – Chordata  
Class – Aves  
Order – Passeriformes  
Family – Sylviidae  
Genus – *Actinodura*  
Species – *nipalensis*



#### Mottled Wood Owl

Phylum – Chordata  
Class – Aves  
Order – Strigiformes  
Family – Strigidae  
Genus – *Strix*  
Species – *ocellata*



**Greater White Fronted Goose**

Phylum – Chordata  
Class – Aves  
Order – Anseriformes  
Family – Anatidae  
Genus – *Anser*  
Species – *albifrons*



















**Isabelline Wheater**

Phylum – Chordata  
Class – Aves  
Order – Passeriformes  
Family – Muscicapidae  
Genus – *Oenanthe*  
Species – *isabellina*



## B. Rare species of birds in Chitwan National Park

			
<b>Common Shelduck</b> ( <i>Tadorna tadorna</i> )	<b>Spot-billed Duck</b> ( <i>Anas poecilorhyncha</i> )	<b>Northern Pintail</b> ( <i>Anas acuta</i> )	<b>Eurasian Wryneck</b> ( <i>Jynx torquilla</i> )
			
<b>Plaintive Cuckoo</b> ( <i>Cacomantis merulinus</i> )	<b>White-throated Needletail</b> ( <i>Hirundapus caudacutus</i> )	<b>Alpine Swift</b> ( <i>Tachymarptis melba</i> )	<b>Fork-tailed Swift</b> ( <i>Apus pacificus</i> )
			
<b>Grey Nightjar</b> ( <i>Caprimulgus indicus</i> )	<b>Indian Nightjar</b> ( <i>Caprimulgus asiaticus</i> )	<b>Common Wood Pigeon</b> ( <i>Columba palumbus</i> )	<b>Ashy Wood Pigeon</b> ( <i>Columba pulchricollis</i> )
			
<b>Bengal Florican</b> ( <i>Houbaropsis bengalensis</i> )	<b>Common Crane</b> ( <i>Grus grus</i> )	<b>Demolselle Crane</b> ( <i>Grus virgo</i> )	<b>Purple Swamphen</b> ( <i>Porphyrio porphyrio</i> )
			
<b>Common Coot</b> ( <i>Fulica atra</i> )	<b>Watercock</b> ( <i>Gallixrex cinerea</i> )	<b>Slaty-breasted Rail</b> ( <i>Gallirallus striatus</i> )	<b>Black-tailed Godwit</b> ( <i>Limosa limosa</i> )



			
<b>Pintail Snipe</b> ( <i>Gallinago stenura</i> )	<b>Jack Snipe</b> ( <i>Lymnocrypte minimus</i> )	<b>Whimbrel</b> ( <i>Numerius phaeopus</i> )	<b>Eurasian Curlew</b> ( <i>Numerius arquata</i> )
			
<b>Spotted Redshank</b> ( <i>Tringa erythropus</i> )	<b>Common Redshank</b> ( <i>Tringa totanus</i> )	<b>Wood Sandpiper</b> ( <i>Tringa glareola</i> )	<b>Little Stint</b> ( <i>Calidris minuta</i> )
			
<b>Eurasian Woodcock</b> ( <i>Scolopax rusticola</i> )	<b>Pheasant-tailed Jacana</b> ( <i>Hydrophasianus chirurgus</i> )	<b>Pied Avocet</b> ( <i>Recurvirostra avosetta</i> )	<b>Norther Lapwing</b> ( <i>Vanellus vanellus</i> )
			
<b>Grey-headed Lapwing</b> ( <i>Vanellus cinereus</i> )	<b>Black-headed Gull</b> ( <i>Larus ridibundus</i> )	<b>Brown-headed Gull</b> ( <i>Larus brunnicephalus</i> )	<b>Little Tern</b> ( <i>Sterna albifrons</i> )
			
<b>White-winged Tern</b> ( <i>Chlidonias leucopterus</i> )	<b>Booted Eagle</b> ( <i>Hieraaetus pennatus</i> )	<b>Short-toed Snake Eagle</b> ( <i>Circaetus gallicus</i> )	<b>Cinereous Vulture</b> ( <i>Aegypius monachus</i> )











**Bright-capped Cisticola**  
(*Cisticola exilis*)



**Jungle Prinia**  
(*Prinia sylvatica*)



**Chestnut-crowned Bush Warbler**  
(*Cettia major*)



**Grey-sided Bush Warbler**  
(*Cettia brunneifrons*)



**Spotted Bush Warbler**  
(*Bradypterus thersiacus*)



**Thick-bellied Warbler**  
(*Acrocephalus aedon*)



**Western Crowned Warbler**  
(*Phylloscopus occipitalis*)



**Large-billed Leaf Warbler**  
(*Phylloscopus magnirostris*)



**Sulphur-bellied Warbler**  
(*Phylloscopus griseolus*)



**Striated Grassbird**  
(*Megahurus palustris*)



**Blue-winged Laughingthrush**  
(*Garrulax squamatus*)



**Spiny Babbler**  
(*Turdoides nipalensis*)



**Thick-billed Flowerpecker**  
(*Dicaeum agile*)



**Yellow-vented Flowerpecker**  
(*Dicaeum chrysorrheum*)



**Tawny Pipit**  
(*Anthus compestris*)



**Crested Bunting**  
(*Melophus lothami*)



**Yellow-breasted Bunting**  
(*Emberiza aureola*)

**C. Uncommon species of Birds in Chitwan National Park**



**Great Slaty Woodpecker**



**Blue - throated Barbet**



**Brown fish Owl**



**Collared Falconet**



**Steppe Eagle**



**Bronzed Drongo**



**Pale Blue Flycatcher**



**Brahminy Starling**



**Blue-capped Rock Thrush**



**Black -crested Bulbul**



**Smoky Warbler**



**Black-breasted Weaver**