

# CHAPTER - ONE

## 1. INTRODUCTION

### 1.1 Background

Herpetology, from the Greek *herpeton*, a crawling thing, is that branch of zoology which deals with the structure, classification, life history and distribution of the amphibians and reptiles (Smith, 1951). As far as the earliest history of herpetology is concerned, it dates back to the Greeks and Romans, who were the first to write on natural history and in that the name of Aristotle and Pliny stand out above all others. The subject concerns all those creatures generally known as caecilians, salamanders, toads and frogs - Amphibian- and the chelonians, crocodiles, lizards and snakes - Reptiles. All these groups differ in structure and appearance from one another and have little in common except that they all have backbone and are cold blooded or ectothermic. Their body temperature fluctuates depending upon external temperature (Rai, 2003).

#### 1.1.1 Amphibian fauna

Amphibians are generally regarded as intermediate groups of animals that provide an evolutionary link between fishes and reptiles. Amphibians were the first creatures to depart from aquatic habitats and develop lungs that enabled them to breathe on land. They lay jelly- coated eggs in water. The young ones emerge from the eggs as tadpoles before becoming adults and, with the few exceptions, undergo a change, as their limbs appear and they transform gill breathing to lung - breathing creatures. Amphibians have soft scaleless and often moist skins through which they are able to increase their intake of oxygen. Amphibians are divided into three orders: Gymnophiona (legless blind worms), Caudata (newts and salamanders) and Salientia or Anura (tailless frogs and toads), (Shah and Tiwari, 2004).

There are currently 6,487 species of amphibian including 5,732 frogs and toads (88%), 579 newts and salamanders (3%) and 176 caecilians in the world (9%) (<http://biothenumbers.com/index.php/tag/amphibians/>; Nov.8, 2009). The biological species concept is increasingly challenged by the 'evolutionary species concept' which has been applied very in - homogeneously in herpetology. As a result, many subspecies have been raised to 'full species' status and therefore the number of species increases just because of that.

### **1.1.2 Reptilian fauna**

The term 'reptile' is used generally to describe the group of creeping or crawling vertebrate creatures that evolved from amphibians during the carboniferous period more than 200 million years ago. Over millions of years true reptiles evolved into creatures more terrestrial and less dependent up on water. They lay shelled, amniotic eggs on land or give birth to live babies (e.g. crocodiles and some snakes, respectively). In either case the young reptile appears as a copy in miniature of adult and never goes through the tadpole stage. The skin of reptile is dry and covered in a variety of scale patterns (lizards and snakes), or in tough wrinkled and plated hides (crocodiles and alligators) while other like tortoises, turtles and terrapins are mainly covered in Horney shell plates (Shah and Tiwary, 2004).

Reptilian skin is scaly, affording protection from drying up through loss of moisture to the air. Also, the reptilian kidney excretes insoluble uric acid, rather than urea or ammonia and the water filled from it is reabsorbed by the body preventing further loss of body fluid. There are five orders of living reptiles while many more become extinct at the close of the cretaceous period (cretaceous period roughly 144 to 65 million years, late cretaceous 99- 65 million years ago (Shah and Tiwary, 2004).

The most distinctive feature that's separates the amphibians from reptiles lie in their development history. The vast majority of the amphibians pass the first stage of their lives as free-swimming aquatic tadpoles breathing by means of gills. No amphibian egg has protective covering to prevent it from drying up. So they need water for their developing purposes. But the reptiles, early in their evolution, succeeded in producing a parchment like as calcareous covering to their eggs and with an abundant supply of yolk and albumin and the development of structure, a completely terrestrial existence became possible. Although the reptilians in their organization are far behind the warm blooded vertebrates, in their general structure, and particularly in the brain, they are in advance of the amphibians (Rai, 2003).

South Asian region shares two bio geographic realms - Palearctic and Oriental and embraces an exceptionally high diversity of habitats and ecosystem. South Asia has a rich diversity of amphibians and reptilian fauna, including several unique and endemic species. South Asia claims over 900 species of amphibians and reptiles,

which represents a relatively greater per unit area of herpetofaunal diversity compared to china (Including Hongkong and Taiwan) with 661 species (Shah and Tiwary, 2004).

The latest number of species of reptile is 8,775 including 25 species of crocodile, 3,000 species of lizards, 5,500 varieties of snake and 250 species of turtle in the world ([www.reptiledatabase.org](http://www.reptiledatabase.org); Nov.2009).

## **1.2 Herpetology in Nepal**

Although, Nepal is small in size, it is strategically located along the central and eastern Himalayas. The country is roughly rectangular in shape, with the total area of 147,181 sq. km of which 86 percent is made up of hills and mountains and only 14 percent is covered by flatlands. The country has been broadly divided into five major physiographic regions e.g. Terai (plains), Siwaliks, Mid hills, High Mountains and Himalayan.

The country therefore has a wide range of habitats and sub population of biological species isolated by mountain ridges and deep Valleys. These conditions have favored the evolution of local assemblages with high diversity and endemism. Amphibians and reptiles are no exception to this diversity – In Nepal they are distributed across a wide altitudinal range (from 80m to 5,490m). Studies to date have confirmed that Nepal's herpetofauna embraces Palearctic, Oriental, Indo- Chinese and Himalayan elements (Shah and Tiwary, 2004).

The diversity of Nepal's herpetofauna is evident in occurrence of a wide range of life-forms from fingernail- sized Bush frog with it's incredibly loud voice and the earthworm-like Brahminy blind snake to the heptic 100kg rock python or ponderous Narrow –headed soft shell turtle that is often heavier than an adult man. Frogs, snakes and turtles are worshipped and depicted as saviors and beneficent creature in Hindu and Buddhist scriptures. Yet, herpetology in Nepal remains one of the least studied subjects in Zoological Science. Only limited knowledge exists with respect to the importance of herpetofauna in the environment and the livelihood of people.

In the last century several important contributions to the study of Nepal's herpetofauna have appeared and among them some significant are the work of Dubois (1974- 84), Fleming and Fleming (1974), Shrestha and Majupuria (1977), Kramer

(1977), Shrestha and Shah (1984), Nanhoe and Ouboter (1987), Shah and Giri (1991 and 1992) and Schleich (1993). In this century publications like "Herpetology of Nepal" by Shrestha (2001), "Amphibians and Reptiles of Nepal" by Schleich and Kastle ed. (2002), "Snake bite management Guidelines" by Shah, Shrestha and Thapa (2003) and "Herpetofauna of Nepal, a conservation companion" by Shah and Tiwari (2004) have added much value to the knowledge of herpetology in Nepalese species.

From a herpetology perspective, the Arun Valley, the Annapurna-Dhaulagiri region, and the Chitwan National Park (CNP) have been extensively studied. Similarly other protected areas such as Koshi Tappu Wildlife Reserve, Bardia National Park, Shuklaphanta Wildlife Reserve, and eastern and central Nepal, have also been explored to a considerable extent. The mid-and far-western region of Nepal remains least studied, due largely to their remoteness and inaccessibility (Shah and Tiwary, 2004).

The herpetofauna of Nepal is extremely rich, though only a little information is available about their status and distribution in the country. Herpetofaunal studies have revealed presence of 190 species of amphibians and reptiles from the country (Shah and Tiwary, 2004). This includes 53 species of amphibians, and 137 species of reptiles. This also includes 11 endemic Species (9 frogs and toads, 1 lizard, and 1 snake species) and 21 species having type locality in Nepal (Shah, 1995). The herpetofauna in Nepal is relatively richer compared to other South Asian countries – well over 206 species and sub- species, including 59 species of which 15 are listed as globally threatened. NPWC Act, 1973 provides protection of only 3 reptilian species under schedule 1 (protected wildlife) and there has not been further amendment to date. However, the red data book of the fauna of Nepal (1995) recommended 31 species of herpetofauna (9 amphibians, 14 turtles, 1 crocodile, 2 lizards and 5 snakes) as meriting legal protection in the country. IUCN- The world conservation union provides a list of 13 globally threatened species of herpetofauna (2 crocodile, 7 turtle, 2 tortoise and 2 serpent's species including 1 python) from Nepal (Shah and Tiwary, 2004).

Research work on herpetofauna of Nepal has been limited to a few areas and detail herpetofauna inventory are urgently needed. Wetlands are important habitats for most

of the herpetofauna. There are 242 recorded wetlands in Nepal (Bhandari, 1996). However herpetofauna of these wetlands are not known so far.

Herpetofauna are also considered as ecological indicator and beneficial faunal groups due to the important role they play in the ecosystems. They have significant role in the food chain of their habitat. They control a wide variety of agricultural pests. They are also used directly and indirectly, as food and medicines in various parts of Nepal (Shah and Tiwari, 2004). Anthropogenic activities, increased human population, deforestation, urbanization, soil and water pollution, land use changes, habitat loss and unsustainable extraction are major threats. Other threats include construction of dams for hydropower and irrigation, direct exploitation for food, recreation and medicinal value.

### **1.3 Ethnoherpetology of Nepal**

Ethnoherpetology is the study of past and present interrelationships between human cultures and reptiles and amphibians. It is sub-field of ethnozoology, which in turn is a sub-field of ethnobiology (<http://en.Wikipedia.org/wiki/Ethnoherpetology>). There has been little documentation of the use of amphibians and reptiles as food and medicine in Nepal (Shrestha, 1981 and 1982; Nanhoe and Ouboter, 1987; Shah and Giri, 1992; and Shah, 1995). Shah (1997) conducted a study to document the food and medicinal uses of herpetofauna and the traditional and modern methods associated with their use in different ethnic communities in Nepal.

Amphibians and reptiles have been used as food and medicine since time immemorial in Nepal. Ethnic communities are known to have used them traditionally as food and protein substitute. In some communities there are practices of consuming smoked and dried meat of frog e.g. *Paa*, *Amolops* and *polypedates* species, turtles, monitor lizards and rat snake for seasonal use. Fat of some snakes, monitor lizards and turtle is regarded for a wide range of medicinal and cultural purposes. Certain ethnic communities of the lowland Terai consume turtles and crocodiles that are found in the particular regions only. Similarly, only the high mountain dwellers consume *manpaha* (*Paa liebighii*) and Pirepaha (*Amolops marmoratus* and *Amolops formosus*), since they are found only in the high mountainous regions. It is interesting to note that many communities that tend to reject amphibians and reptiles as food items often do not hesitate to use them as medicine (Shah and Tiwari, 2004).

Some species of frog (e.g. *Paa liebigii* and *Amolops* spp.), monitor lizards and turtles are hunted intentionally, where as many other useful species are killed out of fear and mistaken beliefs. People engaged in the massive collection of frogs, monitor lizards and turtles generally do not tend to bother about the impact of such collection. Over the survival of these species many ethnic groups collect these species for their own use as well as for commercial purposes e.g. turtle hunting in Terai. Turtles are sometimes sold in the fish markets of Terai region. Marketing of frog meat is not a common practice in Nepal. However, dried or fresh Pahas are occasionally bartered in mountain villages, very often in exchange for cereals, cloths, spices and other household goods.

#### **1.4 Wetlands**

A wetland is an area of land consisting of soil that is saturated with moisture such as a Swamp, Marsh, Bug or Vlei. As defined in terms of physical geography, a wetland is an environment "at the interface between truly terrestrial ecosystems and aquatic ecosystem making them inherently different from each other yet highly dependent on both" (Mitsch and Gosselink, 2007). National Wetlands Policy 2003 of Nepal defines 'wetlands denote perennial water bodies that originate from underground sources of water or rain. It means swampy area with flowing or stagnant fresh or salt water that natural or manmade or permanent or temporary wetland also mean marshy lands, riverine floodplains, lakes, ponds, water storage area and agricultural lands.

Wetlands are highly fertile and productive ecosystem (Bhandari, 1998). The natural wetlands are lakes and ponds, riverine flood plains, swamps and marshes where as manmade wetlands consist of water storage areas and depressed agriculture lands. On a global stage wetlands are considered as CO<sub>2</sub> sinks and climate stabilizers. Wetlands are also known as biological supermarkets due to the extensive food change and immensely rich biodiversity they support (Kumar, 1999).

Ramsar convention defines wetlands as "Areas of marsh, fen, and peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including area of marine water the depth of which at low tide does not exceed 6 meters". Following 9 wetlands are enlisted as Ramsar sites in Nepal:

1. Shey – Phoksundo Wetlands Series, Shey – Phoksundo National Park
2. Koshi Tappu Wildlife Reserve, Sunsari
3. Jagdishpur Reservoir, Kapilvastu
4. Gosaikunda Wetlands Series, Langtang National Park
5. Gokyo Wetlands Series, Sagarmatha National Park
6. Ghodaghodi Lake area, Kailali
7. Beeshazari and Associated Lakes, Chitwan
8. Rara Lake, Mugu
9. Mai Pokhari, Ilam

*Source: Nepal Tourism Board, 2009*

It has been estimated that about 6% of the total world land area (570 Million hectare) fall under various wetlands categories, in which 2% are Lakes, 20% Swamps, 26% Fens, 15% flood plains and 30% bogs ( WCMC, 1998). In Nepal, a total of 242 Wetlands sites have been recorded of which 163 sites (67.4%) are occupied in Terai and 79 sites (32.6%) are occupied in hills and mountains (NBS, 2002, IUCN-Nepal, 1996). The Department of Agriculture Development (2001/2002) has estimated that wetlands occupied 816,954 hectare approximately 5% of Nepal's land area (Table 1). However, IUCN (1998) recorded 19 Terai districts alone and estimated that wetlands cover 724,257 hectare (Table 2). The latest data on wetlands has been given by Bhandari (2009). According to him 891 wetlands sites including 121 (13.58%) sites from Terai, 32 (5.6%) sites from Siwalik zone, 182 sites (20%) from middle mountain zones, and 403 sites (45%) from the High Himal zones.

**Table 1: Estimated area of wetland types in Nepal.**

Wetland types	Estimated Area(ha)	Percent (%)
Rivers	395,000	48.35
Lakes	5,000	0.61
Reservoirs	1,500	0.18
Marginal/Swamp/Ghole etc.	11,500	1.4
Village Ponds	5,954	0.72
Irrigated Paddy Fields	398,000	43.7
<b>Total</b>	<b>816,954</b>	<b>100</b>

Source: DOAD, Balaju (2001/2002)

**Table 2: Wetland types and area in Terai**

Wetland type	Area(ha)
Flood plains	529,136
Canals	183,200
Reservoirs	9,508
Lakes and ponds	1,616
Marshes	797
<b>Total</b>	<b>724,257</b>

Source: IUCN, 1998

**Table 3: Numbers of wetlands by types**

Types of Wetlands	Number	Percentage (%)
Glaciers	202	23
Lakes (including ponds)	563	63
Rivers and rivulets	104	12
Man-made sites	22	2
<b>Total</b>	<b>891</b>	<b>100</b>

Source: Bhandari (2009)



Wetlands support a good variety of herpetofauna species. IUCN Red list (2003) provides a list of 13 globally threatened species of herpetofauna (2 crocodiles including *Crocodylus palustris* and *Gavialis gangeticus*, 7 species of *Turtles* and 2 species of tortoises including *Kachuga kachuga*, *Kachuga dhogoka*, *Indotestudo elongata*, *Hardella thurgii*, *Morenia petersi*, *Melanochelys trigjuga* and *Melanochelys tricarinata* and 2 Serpents species including 1 Python) from Nepal (IUCN, 2004). Among 39 nationally protected species of fauna under the National parks and Wildlife Conservation Act, 1973, 9 species are wetland dependent including *Gavialis gangeticus* a wetland dependent reptile (IUCN, 2004).

Beeshazari lake is a series of Ox-bow lakes. Beeshazari and associated lakes are designated as Ramsar site in September 2003. Adjoining Chitwan National Park (CNP), the lake is rich in reptiles and thirteen (13) species of reptiles are recorded from the area, including the endangered *Varanus flavescens* and *Python molurus*. The lake support the good population (15-20) of Marsh Crocodile (*Crocodylus palustris*), (Shrestha, 1994).

## **1.5 Objectives**

### **1.5.1 Broad objective**

The broad objective of the study is to enumerate diversity of herpetofauna in Beeshazari lake complex.

### **1.5.2 Specific objectives**

- To assess the status of herpetofauna in Beeshazari lake complex.
- To enumerate the various uses of the herpetofauna (Ethnoherpetology).
- To identify the threats pertaining to the herpetofauna species in the area.
- To suggest recommendations for the wellbeing of the herpetofauna and their habitat.

## **1.6 Statement of the Purpose**

Beeshazari and associated lakes are designated as Ramsar site in 2003. It lies in the Barandabhar Corridor Forest. Heavy human settlement surrounding the area has lead to the excessive dependence of people on the forest and its products (Dahal, 2002). The forest area suffers from encroachment due to collection of firewood, fodder, and other forest products. Livestock grazing, tree felling by local people, illegal timber

removal on a large scale and forest clearance near villages seem the major threat to the area (Adhikari et al. 2000). Small scale hunting and poisoning of lakes have threatened the wetland ecosystem (Dahal, 2002). The habitat deterioration mainly caused by the picnickers, illegal fishing and collecting firewood. Because of massive infestation by aquatic weeds open water is drastically reduced.

There has been scattered information about the status of herpetofauna in the area. However, some systematic survey works have conducted by some researcher in the field of herpetology (Schleich and Kastle, 2002). Habitats especially forest and wetlands potentially support a good variety of herpetofauna. With realizing the essence of the study a systematic survey in this area is crucial. Therefore, this study will provide vital information on herpetofaunal diversity, their habitats, conservation threats and their sustainable utilization.

## CHAPTER – TWO

### 2. STUDY AREA

#### 2.1 Description of the Study Area

The study area is located in the Buffer Zone of Chitwan National Park (CNP). It is situated in the Terai valley of central Nepal in between the Mahabharat mountain range, to the north and Siwalik Range to the South. The lake can be considered to be eutrophic to hypertrophic. Beeshazari lake covers an area of 180 hectare (BPP, 1995).

##### 2.1.1 Location

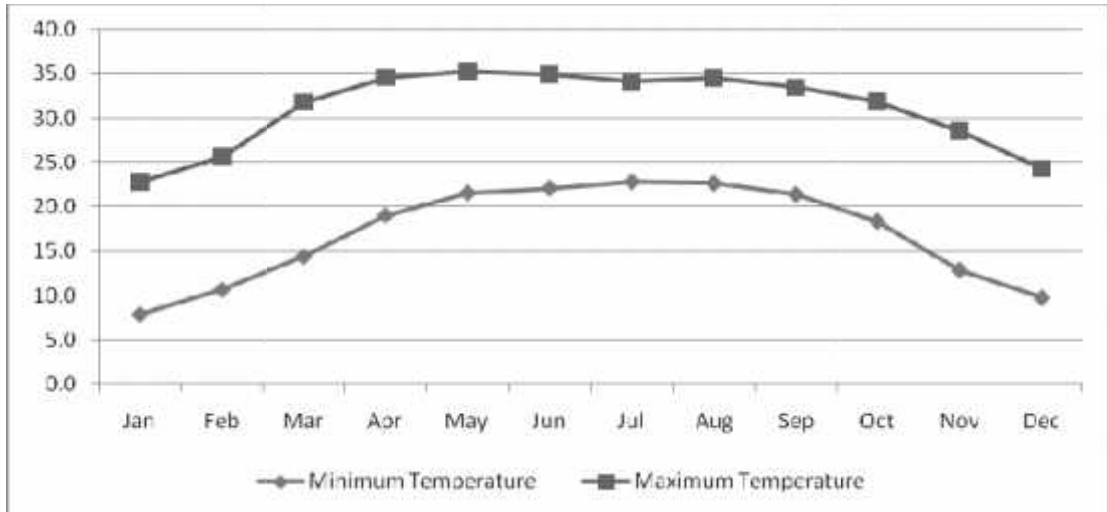
Beeshazari lake (180 ha) is located in latitude 27° 37' 14" N – 27° 36' 34" N and longitude 84° 27' 07 " E – 84° 25' 20" E. Elevation is of 286 m. The lake is located 8 km south from east west highway in the Barandabhar Corridor Forest, Buffer Zone of Chitwan National Park (CNP). This is surrounded by Sal forest and grassland (BPP, 1995).

##### 2.1.2 Geology and Soil

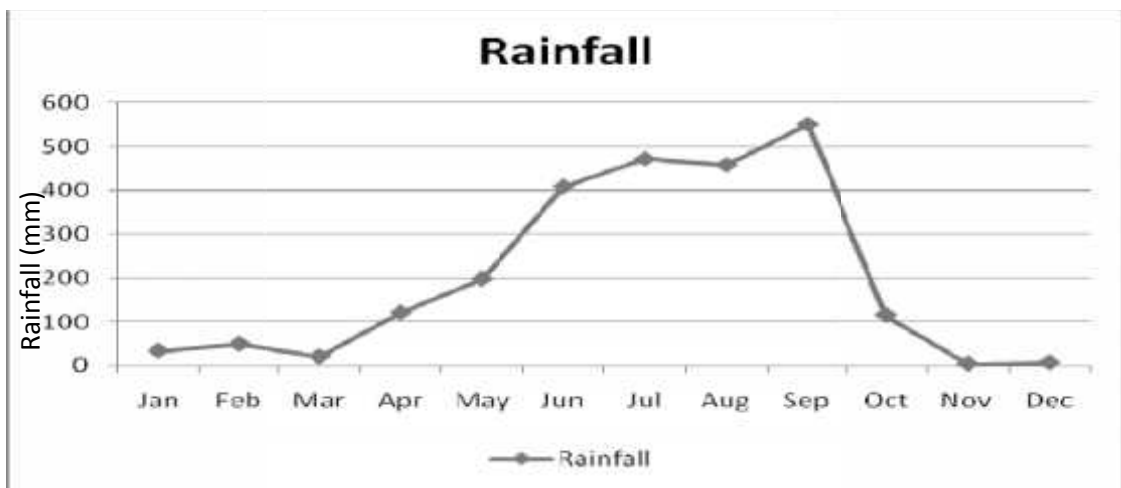
Geology of the area composed of hard rock, principally granite or quartzite and limestone of late Tertiary Siwalik origin which is characterized by the presence of large boulders carried from the north as outwash deposits (IUCN, 1998). The soil consists of deep sand, loam and silt loam (KMTNC, 1998). Soils are largely alluvium left by meandering river courses. The core of the Siwalik consists mainly of sandstone, conglomerates, quartzites, shales, and micaceous sandstones (IUCN, 1998).

##### 2.1.3 Climate

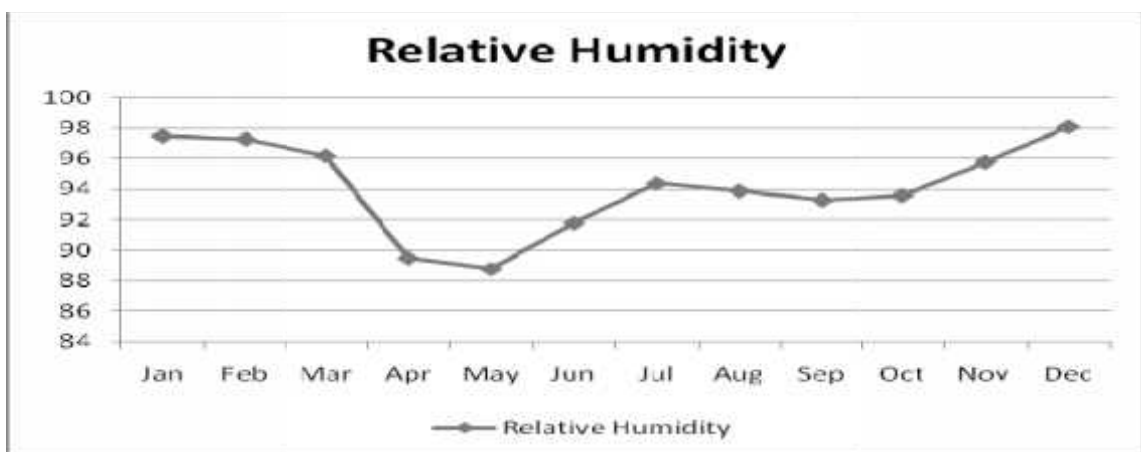
Beeshazari lake lies in the Buffer Zone of CNP. The climate of the study area is mainly subtropical with three distinct seasons, monsoons, cool and hot seasons. The rainfall highest to about 550 mm per year and about 90% of rainfall concentrates within four months of monsoon seasons (June-September). The monsoon rain causes dramatic floods and changes in the character and course of rivers and is one of the important and dramatic in terms of ecosystem dynamics. November to mid February is marked as cool season and temperature can drop to 8°C. Hot season is marked through mid February to May and mercury may rise up to 36.6°C. The minimum relative humidity is 89% and highest is 98%.



**Fig. 1: Mean temperature ( $^{\circ}$ C) recorded from 2001-2007**



**Fig. 2: Mean rainfall (in mm) recorded from 2001-2007**



**Fig. 3: Mean relative humidity recorded from 2001-2007**

### 2.1.4 Hydrological Value

Water is received from direct precipitation during the monsoon and through in flow of the Khageri irrigation canal. The lake water is supplied to the canal and the stream during the dry season. The catchment area of lake helps to control flooding in the Khageri River and recharges the ground water or the streams.

## 2.2 Floral and Faunal Diversity

### 2.2.1 Flora

The terrestrial vegetation of Beeshazari lake complex is dominated by Sal (*Shorea robusta*) forest (BPP, 1995). The prominent associated species includes Myrobalan (*Terminalia alata*), Silk cotton (*Bombax ceiba*), and Bot Dhainyaro (*Lagerstroemia parviflora*).

The wetland vegetation consists of Sedge (*Cyperus* spp.), Common Reed (*Phragmites karka*), Morning Glory (*Ipomea carnea* spp.) and Mikania (*Mikania micrantha*).

The aquatic vegetation is represented by extensive coverage of floating leafed species mainly water hyacinth (*Eichhornia crassipes*), water chestnuts (*Trapa bispinosa*) followed by Evening primrose (*Ludwigia adscendes*). The free floating species include Water velvet (*Azolla imbricate*) and Duckweed (*Lemna* spp.). The abundance submerged species include Hornwort (*Ceratophyllum demersum*), Hydrilla (*Hydrilla verticillata*) and water Nymph (*Najas minor*). In general, the vegetation is in floating leafed succession stage. Reed swamp formations are found in back waters in finger like projections, characteristics of an Ox- bow lake system.

### 2.2.2 Fauna

The study area is surrounded by dense forest consists of herbs, shrubs and trees. The habitat is suitable for many species of wild animals having common to rare and endangered status are recorded in the Beeshazari lake complex. The species recorded in this area are as follows.

#### a. Mammals

Mammalian fauna includes Asiatic one horned Rhinoceros (*Rhinoceros unicornis*), Spotted deer (*Axis axis*), Barking deer (*Muntiacus muntjak*), Royal Bengal Tiger

(*Panthera tigris tigris*), Rhesus monkey (*Macaca mulatta*), Hanuman langur (*Semnopithecus entellus*) (Baral, 1996).

#### **b. Fishes**

Seventeen species of fish are known from this site including, the threatened *Puntius chola* and the endemic *Notopterus notopterus* and *Oxygaster bacaila* (Shrestha, 1994).

#### **c. Amphibians and Reptiles**

The lake is also rich in herpetofauna (amphibians and reptiles) and occurrence of 13 species of reptile had been confirmed including endangered golden monitor lizard (*Varanus flavescens*) and Asiatic rock python (*Python molurus bivittatus*). The lake support a good population of marsh crocodile (*Crocodylus palustris*), and about 15 – 20 individuals are recorded from the site (Shrestha, 1994).

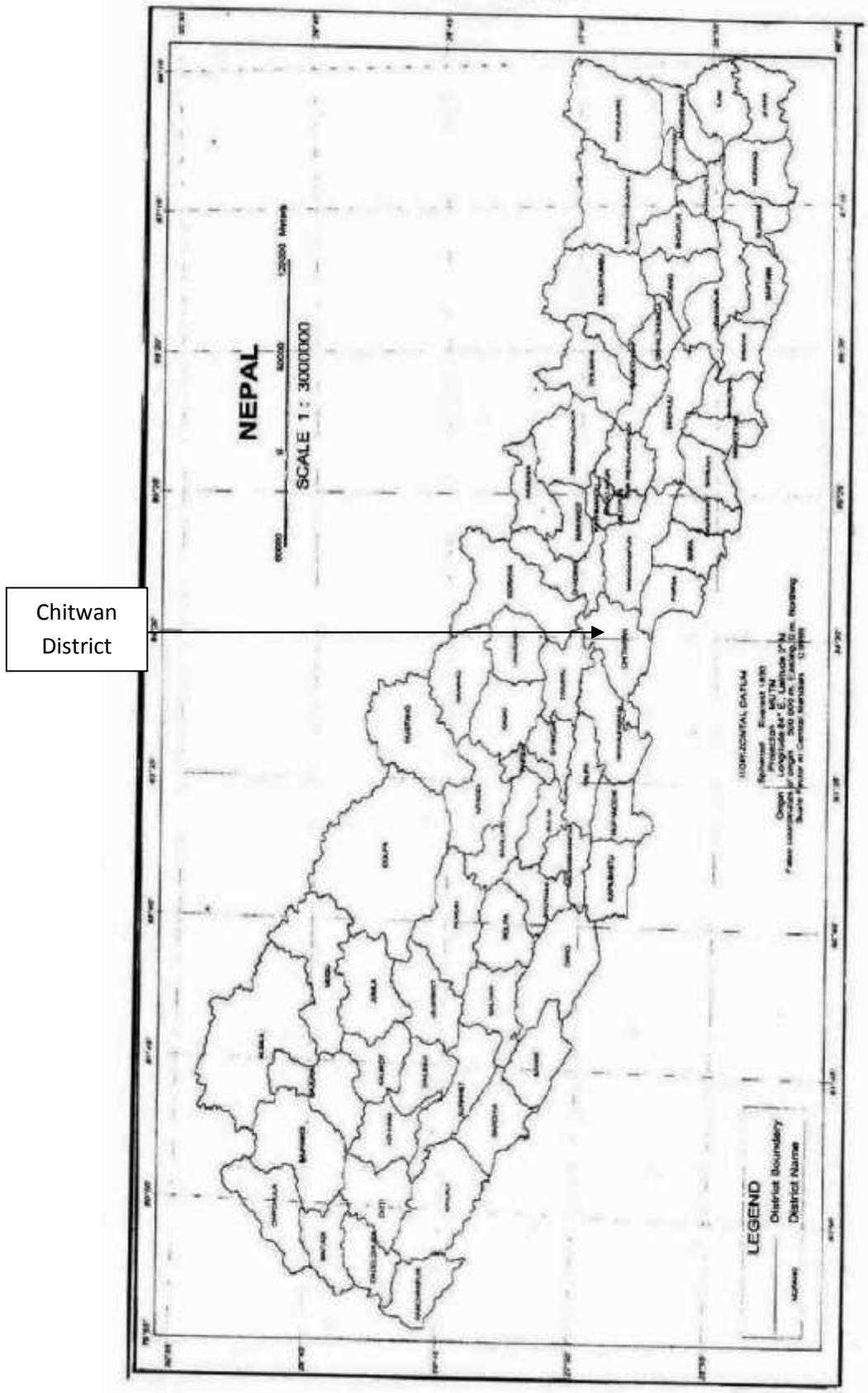
#### **d. Birds**

Avian-fauna of Beeshazari lake complex includes Darter (*Anhinga melanogaster*), globally threatened Lesser Adjutant (*Leptoptiles javanicus*), nearly threatened Great Hornbill (*Buceros bicornis*), Grey-headed fishing eagle (*Ichthyophaga ichthyaetus*), Ferruginous duck (*Aythya nyroca*), Painted Stork (*Mycteria leucocephala*), Black-necked Stork (*Ephippiorhynchus asiaticus*), Indian black vulture (*Aegypius monachus*). As many as 273 birds species of 61 families are recorded, of which sixty 60 are wetland species (Baral, 1996).

### **2.3 Socio-Economic Characteristics**

The study is mainly focused on Beeshazari lake complex and its surrounding settlements. The local inhabitants are economically middle to lower class status Bahun, Chhetri, Tharu, Darai, Damai, Kami, Gurung etc are the main inhabitants of the settlements. However predominant ethnic group was the Tharus who typically live in close proximity to the forests of Terai (Baral and Heinen, 2007). Most of the villagers of the study area are farmers and their houses are also of traditional type. Most of the area's land has been used for agriculture. The people still use traditional methods of farming. Some people do not have their own lands. They are settled on the land of the landowners and half of the crops produced are given to the landowners. In addition to this the local people engage themselves in illegal fishing, livestock grazing, fuel wood and fodder collection from the area.

Map 1: Map of Nepal



## Map 2: Chitwan District

### CHITAWAN DISTRICT

ZONE : NARAYANI

District Code : 35



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SCALE 1 : 575000

LEGEND	
	District Boundary
	VDC Boundary
<b>MORANG</b>	District Name
<small>NAME</small>	VDC Name

DISTRICT : CHITAWAN  
Area :2218 Sq.Km.(Approx.)

11500 0 11500 23000 Meters

HORIZONTAL DATUM  
Spheroid Everest 1830  
Projection MUTM  
Origin Longitude 84° E., Latitude 0° N.  
False coordinates of origin : 500 000 m. Easting, 0 m. Northing  
Scale Factor at Central Meridian : 0.9999

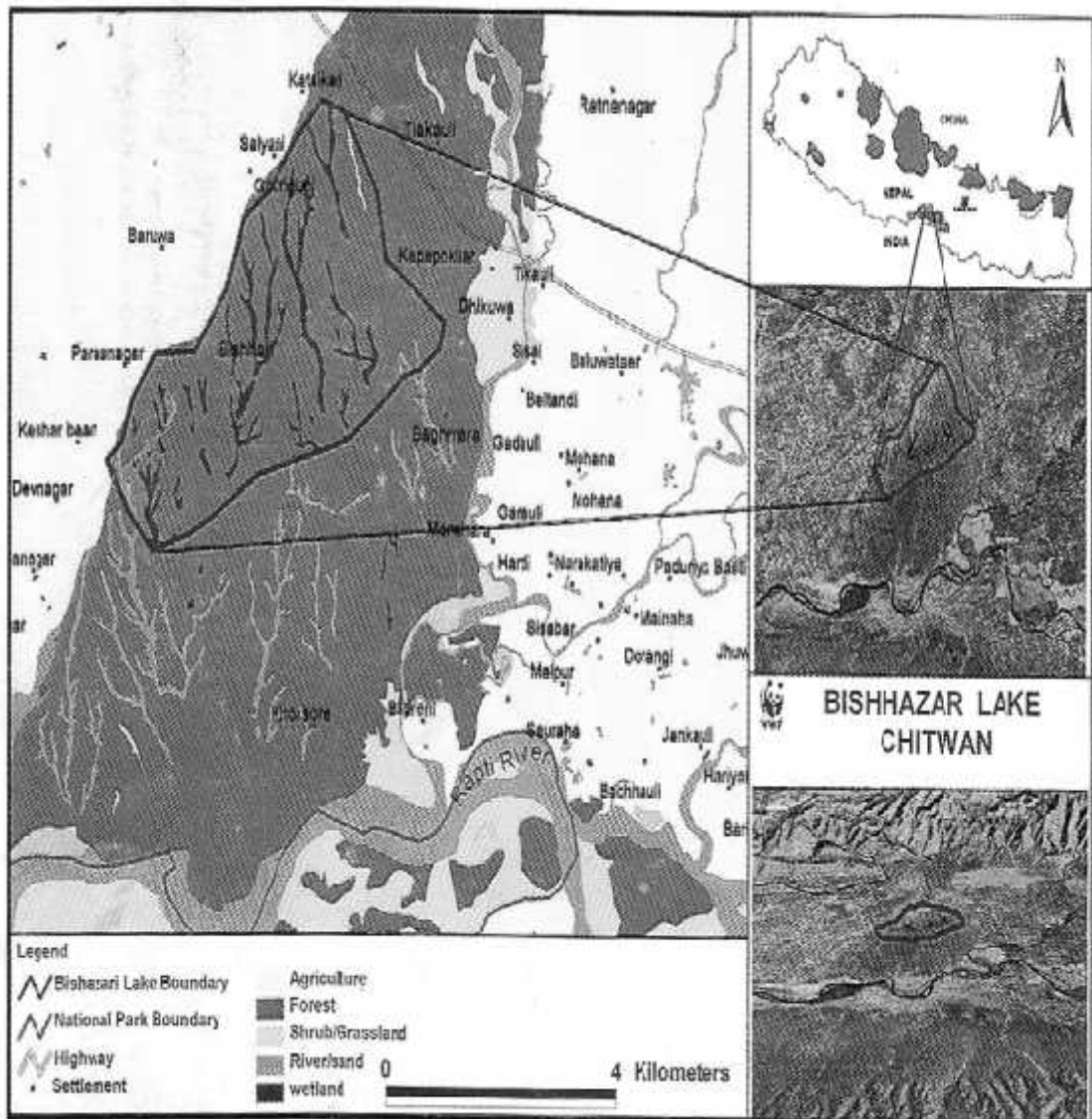
Map compiled from National Topographic Database at scales 1:25 000 and 1:50 000, 2002. Internal administrative boundaries are not demarcated on the ground. Map produced by the Survey Department, National Geographic Information Infrastructure Programme, (NGIIP), Kathmandu.

LOCATION MAP





Map 3: The Study Area



## CHAPTER – THREE

### 3. LITERATURE REVIEW

Herpetofauna (amphibians and reptilians) are the most misunderstood creatures in the world. They are terrestrial, aquatic, tree dwelling and xerophytic in habitat, Amphibians include newts, salamanders, toads and frogs; reptiles include crocodiles, turtles, tortoise, agamas, geckoes, skinks, other lizard and snakes. They are cold-blooded or exothermic animals. Their body temperature fluctuates depending upon external temperature (Shah and Tiwary, 2004)

The herpetofauna in Nepal is relatively richer compared to other South Asian countries – well over 206 species and sub- species, including 59 species of which 15 are listed as globally threatened. NPWC Act 1973 provides protection of only 3 reptilian species under schedule 1 (protected wildlife) and there has not been amendment to date. However, the red data book of the Fauna of Nepal (1995) recommended 31 species of herpetofauna (9 amphibians, 14 turtles, 1 crocodile, 2 lizards and 5 snakes) as meriting legal protection in country. IUCN- The world conservation union provides a list of 13 globally threatened species of herpetofauna (2 crocodile, 7 turtle, 2 tortoise and 2 serpent's species including 1 python) from Nepal. The diversity of Nepal's herpetofauna is evident in occurrence of a wide range of life-forms from fingernail-sized Bushfrog with its incredibly loud voice and the earthworm like Brahminy blind snake to the heptic 100kg rock python or ponderous narrow-headed soft shell turtle that is often heavier than an adult man. Frogs, snakes and turtles are worshipped and depicted as saviors and beneficent creature in Hindu and Buddhist scriptures (Shah and Tiwary, 2004).

The works of the earlier researchers like Hodgson (1846) have provided various information on the fauna of Nepal. Gunther (1861-1862) contributed a lot to the knowledge of the reptiles of the Himalayan Mountains and the list of cold- blooded vertebrates collected by H.B. Hodgson in Nepal. Research literature is also available about the work of Bulenger (1907-1913) for this collection of *Bactrachia*, reptiles and fish from Nepal and Western Himalayas.

Swan and Leviton (1962), through their work on herpetology of Nepal, has made a Zoogeographical analysis of the herpetofauna and produced a check list of 53 species

of reptiles of Nepal along with a sketch of their history. In a study of snakes, Flemming (1971-1974) produced a list of 103 species of snakes of which 29 were found in Nepal.

Many herpetologists have made valuable contribution especially on snake fauna of the country. Whitaker (1978) through his work on common Indian snake have also prepared of field guide for their identification and mentioned a few Nepalese snakes.

Canton (1981), has prepared an extensive field survey of reptiles which has been highly helpful for the identification and classification as well. Work of Nanhoe and Ouboter (1987) is preparing the distribution of amphibians and reptiles in Annapurna Dhaulagiri region of Nepal. The field research by Shah and Giri (1991) relating to the habitat and distribution of some reptiles in Arun Basins. Schleich (1993) contributed to the systemics of amphibians and reptiles by providing a checklist of 1 salamandrid, 36 anura, 2 crocodiles, 22 lizards, 10 testudines and 53 snakes.

Shah (1995) recorded a total of 143 species of amphibians and reptiles for Nepal, including, 43 species of amphibians (1 salamander, 38 frogs and 4 toads) and 100 species of reptiles (24 lizards, 2 crocodiles, 60 snakes and 14 species of turtles), comprising, 11 endemic Species (9 frogs and toads, 1 lizard, and 1 snake species) and also mentioned 21 species having type locality in Nepal.

Shah (1995- 1997) has prepared an extensive enumeration of the amphibians and reptiles of Nepal and described how they are used for food and medicine in the country. Orlov and Helfenberger (1997) have made a study on new mountain species of *Trimeresures* (Serpents, Viperidae, Crotolinae) of green pit viper group from the Himalayas.

Shrestha (1996) collected and reported 156 species of amphibians and reptiles in Nepal. Shah (1997) studied on the turtles in Nepal and recorded one tortoise (*Indotestudo elongata*) and 13 turtles. Thakulla (1999) surveyed in Ghodaghodi Lake and identified 36 species of herpetofauna. Out of which 6 amphibians, 10 lizards, 15 snakes and 5 turtles were recorded.

Shrestha (2001) has described herpetology of Nepal in field guide of Amphibians and reptiles of Trans- Himalayan region of Asia which gives the knowledge of

herpetofauna, their distribution, economic importance and conservation strategies. Schleich and Kastle (2002) provided an account of 50 amphibians and 123 reptiles for Nepal.

Kharel (2002) studied on the effects effluent from Bhrikuti Paper Mill Industry on the wetland dependent species including mugger, gharial, dolphin and fish and concluded that the aquatic species as well as wildlife species living on and around chemically polluted site is at great risk and may be that is why dolphins of Narayani River were disappearing.

Rai (2003) identified 36 species of amphibians and 66 species of reptiles from Eastern Development Region. Out of total species of amphibians 3 (*Ichthyophis sikkimensis*, *Megophrys robusta* and *Sphaerotheca rolandae*) were recorded for the first time from Nepal, 6 species (*Uperodon globulosus*, *Paa ercepeae*, *Sphaerotheca maskeyi*, *Rhacophorus maximus*, *Polypedates* species and *polypedates* species and *Microhyla cf. rubra*) have been recorded for the first time in this region. Among them, *Rhacophorus maximus* has been claimed as the first record for Nepal. Out of total species of reptiles 6 new records (*Cyclemys oldhamii*, *Pangshura tentoria circumdata*, *Gekko gekko*, *Coelognathus radiatus*, *Typhlops jerdoni*, and *Draco* species ) in the list of Nepal.

IUCN (2004) provided a list of 13 globally threatened species of herpetofauna (2 crocodiles, 7 turtles, 2 tortoises and 2 serpent species including 1 python) from Nepal.

Bista (2010) recorded 43 species of herpetofauna from Ghodaghodi Lake consisting 8 amphibians and 35 reptiles, including 10 lizards, 1 crocodile, 11 turtles, and 13 snakes.

Amphibians and reptiles have been used as food and in medicine since time immemorial in Nepal. There are some obvious reasons for herpetofauna being consumed as food some are a delicacy; they are easily available; they are low cost or free; and they provide meaningful substitutes in times of protein scarcity. In some cases they are consumed because of popular belief in their therapeutic or magical properties; and in some cases these very beliefs lead to the unsuitable use of herpetofauna especially in the preparation of traditional medicine. The history of the knowledge on ethnoherpetology in Nepalese societies is as old as the societies

themselves. Crocodiles, turtles, frogs and snakes hold significant religious and cultural value both for Hindus and Buddhists, for the great role they are believed to have played as beneficent creatures and saviors of earth and mankind (Shah and Tiwari, 2004).

According to Hindu mythology, the upper shell of the turtle represents the sky and the lower shell the earth; and with its long lifespan a turtle symbolizes longevity. Farmers believe that frogs announce the beginning of the monsoon rains and they safeguard village ponds and streams for human welfare. They also feed up on the insects that destroy crops. Traditionally, farmers in Kathmandu valley have worshipped frog for saving them from a demon called *Ghantakarna*. Hindus traditionally worship and feed snakes on the day of *Naga Panchami*. Crocodiles are regarded as the vehicles of Lord *Varun*, the god of water (Shah and Tiwari, 2004).

To conclude this brief review of related literature it can be said that even though significant progress has been made in recent years in this field, many important regions of the country with high diversity of herpetofauna have largely remained unexplored. Thus, a great opportunity waits for further study in this field.

## **CHAPTER – FOUR**

### **4. MATERIALS AND METHODS**

The research area was limited to the Beeshazari lake complex and its surrounding settlements. It is located in Buffer Zone of (CNP). Data collection was done according to the species availability and environmental factor. The sampling sites covered all the habitats of herpetofauna such as forest, grassland and wetland.

#### **4.1 Materials**

The research work was followed by field survey and sample collection in the field and identifying the specimens in Natural History Museum, Swayambhu, Kathmandu. During the survey trip following equipments and chemicals were utilized.

1. Forceps
2. Camera
3. Gloves
4. Field note book
5. Pencil
6. Torch light
7. Head light
8. Hand net
9. Plastic bottles

##### **4.1.1 Chemicals**

The live specimens were studied by paralyzing them by chloroform. Some specimens were preserved in 70% alcohol.

#### **4.2 Methods**

To accomplish this research work, two types of data were used. Primary and Secondary.

#### **4.3 Primary data collection**

Primary data were collected by following methods.

### **4.3.1 Reconnaissance**

A preliminary survey of the study area was done in first week of June 2008 to locate herpetofauna, their status, habitats and their importance. The survey process included field observation and interaction with the local people.

The study area was visited by the researcher in different periods of time from June, 2008 to December, 2009. First field visit was conducted in the second week of June and first week each of July and August, 2008. Then the second field visit was carried out in every second week of June, July and August, 2009. Finally the questionnaire survey was conducted in the adjoining village of study area in December, 2009.

### **4.3.2 Amphibian and Reptilian Visual Encounter Surveys (ARVES)**

This method was conducted both day and night. The known habitats of amphibians and reptiles were thoroughly searched for near water bodies, under stones, logs, bushes, tree trunks and decaying vegetation. Arboreal species were looked in trees and bushes up to height of 2m. The same methods were used for the reptiles also (Campbell and Christman 1982; Corn and Bury 1990; Crump and Scott 1994, Heyer et al.1994).

### **4.3.3 Terrestrial Habitat Assessment Method**

#### **4.3.3.1 Ground Searches**

Ground searches were used to make an inventory of all terrestrial habitats for anurans and reptiles. Ground search consists of turning cover objects during the day and searching surface areas with flashlights at night. As far as possible the individuals were managed to collect manually and photographs were taken for those which were not possible to identify at that time.

#### **4.3.4 Questionnaire Survey**

Pre-structured, but open questionnaires were designed to collect quantitative information on herpetofauna which mentioned their status, ethnoherpetology, and local's attitude towards the herpetofauna. Two sets of questionnaires were developed to collect the information in the time of interviews. Altogether 75 households (with

the head of family and in some cases the person above 21 years) were interviewed with Simple Random Selection technique containing 20 questions. The identification of herpetofauna species based on direct observation, literature review and interview with the local people by showing pictures and describing their morphology. The questionnaires were also focused on ethnicity, land composition and occupation (Appendix-I). Among 75 households the ethnic composition of Tharus was highest 22 (29.33%) similarly followed by Bahun 18 (24%), Chhetri 16 (21.33%), Gurung 8 (10.66%) Darai 6 (8%) and Damai and kami 5 (6.66%). Another set of questionnaire containing 12 questions were asked to an individual of concerned institutions (N = 10) such as VDCs, forest guard, ex-forest guard, officials of Range post office, leader of Community Forest Users , School etc (Appendix-II).

#### **4.3.5 Specimen preservation**

All collected specimens were preserved in Alcohol (70%). Before preserving them their measurement, coloration etc and their habitats were also recorded.

#### **4.3.6 Specimen identification**

Most of the collected specimens were identified in field by using standard literature (Shah and Tiwari, 2004), direct observation and interviewed with the local people. Those that could not be identified in the field photographs were also taken and brought to Natural History Museum, Swayambhu, Kathmandu, Nepal and identified through the help of an expert.

#### **4.4 Secondary data collection**

Secondary data were collected from different sources like books, journals, theses and research articles of different authors.



## CHAPTER – FIVE

### 5. RESULTS

#### 5.1 Land Composition

To determine the land composition, questions were asked to 75 households. There were 41.33% , 20%, 16%, 14.66%, 8%, of houses with landless, below 1 Kattha, 1-10 Kattha, 10 Kattha-1 Bigha and above 1 Bigha, respectively.

**Table 4: Status of land composition**

S.N.	Area of the field	No. of Respondents	% of Responded person
1	Landless	31	41.33
2	Below 1 Kattha	15	20
3	1-10 Kattha	12	16
4	10 Kattha -1 Bigha	11	14.66
5	Above 1 Bigha	6	8
	Total	75	100%

#### 5.2 Diversity of the Herpetofauna

The study area has been found rich in herpetofauna (amphibians and reptiles). Altogether 32 species of herpetofauna have been recorded from Beeshazari lake complex. Among them 9 species of amphibians belonging to 3 families and 5 genera and 23 species of reptiles (including 7 species of lizard, 1 species of crocodile, 10 species of snake and 5 species of turtle) belonging to 13 families and 19 genera were recorded from the study area. Among the recorded species of herpetofauna, 2 species are fully protected by the Government of Nepal, National Parks and Wildlife Conservation Act, 1973, 10 species are listed in different Appendices of CITES, 9 species are included in different threat categories of IUCN Red Data Book and 12 species are listed in National Red Data Book. The checklists of recorded species of herpetofauna species from Beeshazari lake complex are provided in Appendix III.

**Table 5. Diversity of Amphibians**

<b>S. N.</b>	<b>Scientific name</b>	<b>Common name</b>	<b>Local name</b>	<b>Order</b>	<b>Family</b>
1	<i>Hoplobatrachus tigerinus</i>	Common bull frog	Sirke paha (Ba., Ch., Gu., Da., Ka.) Paha (Th.)	Salentia	Ranidae
2	<i>Limnonectes teraiensis</i>	Nepalese Terai frog	Tik-tike paha *	Salentia	Ranidae
3	<i>Euphlyctis cyanophlyctis</i>	Skittering frog	Tik-tike paha*	Salentia	Ranidae
4	<i>Limnonectes pierrei</i>	Pierre's cricket frog	Kithre bhyaguto*	Salentia	Ranidae
5	<i>Bufo melanostictus</i>	Black spine toad	Khasre bhyaguto*	Salentia	Bufonidae
6	<i>Bufo microtympanum</i>	Small eared toad	Khasre bhyaguto*	Salentia	Bufonidae
7	<i>Bufo stomaticus</i>	Marbled toad	Khasre bhyaguto*	Salentia	Bufonidae
8	<i>Polypedatus taeniatus</i>	Six – lined tree frog	Rukh paha, rukh bhyaguto*	Salentia	Rhacophoridae
9	<i>Polypedatus leucomystax</i>	Terai tree frog	Rukh paha, rukh bhyaguto*	Salentia	Rhacophoridae

**Table 6. Diversity of Reptiles**

S.N.	Scientific name	Common name	Local name	Order	Family
1	<i>Calotes versicolor</i>	Common garden lizard	Chheparo (Ba., Ch., Gu., Da., Ka.), Girgit (Th.)	Squamata	Agamidae
2	<i>Crocodylus palustris</i>	Marsh crocodile	Mugger gohi*	Squamata	Crocodylidae
3	<i>Hemidactylus brooki</i>	Spotted house lizard	Mausuli*	Squamata	Gekkonidae
4	<i>Hemidactylus flaviviridis</i>	Saffron bellied wall gecko	Tik- Tike (Ba., Ch., Gu., Da., Ka.), Bhatti (Th.)	Squamata	Gekkonidae
5	<i>Hemidactylus garnotii</i>	Garno's, Gecko	Mausuli *	Squamata	Gekkonidae
6	<i>Mabuya macularia macularia</i>	Bronze grass skink	Bhanemungro*	Squamata	Scincidae
7	<i>Varanus flavescens</i>	Yellow/golden monitor lizard	Sungohoro (Ba., Ch., Gu., Da., Ka.), Rani gohoro (Th.)	Squamata	Varanidae
8	<i>Varanus bengalensis bengalensis</i>	Bengal monitor lizard	Bhainse gohoro*	Squamata	Varanidae
9	<i>Bungarus fasciatus</i>	Banded krait	Krait sarpa*	Squamata	Elapidae
10	<i>Bungarus lividus</i>	Lesser black krait	Sarpa, kalo krait*	Squamata	Elapidae
11	<i>Naja naja</i>	Spectacled cobra	Goman sarpa*	Squamata	Elapidae
12	<i>Boiga trigonata trigonata</i>	Common cat snake	Tirrishe sarpa, Sarpa*	Squamata	Colubridae
13	<i>Ptyas mucosus</i>	Asiatic rat snake	Dhaman sarpa*	Squamata	Colubridae

14	<i>Xenochrophis piscator</i>	Common water snake(checkered keel back)	Pani sarpa*	Squamata	Colubridae
15	<i>Trimeresurus albolabris</i>	White-lipped pit viper	Haryou sarpa*	Squamata	Viperidae
16	<i>Vipera russellii</i>	Russell's viper	Gonus*	Squamata	Viperidae
17	<i>Rhamphotyphlops braminus</i>	Common blinded snake	Teliya sanp (Th), Andho sarpa (Ba., Ch., Gu., Da., Ka.)	Squamata	Typhlopidae
18	<i>Python molurus bivittatus</i>	Burmese rock python	Ajinger*	Squamata	Boidae
19	<i>Indotestudo elongata</i>	Elongated tortoise	Kachhuwa (Ba., Ch., Gu., Da., Ka.), Thotari (Th.)	Testudines	Testudinidae
20	<i>Kachuga kachuga</i>	Pointed roofed turtle	Kachhuwa (Ba., Ch., Gu., Da., Ka.), Thotari (Th.)	Testudines	Bataguridae
21	<i>Melanochelys tricarinata</i>	Tricarinate hill turtle	Padani kachhuwa, Thotari *	Testudines	Bataguridae
22	<i>Aspideretes gangeticus</i>	Indian soft-shell turtle	Kataiya*	Testudines	Trionychidae
23	<i>Lissemys punctata andersoni</i>	North Indian flapshell turtle	Putali kachhuwa*	Testudines	Trionychidae

\* = Common local name for all ethnic groups

**Legend: Ba. = Bahun, Ch. = Chhetri, Gu. = Gurung, Da. = Darai and Damai,  
Ka. = Kami and Th. = Tharu**

## 5.3 Ethnoherpetology

It is found that the herpetofauna are used for various purposes such as food, medicine, decorative value, religious value, and so on in the study area. Nine species of herpetofauna are used as food and medicinal purpose by local people. The details on the uses of amphibians and reptiles by local inhabitants of the Beeshazari lake complex are as follows.

### 5.3.1 Amphibian Fauna

#### Food Value

The meat of Common bull frog (*Hoplobatrachus tigerinus*) is eaten by Tharu ethnic groups and Darais. During summer, in the evening just after the rainfall Darais use fire torch and go to the agriculture land (mainly paddy fields) then catch the frogs and remove their head, toes and stomachs. These frogs are then fried in oil with onion, salt and spices until it gets reddish color in order to prepare the dish. It is said that Paha meat is tastier than that of mutton or chicken. To kill live frogs they are put into hot water.

#### Medicinal Value

1. Soup prepared from dried Common bull frog (*Hoplobatrachus tigerinus*) without using salt and spices is used for treating cough, cold, fever, diarrhoea, vomiting and dysentery.
2. The meat of Common bull frog is given to treat dry malnutrition (marasmus).
3. The soup and meat of Common bull frog is given to treat joint pain. The meat is fried and the soup prepared by adding water, salt and spices.

### 5.3.2 Reptilian Fauna

#### 5.3.2.1 Lizards

##### Family: Varanidae

Only two species of Monitor lizards (*Varanus* spp.) are reported from Nepal (Shah, 1997). These both species are found in Beeshazari lake complex. Both species are more or less equally used for food as well as medicinal purposes.

#### Food Value

The meat and eggs of *Varanus* spp. are eaten by Tharu ethnic groups as well as other tribes. The meat is said to be tender and the taste similar to that of pork. Monitor

lizards are the most hunted species of lizard found in Nepal. These lizards are very common in Beeshazari Lake and its surrounding area mainly on paddy fields and Sal (*Shorea robusta*) forests.

After killing the *Varanus* sps., the skin is removed by using blade and kept on the sun for drying. The alimentary canal is removed and smoked over the hearth for future use as medicine. The fats are collected separately and kept in a container then remaining part of the body cut into pieces and delicious food is prepared.

### **Medicinal Value**

Besides foods, monitor lizards body parts are also used as medicinal products. Not any portion of the body of monitor lizard is wasted. It is believed that eating the meat of monitor lizard makes the human body resistance to several diseases.

1. The meat is believed to cure swelling of the body or of an organ. It is also regarded as highly beneficial for tuberculosis and leprosy patients. Consuming the meat of Monitor lizard is believed to cure piles and asthma.
2. To gain normal body weight people are advised to eat monitors lizards meat.
3. A paste made from the bones of a monitor lizard is applied over a poisonous snake bite with the belief that it neutralizes the poison.
4. The fat of a Sungohoro (*Varanus flavescens*), is applied on swellings and to treat itching. It is also used as an insect repellent and also as an anti-leech agent when walking in ponds, jungle, or working in the field.

### **Economic value of the skin**

The monitor lizard's skin is used to make drum-like musical instrument (eg. *Khajedi*). A high quality *Khajedi* is made by using monitor's skin. For this purpose people kill monitor lizards and removes their skin with the help of blade or knife and keep in the sun for drying when it gets fully dried up the skin is immersed in hot water to make it tender and stretched and used to make *khajedi* and sometime sold in the market.

**Family: Gekkonidae**

So far 10 species from this family are reported from Nepal (Shah and Tiwari, 2004). All species are equally used for the medicinal purpose. However, only three species are reported during the study period from Beeshazari lake complex. Local people believe that the geckos are deadly poisonous (which is not true) so they are never used as food.

**Family: Scincidae**

So far 15, species from this family are reported from Nepal (Shah and Tiwary, 2004). Only one species is reported from the Beeshazari lake complex.

Skins are not used as food and medicine by local people in the study area.

**Crocodiles****Family: Crocodylidae**

In Nepal this family is represented by only two species. However, only one species occurs in the Beeshazari Lake that is Marsh crocodile (*Crocodylus palustris*).

**Food Value**

The eggs of Marsh crocodile are eaten by Tharus. The eggs are said to be tastier than that of chicken. However there is no record of Crocodile meat taken as food by the local people.

**5.3.2.2 Serpents (Ophidia)**

Easily available and large bodied snakes are found used as food and in medicines. Both poisonous as well as non-poisonous snakes are used for making medicines, however only non-poisonous and large sized snakes are chosen for the food. (Shah and Tiwari, 2004).

**Food Value**

Snakes are not used as food by local people in the study area.

## **Family: Boidae**

### **Medicinal Value**

1. Pythons fat is used to treat a skin disease called 'dubi' (Vitiligo). The fat is also used to treat arthritis, body pain and wound which is caused by fire.
2. Python's meat is given to a Tuberculosis patient in the belief that it will cure the disease.
3. Oil extracted from fat of python is applied to the scalp in the belief that it enhances hair growth.
4. The skin of the python if tied in the waist like a belt the belief that it reduces the waist pain.

### **5.3.2.3 Turtles and Tortoises**

So far, 17 species of turtle are reported from Nepal (Shah and Tiwary, 2004). Among them only five species are recorded from the Beeshazari lake complex. These all species are often used for food and medicinal value by the local people.

### **Food Value**

Almost all the species of tortoise and turtles identified in Beeshazari lake complex during the study period are eaten by the local people. Tharus, Darais, Gurungs as well as other tribes. However, the meat of all soft shell turtles is very delicious and that of Indian soft shell turtle, *Aspideretes gangeticus* was tastiest. The meat of the land tortoise (*Indotestudo elongata*), is one of the species of land tortoise found in Nepal is said to be less tasty and eaten occasionally by the people (Shah and Tiwary, 2004).

The eggs of all species are eaten with the same preference and said to be as delicious as the chicken eggs.

### **Medicinal Value**

1. The shell of *lissemys* spp. is frequently used to treat several infecticious diseases in children's.
  - In case of tonsillitis a paste is prepared by rubbing the shell on a stone with water and the paste is given orally.
  - The paste made by rubbing the shell is applied externally to treat measles.
  - To treat other infecticious diseases like cold, pneumonia and painful joints the paste is applied on the nose, knees and ankles. It is believed that if that paste



given orally especially in children suffering from pneumonia it can be cured completely which can't be cured by medicine given by a doctor.

2. To treat skin diseases like scabies and eczema a turtle shell is burnt, crushed to fine powder and mixed with coconut oil. The paste is applied on the affected regions.
3. Keeping a turtle shell in the house is believed to bring prosperity and keep the house free of diseases.
4. The bile of turtle is considered to be an excellent medicine for underweight children and children suffering from chronic diarrhoea, appetite loss, indigestion and night fever.
5. Dried bile of turtle with lukewarm water is given orally for 10-15 days to treat newly developed (2-3 months old) tuberculosis. It is believed that this also controls cough and chest pain associated with the diseases.
6. To reduce high fever the gall bladder of land tortoise (*Indotestudo elongata*) is consumed.
7. To treat hysteria turtle's penis is rubbed on stone with water and taken orally.

It is believed that a person who eats turtle's meat remains unattacked by asthma, jaundice, leprosy and cough.

#### **5.4 Diversity of use among different Ethnic groups (Only medicinal and food)**

Nine species of the herpetofauna are used for food and medicinal purpose. Python is used as only medicinal, eggs of the crocodile and *Kachuga kachuga* is used as only food. Common bull frog (*Hoplobatrachus tigerinus*), was found to be used only by Tharus and Darais as food and medicinal purpose. The eggs of Marsh crocodile (*Crocodylus palustris*) are eaten by only Tharus. Whereas the python is used as medicinal purposes by the all ethnic groups. However, *Varanus* species and almost all the recorded species of Turtle were highly exploited for both food and medicinal purposes by all ethnic groups. Most of Bahun and Chhetri use these species as medicinal purpose than food due to their traditional knowledge of medicine. Therefore, these herpetofauna species are highly threatened. So the conservation of these species is highly essential in that area.

**Table 7. Diversity of use among different Ethnic groups**

S.N.	Herpetofauna	Local name	Medicinal						Food					
			Tharu	Bahun/ Chhetri	Gurung	Darai	Damai/ Kami	Total	Tharu	Bahun/ Chhetri	Gurung	Darai	Damai/ Kami	Total
1	<i>Hoplobatrachus tigerinus</i>	Sirke paha, Paha	+	-	-	+	-	2	+	-	-	+	-	2
2	<i>Crocodylus palustris</i>	Mugger gohi	-	-	-	-	-	-	+	-	-	-	-	1
3	<i>Varanus flavescens</i>	Sungohoro, Rani gohoro	+	+	+	+	+	5	+	+	+	+	+	5
4	<i>Varanus bengalensis bengalensis</i>	Bhainse gohoro	+	+	+	+	+	5	+	+	+	+	+	5
5	<i>Python molurus bivittatus</i>	Ajinger	+	+	+	+	+	5	-	-	-	-	-	-
6	<i>Indotestudo elongata</i>	Kachhuwa, Thotari	+	+	+	+	+	5	+	+	+	+	+	5
7	<i>Kachuga kachuga</i>	Kachhuwa, Thotari	-	-	-	-	-	-	+	+	+	+	+	5
8	<i>Aspideretes gangeticus</i>	Kataiya	+	+	+	+	+	5	+	+	+	+	+	5
9	<i>Lissemys punctata andersoni</i>	Putali kachhuwa	+	+	+	+	+	5	+	+	+	+	+	5

## 5.5 Conservation threats

The Beeshazari Lake, which is one of the important wetland of Nepal, and also a major habitat of various faunal species, is in continuous process of natural eutrophication (Picture 1). In addition to tourist pressure local people are engaged in fuel wood and fodder, grasses, illegal fishing, haphazardly throwing of solid waste by locals and visitors livestock grazing etc. Due to massive growth of aquatic weeds, open water is drastically reduced.

Maximum threats were found to turtles and followed by *Varanus* spp. Because these herpetofauna species highly exploited for both food as well as medicinal purposes by local people. The forest fire inside the Barandabhar Corridor Forest was a great problem in summer season. This may also be one of the most destructors for terrestrial species of herpetofauna. Local people and smokers sometimes make fire deliberately inside the forest around Beeshazari Lake for various purposes like searching Kurilo (*Asparagus* spp.), Nigro (*Dryopteris* spp.), Mushroom (*Agaricus* spp.) and clear the understory vegetation. Natural factors also sometimes play a major role of habitat destruction. Wind blow and flood due to torrential rainfall are the most noticeable natural hazards for forest and grassland and wetland devastation.

As many as 29 persons fishing illegally in the lake were spotted during the study period. The poachers mostly used hook rather than net for fishing purpose (Picture 14). The poachers killed turtles by using large hook. The poachers used live frog, fish, rat or intestine of chicken in the hook and thrown into the lake area where turtles occur. The turtle's meat is found to be sold at NRs.200-250 per kg. During the study period from June 2008 to December 2009 I observed 7 Indian soft-shell turtles (*Aspideretes gangeticus*) hunted by the single person. It was determined by observing carapace of turtle (Picture 3). So it is believed that this species holds remarkable number of population. It means this species found in the study area are highly threatened. Forest fire and deforestation are also the major cause for the reduction of herpetofauna including land tortoises, *Indotestudo elongata* and *Melanochelys tricarinata*. The *Varanus* spp. are either killed by chasing in the paddy field or forest area or by digging the burrows where they live.

Collection of eggs of turtles and crocodiles mainly by Tharus and other peoples were used for subsistence purposes, to supplement meager diet. The egg collectors not only collect the eggs but also destruct the nesting sites. Some of the wildlife's have been recorded as potential predators on eggs of the turtles, *Varanus* and crocodiles, such as otter, monitor lizards, jackals, mongoose, wild dog and wild boar (Chaudhary, B.R Pers comm.).

No electric fishing was recorded. According to the secretary of the Tikauli Buffer Zone community forest, about 30-35 households directly as well as indirectly depend on Beeshazari Lake for their livelihood. Local people of the adjoining and surrounding area use liquid and powder, pesticides along with the fertilizer in their crop fields. In Chitwan district there are 58 certified suppliers of pesticides of which six are in Bharatpur and four in Ratnanagar municipalities. The farmers used 5000 liters of liquid pesticides and 40 metric ton of powder pesticides in the whole Chitwan district (DADO, 2002). Similarly, the fertilizer, Urea, D.A.P., Potash etc. Utilization rate also high in the district. Although, no poisoning cases of fishes and herpetofauna were observed in the field visit it may be one of the hidden causes for amphibian and reptiles population decline.

Timber collection by the villagers, livestock grazing, collection of fuel wood and fodder are also high around the lake. These all make soil impervious and habitat destruction of certain terrestrial herpetofauna species like turtles and tortoises, monitor lizard, crocodiles and snakes etc. Destruction of ground vegetation which leads to low fertile soil erosion by rain water. These are the factor responsible for decline in the population of herpetofauna. Due to misconception of people, they always think that all the snakes are poisonous and deadly as a result, they are killed. Illegal hunting for meat and skin, habitat degradation and disturbances, particularly in patchy forest adjoining the agricultural land appear to be the most significant threats to *Varanus* species in the study area. Local people believe they damage the irrigation canals by making burrows. Furthermore, local people regard *Varanus* species as highly poisonous.

**The threats of herpetofauna are summarized below:**

- Habitat loss and fragmentation
- Over hunting
- Leaching of inorganic fertilizer and pesticides from farmland
- Pollution
- Over exploitation
- Forest firing
- Predators

## CHAPTER – SIX

### 6. DISCUSSION

The present study was conducted in Beeshazari lake complex and its surrounding settlements of Chitwan district. The lake is facing serious problems from the local inhabitants. The lake harbors good diversity of herpetofauna (amphibians and reptiles). The lake is highly threatened by the local people as well as the outside visitors. The herpetofauna species are highly exploited for food, medicine and other purposes.

The area has been found rich in herpetofauna (amphibians and reptiles). A total of 32 species of herpetofauna are recorded from the Beeshazari lake complex. Out of which 9 amphibians and 23 reptiles including 7 lizards, 1 crocodile, 5 turtles and 10 snakes. Shah and Tiwary (2004) recorded 75 species of herpetofauna from Chitwan district consisting 17 amphibians, 13 lizards, 2 crocodiles, 10 turtles and 33 snakes. Shah and Tiwary (2004) mentioned the occurrence of all those amphibian species except *Bufo microtypanum* from Chitwan district.

Zug and Mitchell (1995) recorded 55 species of herpetofauna from Chitwan National Park consisting 11 amphibians, 2 crocodilians, 8 turtles, 10 lizards and 24 snakes and recorded all the species of amphibians except *Hoplobatrachus tigerinus*, *Limnonectes teraiensis*, *Limnonectes pierrei*, *Euphlyctis cyanophlyctis*, *Bufo microtypanum*, *Polypedates taeniatus* and *Polypedates leucomystax*.

Among the 7 species of lizard *Calotes versicolor*, *Hemidactylus brooki*, *Hemidactylus flaviviridis*, *Hemidactylus garnotii*, *Mabuya mucualaria mucualaria*, *Varanus flavescens* and *Varanus bengalensis* are recorded from the study area. Shah and Tiwari (2004) have also mentioned the occurrence of all those species from Chitwan district. Zug and Mitchell (1995) had also recorded all those species from Chitwan National Park. Eleven *Crocodylus palustris* were observed during the study period. Shrestha (1994) had also recorded 15 to 20 individuals of marsh crocodiles (*Crocodylus palustris*) from Beeshazari Lake. Khatiwada and Ghimire (2008) recorded one *Varanus flavescens* from the forest area near Beeshazari lake.

Ten species of the snake are recorded from the study area. Shah and Tiwari (2004) recorded all those species of snake from Chitwan district. Zug and Mitchell (1995) recorded all the species of snake except *Bungarus lividus* from the Chitwan National Park.

Five species of turtle are recorded from the study area. Shah and Tiwari (2004) also mentioned the occurrence of all those species of turtles from Chitwan district. Zug and Mitchell (1995) recorded all the species of turtles except *Lissemys punctata andersoni* from Chitwan National Park. Bista (2010) also recorded all the species of turtles from the Ghodaghodi lake complex.

Among the recorded species of the herpetofauna (*Hoplobatrachus tigerinus*, *Varanus flavescens*, *Varanus bengalensis*, *Crocodilus palustris* and almost all the recorded species of turtles (*Indotestudo elongata*, *Kachuga kachuga*, *Melanchelys tricarinata*, *Aspideretes gangeticus* and *Lissemys punctata andersoni*) are used as both food and medicine by local people. Shah (1997) had also mentioned about the uses of these herpetofauna species as both food and medicinal value by the people. However, *Calotes versicolor*, *Hemidactylus brooki*, *Hemidactylus flaviviridis*, *Hemidactylus garnotii*, *Mabuya mucualaria mucualaria* were never taken as food items because people assume they are deadly poisonous. Shah (1997), Thakulla (1999) and Shah and Tiwari (2004) mentioned about the uses of snakes as food and medicine. But I have recorded only a few medicinal usages of the snakes in the study area. I have found the skin of both Monitor lizards (*Varanus flavescens* and *Varanus bengalensis*) are used for making drum like musical instrument locally called *Khajedi* which had also mentioned by Rai (2003) but had not mentioned by Thakulla (1999). Python fat is used to treat skin disease called 'dubi' (Vitiligo), arthritis, body pain and wound caused by fire by the local people in the study area which had also mentioned by Shah (1997), Thakulla (1999) and Shah and Tiwari (2004). All the species of turtles are used for both food and medicine by the local people in the study area. Carapace, bile and penis of turtle are used as medicine. Shah (1997) and Shah and Tiwari (2004) had also mentioned those turtles species used as both food and medicine by the people.

Herpetofauna are highly exploited for food and medicine in the study area. Habitat loss and fragmentation, over hunting, pollution, forest firing, over grazing, deforestation, disturbances by the local people, wanton killing, leaching of inorganic fertilizer and pesticides from farm land are found to be the major threats to the survival of the herpetofauna species in Beeshazari lake complex.



## CHAPTER - SEVEN

### 7. CONCLUSION AND RECOMMENDATIONS

#### 7.1 Conclusion

The aim of the study is to find out the status of the herpetofauna in the Beeshazari lake complex, to enumerate the various uses of herpetofauna (Ethnoherpetology) and conservation threats. The study was conducted at Beeshazari lake complex and its surrounding settlements which lie in the Buffer Zone of Chitwan National Park (CNP). The lake provides suitable habitats for most of the herpetofauna species. A total of 32 species of herpetofauna were recorded from the study area including 9 species of amphibians belonging to 3 families and 5 genera and 23 species of reptiles belonging to 13 families and 19 genera.

Most of the people in the study area are poor and illiterate and also they do not have their own lands. They settled on the land of the landowners. They cultivate their land and take half of the crops produced. So they face difficulty in living a sustainable life. Besides cultivation, the local people engage themselves in illegal fishing, livestock grazing, fuel wood and fodder collection. Most of the herpetofauna (amphibians and reptiles) are highly exploited for food and medicine by the local inhabitants. Habitat loss and fragmentation, use of pesticides, deforestation, disturbances, over grazing, wanton killing, medicinal use, fire, collection of eggs and pollution of water, are identified as major threats to the herpetofauna.

One species of frog, both species of monitor lizard, and almost all the recorded species of turtle are found to have great ethno-biological value. These all are eaten by Tharus ethnic groups as well as other tribes. Due to the high food and medicinal value especially, *Varanus* spp. and turtle's spp. are highly threatened in that area.

#### 7.2 Recommendations

During the study period the researcher had interviewed several local inhabitants and also observed the habitats and human induced impacts at the study area. Based on this, following are some recommendations, which will be useful for the proper conservation of herpetofauna in the study area.

- Environment Impact Assessment (EIA) must be done before cleaning the lake.
- Collections of fodders and fuel wood should be made limited and should be allowed only in the permitted area.
- A dam should be built across the outlet of the lake by widening only than it will help to increase the water level of the lake so that dam will not rupture during torrential rainfall.
- Precaution against the forest fire should be taken during the dry season.
- Grazing should be done in a rotational way and stall feeding should be encouraged.
- A watch tower should be built in the area in order to find out the activities of the local people as well as the visitors.
- For sound management of the lake system and its flora and fauna, conservation education should be provided to the local people.
- Illegal hunting, fishing and trapping in lakes should be strictly prohibited.
- Reduce in the use of pesticides in the area and look for alternatives; such as biological control.
- Solid waste such as plastic, paper, bottles should be well managed which are haphazardly thrown by the visitors.
- Radio and Television programmes especially on the endangered fauna including herpetofauna should be broadcasted in local ethnic languages which will also help to awaken, protect and conserve the herpetofauna.

- Community Forest management Programs with the local people should be conducted.
- Community Forests user groups should be made conscious about the conservation of herpetofauna.
- People should be encouraged in plantation in the severely degraded area in order to increase habitats for the fauna.
- Public awareness programmes should be launched about the herpetofauna, their importance and conservation.

## REFERENCES

- Adhikari, R., Karmacharya R., Adhikari Y., and Sapkota D. R. (2000). *The birds of Barandabhar*. Unpublished report. Bird Education Society, Sauraha.
- Baral, H.S. (1996). *Avian-fauna of Beeshazari Lake Chitwan*. Report submitted to IUCN, Nepal.
- Baral, N. and J.T. Heinen. (2007). *Resources use, Conservation attitudes, management intervention and park-people relation in the Western Terai landscape of Nepal*. Environmental Conservation 34(1): 64-72.
- Bhandari, B.B. (1996). *The status of Nepal's Wetlands in the Terai*. Paper presented at the Salim Ali Centenary Seminar on the Conservation of Avian Fauna of Wetlands and Grasslands, Bombay Natural History Society. 12-15 February. Bombay, India.
- Bhandari, B.B. (2009). *Preliminary Inventory of Nepal's Wetlands*. Kathmandu: IUCN, Nepal.
- Bhandari, B. (1998). *An Inventory and Nepal's Terai wetlands* -IUCN -Nepal; The World Conservation Union.
- Bista, D. (2010). *Assessment of the Status of Herpetofauna especially focusing on the Turtles in Ghodaghodi Lake, Kailali. A Ramsar Site of Nepal*. Master's degree dissertation submitted to T.U, Central Dept. of Environmental Science, Kirtipur.
- BPP. (1995). *Biodiversity assessment of Terai wetlands*. Biological Project Profile. Technical publication No.1. Department of National Parks and Wildlife Conservation, Ministry of Forests and Soil Conservation. His Majesty's Government of Nepal, Kathmandu.
- Boulenger, G.A. (1907). *Batrachia*. In: *Boulenger et al. Reports on collection of Batrachia. Reptiles and Fish from Nepal and the western Himalayas*. Rec.Ind. Mus. **1**: 149-151.
- Boulenger, G.A. ( 1913). *A list of the Reptiles obtained by N.H. Stevens in Upper Assam and the Eastern Himalayas*. Rec. Ind. Mus. **9**: 337-338.

- Campbell, H.W., and S.P. Christman. (1982). *Field techniques for herpetofaunal community analysis*. Pages 193-200 In N. J. Scott, Jr. (ed.), *Herpetological Communities*, U.S.D.I. Fish and Wildlife Service, Wildlife Research Report 13, Washington, D.C. 239 pp.
- Cantor, T.E. (1981). *Catalogue of Reptiles*, Cosmo publication, Delhi pp.107-147.
- Corn, P. S., and R. B. Bury. (1990). *Sampling Methods for Terrestrial Amphibians and Reptiles*. USDA Forest Service, General and Technical Report PNW-GTR-256, 34 pp.
- Crump, M.L., and N.J. Scott. (1994). Visual encounters surveys. In W.R. Heyer, M. A. Donnelly, R. W. McDiarmid, L. C. Hayek, and M. S. Foster (eds.) *Measuring and Monitoring Biological Diversity. Standard Methods for Amphibians*. Smithsonian Institution Press, Washington, DC Pages 84-92.
- DADO. (2002). *Chitwan Jilako Krishi Vikash Karyakram Tatha Tathayank Pustika*. District Agriculture Development Office, Chitwan.
- Dahal, B.R. (2002). *Birds Checklist of Barandabhar Corridor forest*. Unpublished report submitted to National Trust for Nature Conservation (NTNC), Jawalakhel, and Lalitpur.
- DOAD. (1992). *National Fisheries Development Plan, 1992/1993*. Fisheries Development Division, Department of Agriculture Development. Government of Nepal, Kathmandu, Nepal.
- Fleming, R.L. Jr. (1971). "*Snakes of Nepal*". *Swatantra Biswa*. Vol. I: 22-46.
- Fleming, R.L. and Fleming, R.L.Jr.(1974). *Some snakes from Nepal*. *J. Bombay Nat. Hist.soc.*, **70** (3): 426-437.
- Gunther, A. (1861). List of the cold- blooded vertebrates collected by B.H. Hodgson. Esq., in Nepal, *proc.zool. London*. 1861: 213-227.
- Heyer, W. R., M. A. Donnelly, R. W. McDiarmid, L. C. Hayek, and M. S. Foster, eds.(1994). *Measuring and Monitoring Biological Diversity. Standard Methods for Amphibians*. Smithsonian Institution Press, Washington, DC. 364 pp.

- Hodgson, B.H. (1846). *"Various papers on the fauna of Nepal"*. J. Asiatic Soc. Gengal 1.
- IUCN. (1998). *A study on Conservation of Beeshazari Tal*. Wetland and Heritage Unit IUCN, Nepal.
- IUCN. (2003). *Conservation and Sustainable Use of wetlands in Nepal*. Kathmandu: IUCN.
- IUCN. (2004). *A Review of the Status and Threats to wetland in Nepal*. 78+V pp.
- Kharel, S. (2002). *Pollution in Narayani River : Theratened to Wildlife and Environments* (Eds. Dhakal, J.). Vol.4, No. 1. May-2002.pp. 54.
- Khatiwada, J. and Ghimire, B. C. (2008). *Conservation Status of Varanus flavescens*. Biawak 3(4), pp. 101-105.
- KMNTC. (1998). *Royal Chitwan National Park After Twenry Years: An assessment of threats and opportunities*, KMNTC, Kathmandu, Nepal.
- Kumar, A.B. (1999). *Our Vanishing Wetlands*. J. Science Reporter: Dec. 1999: 9-15. New Delhi.
- Mitsch,W.J, and J.G. Gosselink. (2007). *Wetlands*, 4<sup>th</sup> ed., John wiley and Sons, Inc., NewYork, 582pp.
- MOFSC, (2003). *National Wetland Policy*. Ministry of Forest and Soil Conservation, Kathmandu, Nepal.
- Nanhoe, L.M.R and Ouboter, P.E. (1987). *The Distribution of Reptiles and Amphibians in the Annarpurna-Dhaulagiri Region (Nepal)*. Zoo. Verhandel., Leiden,Netherland. 229: 1-66.
- Nepal Tourism Board, (2009). *Tourism Development Endeavors (TUDE) "For Sustainable, Ethical and Decentralized tourism in Nepal*.
- Orlov, N. and Helfenberger, N. (1997). *New Mountaitain species of Trimeresurus (Serpents, Viperidae, Crotalinae) of the Green Pit Viper group from the Himalayas*. Rus. Jour. Herp., 4 (2): 195-197.

- Rai, K. R. (2003). *Environmental Impacts, systematics and Distribution of Herpetofauna from East Nepal*. A Ph.D. Dissertation submitted to Central Department of Zoology, Tribhuvan University, Kirtipur, Kathmandu, Nepal. pp.492.
- Red Data Book of Fauna of Nepal, (1995). *Biodiversity Profiles Project*, technical publication No.4. Department of National parks and Wildlife Conservation, HMG, Nepal.
- Schleich, H.H. (1993). *Contribution to the Systematic and to a Bibliography of the Amphibians and Reptiles from Nepal*. Journal of the Nepal Research center. Vol. IX, pp. 141-168.
- Schleich, H.H. and Kastle, W. (Eds.) (2002). *Amphibians and Reptiles of Nepal*. A.R.G. Ganther Verlag K.G. Germany. pp. 1295.
- Shah, K.B. (1995). *Enumeration of the Amphibians and Reptiles of Nepal*. Biodiversity Profiles Project, Technical publication No. 2, HMG's . Department of National Parks and Wildlife Conservation, Ministry of Forests and Soil Conservation. Government of Nepal Kathmandu, Nepal. Kathmandu.
- Shah, K.B. (1997). *Amphibians and Reptiles Used as Food and Medicines in Nepal*. A project Report Submitted to Tribhuvan University, Natural History Museum, Swoyambhu, Kathmandu, Nepal. pp.31.
- Shah, K.B. (2001). *Herpetofauna and ethnoherpetology of the southern Annarpurna region, Kaski district, Nepal*. (2001). J. of Nat. Hist.Mus. Vol.**20**: 105-128.
- Shah, K.B. and Giri, M.K. (1991). *Habit and distribution of some Reptiles in Arun Basin, East Nepal*. Jour. Nat. Hist. Mus., **12** (1-4): 61-70.
- Shah, K.B. and Giri, M.K. (1992). *Some Amphibians and their local uses in Arun Basin*. Jour. Nat. Hist. Mus.,**13** (1-4): 9-17.
- Shah, K.B. and Tiwari, S. (2004). *Herpetofauna of Nepal: A Conservation Companion* IUCN- the World conservation Union, Nepal. VIII + 237 pp.
- Shrestha, R.L. and Shah, K.B. (1985). *Nepalka sarpaharu* (English: Snakes of Nepal). In Nepali, T.U., Natural History Museum, Kathmandu. pp.84.

- Shrestha, T.K. (1981). *Wildlife of Nepal. A study of renewable resources of Nepal Himalayas*. T.U., Curriculum development Centre, Kathmandu, Nepal. pp.734.
- Shrestha, T.K. (1982). *Distribution of Amphibians in Nepal*. In Majupuria, T.C. (ed.). *Wild is Beautiful*. S. Devi, Lashkar, India .pp.142-146.
- Shrestha, T. K. (1994). *Wetland Fauna in Nepal*. In Bhandari, B., Shrestha, T.B. and Mc Eacharn, J. (Eds.) *Safeguarding Wetlands in Nepal. Proceeding of the National workshop on wetlands management in Nepal*, IUCN. pp. 41-52.
- Shrestha, T. K. (2001). *Herpetology of Nepal. A field guide to Amphibians and Reptiles of Trans-Himalayan region of Asia*. Published by Mrs. Bimala Shrestha; Kathmandu, Nepal pp. 280.
- Smith, M.A. (1951). *On a collection of Amphibians and Reptiles from Nepal*. - London; Ann.Mag. Nat. Hist., **4**, 726-728.
- Swan, L.W. and Leviton, A.E. (1962). *The Herpetology of Nepal: A history, checklist and zoogeographical analysis of the herpetofauna*. Proc. Calif. Acad . Sci., 32(6): 103-147.
- Thakulla, H.B. (1999). *Survey of Herpetofauna and their local uses in the Ghodaghodi tal area of Shukhad, Kailali District*. Unpublished Master's degree dissertation submitted to T.U., Central Department of zoology, Kirtipur, Kathmandu, Nepal. pp.56.
- Whitaker, R. (1978). *Common Indian snakes. - A field guide*; Macmilan, India. pp.155.
- Zug, G.R. and Mitchell, J.C. (1995). *Amphibians and Reptiles of Royal Chitwan National Park, Nepal* – Asiatic Herpetological Research, Vol.6: pp.172-180.



## APPENDIX- I

### Questionnaires for local People

#### **Herpetofauna and Ethnoherpetology of Beeshazari Lake Complex, Chitwan District**

Questionnaire No..... Date.....

Name of respondent... Age .....

Sex: Male/ Female

Address ..... Village/Tole .....

#### **Group A (General)**

1. How many members are there in your Family?

.....

2. How much land do you have?

Bigha..... Ropani ..... Kattha..... Dhur .....

3. What are the sources of income?

(a) Agriculture                      (b) Service                      (c) Business                      (d) Others

#### **Group B (Specific)**

1. Have you ever seen animals in Beeshazari lake complex?

(a) Yes                                      (b) No

2. If yes, what type of animals that you have seen?

(a) Vertebrate                              (b) Invertebrate

3. Among the group of vertebrates what are these that you have seen?

(a) Fishes    (b) Reptiles    (c) Birds    (d) Amphibians    (f) Mammals

4. Can you say the name of Animals that belongs to the Group of Reptiles and Amphibians?

(a) Yes                      (b) No                      (c) Don't know

5. If yes, what are these?

- (a) Frog (b) Snake (c) Toad (d) Lizard (f) Turtle

6. At what time are Herpetofauna seen most?

- (a) Winter (b) Summer and rainy Season (c) Every months of the year

7. Despite of having agriculture, do you also depend on Beeshazari Lake?

- (a) Yes (b) No

8. Can you tell the economic importance of Herpetofauna?

- (a) Yes (b) No

9. If yes, what is the importance?

- (a) Food (b) Skin (c) Medicine

10. Tell me separately the name of species that are used for above purpose.

Food	Skin	Money	Medicine	Others

11. Have you applied any equipment for catching Herpetofauna?

- (a) Yes (b) No

12. If yes, what are they?

- (a) Hook (b) Net (c) Electric current (d) Others

13. Which Equipments were most effective?

.....

14. What are the most favorable foods for Herpetofauna?

.....

15. Tell me the name of poisonous Herpetofauna found in Beeshazari lake complex.

- (a). ..... (b) ..... (c) .....

(d) ..... (e) ..... (f) .....

16. Do Herpetofauna bite any members in your Family?

(a) Yes (b) No

17. If yes, what is the name of the person and name of species and date of attack?

Name: ..... Date: ..... Species Name: .....

18. What was the incident?

.....

19. What are the reasons that your child is attracted towards Beeshazari Lake?

(a) Baiting (b) Swimming (c) Any other Entertainment

20. The Herpetofauna species are decreasing day by day. In your opinion, how can we conserve or save the Herpetofauna especially in Beeshazari Lake complex.

(a)..... (b) ..... (c) .....

(d) ..... (e) ..... (f).....

## APPENDIX- II

### Questionnaires for institutes

#### **Herpetofauna and Ethnoherpetology of Beeshazari Lake Complex, Chitwan District**

Questionnaire No..... Date.....

Name of respondent.....Sex..... Age .....

Institution .....

1. Have you ever heard about Beeshazari Lake?

- (a) Yes (b) No

2. If yes, tell me about Beeshazari Lake.

.....

3. Why People go to Beeshazari Lake?

- (a) Picnicking (b) Fodder collection (c) Fishing (d) Boating  
(e) Others.....

4. In spite of having agricultural occupation do people also depend upon Beeshazari Lake?

- (a) Yes (b) No

5. If yes, what type of people goes to Lake?

(a)..... (c).....

(b)..... (d).....

6. Have you ever known about Herpetofauna?

- (a) Yes (b) No

7. If yes, tell me the name of Herpetofauna species that are found in the Lake?

(a)..... (c) .....

(b) ..... (d).....

8. Which species mostly found respectively in Beeshazari Lake complex?

(a)..... (b).....

(c)..... (d).....

9. Can you tell me the uses of Herpetofauna?

(a) Yes

(b) No

10. If yes, tell me broadly the uses and methods of using Herpetofauna?

S.N	Name of the species	Uses	Methods of using	Remarks
2				
3				
4				
5				
6				
7				

11. What are the major threats of Herpetofauna in Beeshazari Lake complex?

- (a)..... (c).....  
 (b)..... (d).....

12. The Herpetofauna species are decreasing day by day. In your opinion, how can we conserve or save the Herpetofauna especially in Beeshazari Lake complex.

- (a)..... (b) ..... (c) .....  
 (d) ..... (e) ..... (f).....

## APPENDIX – III

### Checklist of the Herpetofauna Recorded from the Beeshazari Lake Complex

S.N.	Common name	Scientific name	Method of Confirmation
1.	Common bull frog	<i>Hoplobatrachus tigerinus</i> Daudin, 1802	Observation
2.	Nepalese Terai frog	<i>Limnonectes teraiensis</i> Dubois, 1984	Observation
3.	Pierre's cricket frog	<i>Limnonectes pierrei</i> Dubois, 1975	Observation
4.	Skittering frog	<i>Euphlyctis cyanophlyctis</i> Schneider, 1799	Observation
5.	Black spined toad	<i>Bufo melanostictus</i> Schneider, 1799	Observation
6.	Small-eared toad	<i>Bufo microtympanum</i> Boulenger, 1882	Observation
7.	Marbled toad	<i>Bufo stomaticus</i> Lutken, 1862	Observation
8.	Six-lined tree frog	<i>Polypedates taeniatus</i> Boulenger, 1906	Observation
9.	Terai tree frog, Java whipping frog	<i>Polypedates leucomistax</i> Gravenhorst, 1829	Observation
10.	Common garden lizard	<i>Calotes versicolor</i> Daudin, 1882	Observation
11.	Yellow monitor lizard	<i>Varanus flavescens</i> Hardwicke and Gray, 1827	Observation
12.	Bengal monitor lizard	<i>Varanus bengalensis</i> Daudin, 1802	Shah and Tiwary, 2004 and Interview

13.	Spotted house lizard	<i>Hemidactylus brooki</i> Gray, 1845	Shah and Tiwary, 2004 and Interview
14.	Saffron belled wall gecko	<i>Hemidactylus flaviviridis</i> Ruppel, 1830	Observation
15.	Garnots' gecko	<i>Hemidactylus garnotii</i> Dumeril and Bibron, 1836	Observation
16.	Bronze grass skink	<i>Mabuya macularia macularia</i> Blyth, 1853	Shah and Tiwary, 2004 and Interview
17.	Marsh crocodile	<i>Crocodylus palustris</i> Lesson, 1831	Observation
18.	Elongated tortoise	<i>Indotestudo elongata</i> Blyth, 1853	Observation
19.	Pointed roofed turtle	<i>Kachuga kachuga</i> Gray, 1831	Shah and Tiwary, 2004 and Interview
20.	Tricarinate hill turtle	<i>Melanochelys tricarinata</i> Blyth, 1856	Observation
21.	North Indian flapshell turtle	<i>Lissemys punctata andersoni</i> Webb, 1980	Shah and Tiwary, 2004 and Interview
22.	Indian softshell turtle	<i>Aspideretes gangeticus</i> , Cuvier, 1825	Observation
23.	Banded krait	<i>Bungarus fasciatus</i> Schneider, 1801	Observation
24.	Lesser black krait	<i>Bungarus lividus</i> Cantor, 1839	Shah and Tiwary, 2004 and Interview
25.	Spectacled cobra	<i>Naja naja</i> Linnaeus, 1758	Shah and Tiwary, 2004 and Interview



26.	Common Cat snake	<i>Boiga trigonata trigonata</i> Schneider in: Bechstein, 1802	Observation
27.	Asiatic rat snake	<i>Ptyas mucosus</i> Linnaeus, 1758	Observation
28.	Checkered keel back	<i>Xenochrophis piscator</i> Schneider, 1799	Observation
29.	Common blind snake	<i>Rhamphotyphlops braminus</i> Daudin, 1803	Shah and Tiwary, 2004 and Interview
30.	White- lipped pit viper	<i>Trimeresurus albolaris</i> Gray, 1842	Shah and Tiwary, 2004 and Interview
31.	Russel's viper	<i>Vipera russellii</i> ( Shaw)	Shah and Tiwary, 2004 and Interview
32.	Burmese rock python	<i>Python molurus bivittatus</i> Kuhl, 1820	Shah and Tiwary, 2004 and Interview

## APPENDIX - IV

### List of the Protected Species of the Herpetofauna Recorded from the Beeshazari Lake Complex

S.N.	Species	NPWC Act. 1973	CITES	IUCN	NRDB
1	<i>Hoplobatrachus tigerinus</i>		II		
2	<i>Limnonectes terainis</i>			LC	S
3	<i>Limnonectes pierrei</i>				S
4	<i>Euphlyctis cyanophlyctis</i>				
5	<i>Bufo melanostictus</i>			LC	
6	<i>Bufo microtyimpanum</i>				
7	<i>Bufo stomaticus</i>			LC	
8	<i>Polypedates taeniatus</i>				
9	<i>Polypedatus leucomistax</i>				
10	<i>Calotes versicolor</i>				
11	<i>Crocodylus Palustris</i>			VU	V
12	<i>Hemidactylus brooki</i>				
13	<i>Hemidactylus flaviviridis</i>				
14	<i>Hemidactylus garnotti</i>				
15	<i>Mabuya macularia macularia</i>				
16	<i>Varanus flavescens</i>	P	I	LC	S
17	<i>Varanus bengalensis</i>				S

18	<i>Bungarus fasciatus</i>				
19	<i>Bangarus lividus</i>				
20	<i>Naja naja</i>		II		
21	<i>Boiga trigonata trigonata</i>				
22	<i>Ptyas mucosus</i>		II		S
23	<i>Xenochrophis piscator</i>				
24	<i>Trimeresurus albolabris</i>				
25	<i>Vipera russellii</i>				
26	<i>Rhamphotyphlops braminus</i>				
27	<i>Python molurus bivittatus</i>	P	I	CR	V
28	<i>Indotestudo elongata</i>		II	EN	S
29	<i>Kachuga kachuga</i>				V
30	<i>Melanochelys tricarinata</i>		I	VU	V
31	<i>Aspideretes gangeticus</i>		I		
32	<i>Lissemys punctata andersoni</i>		II	LC	S

Source: BPP (1995 No. 2), DNPWC (2003), Shah and Tiwari (2004) and NRDB (2007).

**Legends: P = Protected by National Park and Wildlife Conservation Act, 1973 – Nepal, LC = Least concern, NT = Not threatened, VU = Vulnerable, V = Vulnerable, S = Susceptible and I, II, III = CITES Appendices**

## APPENDIX - V

### Maximum temperature (°C) pattern in Chitwan from 2001-2007

Year/Month	Maximum Temperature							Mean
	2001	2002	2003	2004	2005	2006	2007	
Jan	24.5	22.8	-	22.6	22.8	-	21.4	22.8
Feb	26.3	26.5	-	26.3	25.0	-	23.9	25.6
Mar	32.4	31.5	-	33.7	31.5	-	29.7	31.8
Apr	35.6	34.1	35.3	34.0	33.4	-	34.9	34.6
May	33.8	33.6	35.8	37.1	35.5	-	35.8	35.3
Jun	33.8	34.8	33.8	34.4	38.1	35.0	34.2	34.9
Jul	34.4	33.2	33.6	35.0	36.6	34.1	31.7	34.1
Aug	34.0	33.5	34.1	35.6	36.9	33.8	33.4	34.5
Sep	33.1	33.2	33.1	34.4	35.6	32.7	31.9	33.4
Oct	32.4	32.0	32.3	32.2	31.4	31.6	31.0	31.8
Nov	28.1	28.7	28.2	29.0	27.9	29.3	28.3	28.5
Dec	22.9	24.1	25.4	25.9	-	-	23.2	24.3

**Source: Department of Meteorology and Hydrology, Babarmahal, Kathmandu, 2009.**

## APPENDIX- VI

### Rainfall (in mm) pattern in Chitwan from 2001-2007

Year/Month	Rainfall				Mean
	2004	2005	2006	2007	
Jan	58.8	41.7	-	0.0	33.5
Feb	0.0	6.0	-	141.5	49.2
Mar	9.0	24.1	-	27.5	20.2
Apr	184.4	24.0	-	155.5	121.0
May	145.8	218.9	-	228.4	198.0
Jun	603.7	215.6	-	408.4	409.0
Jul	336.3	479.0	436.5	635.0	472.0
Aug	293.4	532.0	429.0	576.4	458.0
Sep	443.9	115.5	643.7	1002.3	551.0
Oct	92.9	192.7	-	60.4	115.0
Nov	9.1	0.0	5.5	0.0	3.65
Dec	0.0	-	19.0	0.0	6.33

Source: Department of Meteorology and Hydrology, Babarmahal, Kathmandu, 2009.

## APPENDIX - VII

### Relative Humidity (in %) in Chitwan from 2001-2007

Year/Month	Relative Humidity							Mean
	2001	2002	2003	2004	2005	2006	2007	
Jan	97.2	100.0	-	98.9	97.7	-	93.9	97.5
Feb	99.8	98.8	-	97.8	97.7	-	92.5	97.3
Mar	100.0	99.8	-	96.0	97.9	-	87.2	96.2
Apr	100.0	87.4	90.6	94.3	91.5	-	73.4	89.5
May	100.0	81.0	85.8	95.1	93.0	-	77.8	88.8
Jun	100.0	87.4	90.0	97.8	88.3	95.8	83.4	91.8
Jul	99.7	95.6	93.1	97.1	89.2	96.3	89.6	94.4
Aug	100.0	92.3	93.9	95.5	89.0	96.4	90.4	93.9
Sep	100.0	91.5	95.6	91.3	89.6	94.1	90.8	93.3
Oct	100.0	92.8	96.7	88.0	93.7	95.6	88.4	93.6
Nov	100.0	97.6	96.0	96.0	97.7	96.8	86.3	95.8
Dec	99.9	98.6	99.4	99.4	-	-	93.3	98.1

**Source: Department of Meteorology and Hydrology, Babarmahal, Kathmandu, 2009.**

## APPENDIX-VIII

### LIST OF PHOTOGRAPHS



Picture 1: Beeshazari Lake



Picture 2: Researcher interviewing local people



Picture 3: Carapace of Indian soft



Picture 4: Turtle and fish catching

2025



**Picture 5: Hooks used for catching the**



**Picture 6: Claw of Indian soft shell**



**Picture 7: Carapace of land tortoise**



**Picture 8: A captive Tricarinate hill  
turtle  
(*Melanochelys tricarinata*)**





**Picture 9: Firewood collection by  
local people**



**Picture 11: Common Garden Lizard  
(*Calotes versicolor*) in it's**

**Picture 10: Golden Monitor Lizard  
(*Varanus flavescens*) in  
naddy field**



**Picture 12: Banded Krait (*Bungarus  
fasciatus*) killed by a**



Picture 13: Collection of  
Herpetofauna and



Picture 14: Researcher observing a hook,  
used for trapping turtle in



Picture 15: Black spined toad (*Bufo  
melanostictus*)



Picture 16: Marbled toad (*Bufo*



Picture 17: Java whipping frog  
*(Polypedates leucomistax)*



Picture 18: Garnot's gecko  
*(Hemidactylus garnotii)*

bull frog  
*(Rana tigrina)*

Picture 20: Nepalese Terai frog



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**Picture 21: Common Cat snake (*Boiga trigonata trigonata*)**

**Picture 22: Pierre's cricket frog (*Limnonectes pierrei*)**

**Picture 23: A farmer using pesticides in the agricultural field**



**Picture 24: Crocodiles basking in the lake.**

