

# 1 INTRODUCTION

## 1.1. Background

A population is defined as any group of organisms of the same species occupying a particular space at a particular time (Krebs, 1994) and functioning as a part of a biotic community (Odum and Barret, 2005). The ultimate constituents of the population are individual organisms that can potentially interbreed (Krebs, 1994). The population becomes an important study level when a species is nearing extinction. In order to maintain or re-establish the species; one needs to know what space, shelter and food the population requires. To know and understand the interactions of the endangered animals with other species is also important for a successful conservation programme (Flemming, 1973).

Conservation, in contrast to the preservation, means the utilization of renewable natural resources in such a way that they are not destroyed but are to be used later. Wildlife management which is an important branch of conservation is concerned with assuring the maximum possible populations of the game animals consistent with other land uses in the same area and with the number that the given habitat will support. This is attained by manipulating the balance of nature in such a way that the desired game species are favored (Verma and Agrawal, 1998). The aim of wildlife management can range from conservation of endangered species, through exploitation of a resource species to extermination of pest (Farland, 1981). The basic role of wildlife management is to keep the wild animal population optimal, diversified and harmonized with the environment in order to satisfy the economic, recreational, scientific, educational and social needs of man (Shrestha, 2003). The wildlife manager often has to strike a compromise between many conflicting interests. These may include the future viability of the habitat, the population size of the species within the particular area, the welfare of individual animals, the economic impacts of management practices, the traditional interests of the local human

population etc. Research ethology and ecology can do much to provide this knowledge and to safeguard the interests of animal and plant communities in the world (Farland, 1981).

Three species of francolins are found in Nepal. Swamp Francolin (*Fracolinus gularis*) is the largest of all species. It has different morphological characteristics which differ markedly from the other two species. Grey Francolin (*Francolinus pondicerianus*) and Black Francolin (*Francolinus francolinus*) are the other two francolins found in Nepal. Grey Francolin and Swamp Francolin are the inhabitants of grassy plains of lowland Nepal. Nepal being on the northern edge of its distribution, Grey Francolin is a scarce bird to this country, but fairly common within its normal range, e.g. in India. Black Francolin is the commonest francolin found in Nepal and has a much wider range of altitude than the other two species. It is found from 75 m. up to 2000 m. above sea level (Inskipp and Inskipp, 1991). Swamp Francolin is endemic to south Asia.

## 1.2. Swamp Francolin

### 1.2.1. Taxonomy

Kingdom: Animalia  
Phylum: Chordata  
Class: Aves  
Order: Galliformes  
Family: Phasianidae  
Subfamily: Perdicinae  
Genus: *Francolinus*  
Species: *F. gularis*

### Binomial name

*Francolinus gularis* (Temminck, 1815)

Various taxonomic descriptions were presented by various scientists. *Perdix gularis* (Temminck, 1815), *Ortygornis gularis* (Jerdon, 1864) and *Francolinus gularis* (Gray, 1892 cited in Baral, 1998) are the major taxonomic descriptions. The last binomial nomenclature presented by Gray is still in effect today.

**Present English Name:** Swamp Francolin (Inskipp and Inskipp 1991, Partridge, Quail and Francolin Specialist Group). This name is adopted by the Partridge, Quail and Francolin Specialist Group of IUCN, WPA and Birdlife International. We have also adopted this name throughout the write up. In recent years the word Francolin has been used for birds which have the genus *Francolinus* replacing its traditional name, the Partridge.

**Synonyms:** Kyah Partridge (Jerdon 1864, Inghish 1921), Marsh Partridge (Inghish, 1921), Swamp Partridge (Ali and Ripley 1987, Fleming *et. al.* 1984)

**Nepali Name:** Sim Titra

### **1.2.2. Field Characteristics**

Swamp Francolin is easily identified in the field by its marshy habitat, large size, body markings and diagnostic call (Ali & Ripley, 1989). It is a large and conspicuously long-legged partridge having a short, stout beak which, besides feeding is used also for fighting. Legs are of dull red color. Males are larger and differ from females in having a spur on each leg. These spurs are used for fighting among rival males and are also thought to be used for mating activities. The cock of this species, which is a little larger than the hen,

will measure fifteen inches, though his tail is only a little over four; the wing is more than seven inches, and the shank two-and-a-quarter (Ali & Ripley, 1987).

Both the sexes have a brown crown and nape with distinct buffy supercilium and a broader band below eye through ear-coverts. The upper part brown with rufous – brown patches which are transversely barred with buff as in Grey Partridge. The tail is largely chestnut with pale tips. The chin, throat and fore neck are of rusty red while rest of under part is brown with road white longitudinal streaks edge with black. Under tail-coverts pale rufous.

Blanford (1989) says it much resembles the common Grey Partridge in its edible qualities, as it also does in its call; and it is equally pugnacious.

### **1.2.3. Distribution of Swamp Francolin**

The Swamp Francolin is endemic to Indian subcontinent, where it is distributed from Northern Uttar Pradesh and Southern Nepal, east through Northern Bihar and West Bengal to the Brahmaputra Valley in the North-Eastern India and at least historically to parts of Bangladesh (Ripley, 1982; Inskipp and Inskipp, 1991).

In the nineteenth century, the Swamp Francolin was plentiful near the Ganges in Bihar. It became apparent in the latter half of the twentieth century that a considerable decline had taken place prompting concern regarding the survival prospects of the species (Javed, 1993). One of the most important population of the species survives in the grasslands of the Brahmaputra valley, Assam where it occurs at a minimum of 30 localities (11 of which are protected), sometimes in fairly high numbers (Choudhary, 2000).

This species was once presumably found throughout the Tarai belt of Nepal, but its range is now restricted to a few protected areas. Although the records were from different areas including Seti Bazaar, Kailali (Rand and Fleming, 1957) Chitwan, Bardia etc. in the

past, now have been recorded only inside two protected areas, i.e., Koshi Tappu Wildlife Reserve and Shukla Phanta Wildlife Reserve.

In Bangladesh, historically, the species was quite widespread with records from Sylhet and Comilla (Tippera) districts, the course of the Ganges and Meghna, Coastal Sunderbans districts and the lowlands of Chittagong (Baker, 1930). Records are from the base of the Mymensingh hills, Kushiara River, foot of Sylhet hills, Dhaka, Barisal (Baker, 1930) and other different places.

It has not been recorded in the Sunderbans during many recent visits in recent years and is probably extinct in the area. It might still occur in small numbers in unsurveyed marshlands (Harvey, 1990; Grimmett *et al.*, 1998).

#### **1.2.4. Ecology of Swamp Partridge**

##### **Habitat**

The species generally inhabits swampy or riverine grassland (Baker, 1930) in the Cow lands, although there is a record from the Cherrapunji plateau at 1,400m (Godwin – Austen, 1872). It is commonest within 200m of water and has unusually long legs for the genus, allowing it to wade through water with ease (Finn, 1916). It tolerates several different grassland structures (Javed *et al.*, 1999) including tall riverine grasslands, shorter *Imperata*-dominated grasslands and mixed short and tall grassland (Baral, 1998).

In Nepal, it is found in tall and moist grasslands, preferring those with an average height of 2-3 m and some clear patches (Baral, 1998). In Koshi Tappu Wildlife Reserve it occurs in wet grassland dominated by *Saccharum spontaeum* and *Phragmites karka* and also on embankments with scrub and trees including *Dalbergia sissoo*, *Ziziphus mauritiana* and *Cassia tora* (Baral, 1998). Tall grasslands around rivers and lakes were also utilized in Bangladesh, and were dominated by ekra (ikora) *Erianthus ravaneae*, nal

“*Orundo karka*” (presumably either *Phragmites karka* or *Arundo donex*), *ullu Saccharum cylindricum* (possibly *Saccharum* or *Imperata cylindrical*), *hogla Typha elephantina* and *hargoza Acanthus ilicifolius*. Birds moved to cultivated areas during times of flood and were occasionally seen on tidal banks. The species apparently once abounded in the “rose- bush jungles at the foot of the Mymensing and Sylhet hills”, although this appears to be an unusual habitat (Baker, 1922-1930). In India its strong association is with the wet grassland containing *Phragmites karka*, *Arundo donex*, *Themeda arundinaceum*, *Narenga porphyrocoma*, and particularly *Sclerostachya fusca* and *Saccharum* (except *S. munja* [= bengalense]) (Javed *et al.*, 1999).

The species is found in groups of up to 10, although adult birds are most often found in pairs (Javed *et al.*, 1999). They fly reluctantly and usually only if nearly stepped on (Godwin-Austen, 1876). However, they are highly vocal, with a peak in calling at dawn and dusk that increases during the breeding season. Birds clamber for prolonged periods amongst tall reeds (Baker, 1921-1930) and may roost in reeds (Stevens, 1914-1915).

### **Food**

The species is omnivorous consuming seed and grain, as well as sprouting shoots of mustard, paddy and other crops, insects, snails, worms, shellfish and small crabs. In Sundarbans it has been recorded following the ebb tide in creeks to feed on small fish (including mudskippers), shrimps and crabs left stranded by the receding water (Baker, 1930).

### **Breeding**

It breeds from April to June in Nepal, where chicks have been seen in May at Sukla Phanta (Baral, 1998). Elsewhere, most eggs are laid between the end of March and early April, and some as early as February (Baker, 1921-1930).

Nests consist of a thick pad of rushes, grass and weeds, 20-30 cm across and 5-10 cm deep with a shallow, well-made hollow for the eggs (Baker, 1921-1930). When the nest is placed on dry margins of wetlands, it is apparently less carefully constructed and compact. On average, five chicks (range 2-8) are raised, although considered 3-4 eggs normal (Baker, 1930). Chicks are precocial, becoming highly active in a few days and following their parents around, catching insects and feeding themselves.

### **Migration**

The species is doubtless resident (Ripley, 1982), although rising floods displace populations over short distances (Baker, 1930).

### **1.2.5. Conservation Measures**

**Nepal** The species is officially protected in Nepal. It occurs in two protected areas: Sukla Phanta (155 km<sup>2</sup>) and Kosi Tappu Wildlife Reserves (175 km<sup>2</sup>) — Koshi barrage lies close to the latter but outside its boundaries. It has probably been extirpated from Chitwan and Bardia National Parks. Whilst it utilizes areas of planted *Dalbergia sissoo* trees and associated scrub in Koshi Tappu, the planting has occurred on raised river embankments, and tree planting should not be encouraged in the grasslands themselves (Baral, 1998).

**India** The Swamp Francolin is protected under the Wildlife Act 1972 (Schedule IV). It is listed from 15 protected areas in India, ranging in size from 11 km<sup>2</sup> to 614 km<sup>2</sup> although the extent of available habitat within these areas is not known (Kaul, 1998).

**Research** A considerable number of studies have improved knowledge of the distribution, status and ecology of this species in Nepal and India, resulting in a large quantity of published data of relevance to protected-area management.

### **1.2.6. Threats**

The Swamp Francolin has declined as a result of extensive habitat loss compounded by hunting, and these factors continue to threaten the species.

#### **1.2.6.1. Habitat loss, modification and disturbance**

Virtually all remaining grasslands within the species' range are subject to intense pressures from encroachment by people (settlement and agriculture), domestic livestock, grass harvesting, fire, forestry and hydrological schemes (Peet *et al.*, 2000). In many areas grasslands of conservation value are restricted to protected areas but continue to suffer degradation (Bell and Oliver 1992; Peet, 1997), and grasslands are generally poorly represented in protected-area systems (Baral, 1998).

#### *Nepal*

Grasslands in the Tarai of Nepal have declined in area and quality, particularly since the virtual eradication of malaria in the Tarai in the 1950s (Peet, 1997). Since this period there has been rapid human population growth, and large areas of grassland have been lost to settlement, conversion to agriculture, forestry and flood control (Bell and Oliver 1992, Peet, 1997). Outside protected areas virtually no grasslands capable of supporting threatened birds remain, as most are heavily grazed by domestic livestock, harvested for cane or thatch and subject to overwhelming levels of human disturbance (Peet, 1997). Tall (upto 5 m) grasslands, dominated by the genera *Erianthus*, *Narenga*, *Saccharum*, *Phragmites* and *Themeda*, and shorter grasslands, dominated by *Imperata cylindrica*, remain in the four protected areas of Chitwan and Bardia National Parks and Sukla Phanta and Koshi Tappu Wildlife Reserves (Peet et al. 1999, Lehmkuhl 1994, Baral 2000). Within these protected areas grasslands are threatened by several problems.



At the key site of Koshi Tappu Wildlife Reserve grazing by domestic stock is a major threat, with 5,000 cattle and 3,000 buffaloes present (*Oriental Bird Club Bull.* 21 [1995]: 15-20), leading to severe habitat degradation in parts of the reserve; the problem is complicated by land right claims. The reserve lies between two large embankments around the Sapta Koshi River; whilst the grasslands are maintained by partial inundation during the monsoon. They are also vulnerable to erosion during floods (Dodman 1992, Peet *et al.* 1999) and there are then few refugia available to francolins (Peet, 2001).

New localities holding the species have been found in and around Sukla Phanta Wildlife Reserve, but some (e.g. the Jhilmila grasslands) are heavily disturbed and overgrazed and the population in these areas may have declined (Baral, 1997). There are too few guards covering the area, and they are unable to control the influx of people and domestic livestock; it was recorded in May 1997 that, more than 100 domestic buffalo were grazing in Dudhiya phanta of the reserve (Baral, 2000).

### ***India***

Over the latter half of the twentieth century, large - scale conservation of Terai grasslands into cropland has taken place. Plantation of commercially important trees such as *Eucalyptus*, *Dalbergia sissoo* and *Bombax ceiba* has further impinged on large areas of this habitat (Javed and Rahmani, 1991).

Unsustainable grazing pressure is also deleterious to Swamp Francolin habitat and is rampant throughout the Indian subcontinent as the livestock population continues to grow; grazing especially damaging in summer when post-burn re-growth emerges and water distribution is limited (moreover, this period coincides with chick rearing in the francolins). Even in protected areas overgrazing is a major problem (Rahamani, 1988).

Two factors have, however, raised some qualified optimism about the species' future. (1) The development of canals and dams and their resultant seepage marshes, has provided habitat for Swamp Francolins, although the numbers involved are probably small and most of these sites are isolated from each other by forest or agricultural fields (Kaul and Kalsi, 1990; Javed and Rahmani, 1991). (2) The species has been found calling and even nesting in sugarcane crops. However, breeding success appears to be low in this habitat owing to human disturbance, and the species almost certainly requires access to less disturbed habitats (Iqbal et. al., 1994).

### ***Bangladesh***

The rapidly increasing human population has caused widespread damage to and disturbance of natural habitats and a loss of indigenous wildlife. There are now very few, if any, extensive patches of grassland in Bangladesh and any that might remain are inundated for two-thirds of the year with no alternative refugia available. Most remaining grassland areas are fragmented, heavily used and harvested up to three times a year. Furthermore, the reed lands of north-east Bangladesh were leased out for paper production and are reported to have been entirely destroyed and settled by encroachers. The Sunderbans are disturbed throughout the year by "a large number of wood cutters, fishermen, honey collectors, wooden boats and mechanical vessels", all activities that are deemed a threat to the Swamp Francolin if it survives in the area (Sarker *et.al*, 2000)

#### **1.2.6.2. Hunting and trade**

*Nepal* The influx of people into the Tarai resulted in a "destructive period", especially between 1960 and 1975, when animals such as Swamp Francolins were hunted wantonly (Baral, 1998). Hunting is apparently increasing again in the Koshi area (Inskipp and Inskipp, 1998). In addition, Shakya (1995) listed several pressures on birds in Nepal, including capture of galliformes for cock-fighting, bird meat (particularly to traders from Bihar, India), medicinal purposes and the cage bird trade.

**India** During the British occupation of India, large numbers of game birds were shot and the species was trapped for food. On account of its pugnacious disposition it was, and apparently still is, a favorite with locals for partridge fighting and many are caught, hatched or traded for this purpose. Currently, there are approximately 70,000 human families reliant on the trading of wild birds in Uttar Pradesh, a statistic that hangs gloomily over the future of this species and other susceptible to trapping and hunting (Baker, 1922 - 1930).

**Bangladesh** Indiscriminate killing and trapping of birds, particularly since the partition of India in 1947, have reduced their populations (Karim undated). Legislation intended to control hunting remains ineffective. Eggs and chicks of most birds are collected for food (Sarker, 1986) and, as in India, the species was commonly collected for cock-fighting (Baker, 1930).

#### **1.2.6.3. Natural predation**

In Koshi Tappu Wildlife Reserve the population of jackals, foxes, mongooses and cats may reduce breeding success (Baral, 1998), although predators are only likely to threaten small fragmented populations or be a problem where predators are at unnaturally high densities.

#### **1.2.6.4. Pesticides**

Agricultural pesticides may be affecting its numbers either by direct mortality or by reduction of its invertebrate prey (Rahmani, 1998).

### **1.3. Objectives**

The general objective of the study is to explore the population status, distribution and conservation threats of Swamp Francolin in Koshi Tappu.

The specific objectives are:

- ) To study the population status of Swamp Francolin in Koshi Tappu area.
- ) To study the distribution of Francolin within the reserve.
- ) To assess the human disturbance in survey areas and suggest recommendations.

#### **1.4. Scope of study**

Swamp Francolin (*Fracolinus gularis*) is a threatened bird species in the Vulnerable Category of Birdlife International and World Pheasant Association (Birdlife International, 2005, Fuller *et. al.*, 2000) and is classified as an endangered species by Bird Conservation Nepal at a national level (Baral & Inskipp, 2004).

IUCN has listed this bird as threatened in its Red Data Book (Groombride, 1993). Swamp Francolin is confined to India and Nepal (Singh, 2007). Due to change in land use patterns in the Tarai region, it is regarded as threatened with extinction in India and Nepal (Birdlife International, 2005).

Swamp Francolin (*Francolinus gularis*) is considered Vulnerable to extinction as its native grassland habitat is converted to agricultural land. These birds inhabit tall grass and swamps from 50-200 m. in Tarai grass land. Population is highly fragmented due to its specific habitat requirements. It is regarded as threatened with extinction due to changing land use patterns in the Tarai region of Nepal and India (Collar *et. al.*, 1994). Due to the change of the course of the Koshi river flooding and illegal activities inside the reserve these birds are on the verge of extinction.

In Nepal, although some information is carried out about Swamp Francolin, it is not sufficient to ensure the long term conservation. Koshi Tappu Wildlife Reserve considered as a main potential site for this species and is declining currently due to the lack of the scientific research and proper monitoring on this bird; it is not easy to point out the causes hence it is not known exactly. Detailed research work providing information on its status at KTWR and making appropriate management recommendation to the concerned body would be more beneficial and constantly required.

### **1.5. Limitations**

Present research work is meant for Master Level Dissertation and a number of obstacles were felt in the process of field work.

- ) Being a student researcher, resources were limited.
- ) Duration of study was very short, so study for all reasons could not be made.
- ) Another prime limitation was the security problem after the situation created just after Madhesh Moment held on Jan-Feb 2007. This was the reason due to which western part of Reserve could not be covered in Saptari district.

## 2 REVIEW OF LITERATURE

Different researchers, scientists and bird watchers have the following remarks on the species of their research sites,

English *et al.* (1920) noted that Swamp Francolin was getting scarce as suitable localities decrease in Jalpaiguri district, but Anon (undated) listed it as still occurring in Buxa (Allen, *et al.* 1997).

Baker (1928) writes them as being common in the Sundarban areas of India.

In the past, Swamp Francolins were sighted at Seti Bazaar of Kailali District of far western development region of Nepal (Rand and Fleming, 1957).

Today certainly Swamp Francolins are believed to be extinct from Indian parts of Sundarbans and southern part of West Bengal (Mukherjee, 1977).

Today miles away from Culcutta presence of this species is hard to detect. As early as 1946 the birds from Culcutta are thought to have become extinct (Mukherjee, 1977).

The species was first described to the science by Temminck in 1815 from type specimens collected in the vicinity of Culcutta, India (Ali & Repley, 1983).

Swamp Francolin was widely distributed in the past west from Sind east to Assam, Sythet, Cachar, Tripperah (Jerdon, 1864) and Meghalaya (Ali and Ripley 1983).

To the South it extended to Calcutta and Bangladesh abundantly (Ali & Ripley, 1983).

The Swamp Francolin is endemic to the Indian Subcontinent, where it is distributed from Northern Uttar Pradesh and Southern Nepal, East through Northern Bihar and West Bengal to the Brahmaputra Valley in North-Eastern India and, at least historically, to parts of Bangladesh (Ali & Ripley, 1998, Inskipp & Inskipp 1991).

Distribution of Swamp Francolin is restricted to the South Asian countries mainly Nepal, North India and Bangladesh, (Inskipp & Inskipp 1991).

A scarce and local resident found in marshes and other wet areas in the lowlands and is most easily located by looking from the embankment Koshi Tappu (Inskipp, 1991). The maximum number of 28 individuals recorded in November 1989 (Inskipp and Inskipp 1991). While Suwal (1991) recorded 19 individuals from Kushaha to Haripur in a single day.

Regular reports of these birds came from Koshi Barrage since 1981. It is suggested that the changes in the course of Koshi River during 1986 moved a population of the species into the reserve (Inskipp and Inskipp, 1991).

There were 45 to 75 Francolins observed at Koshi Tappu in 1989-1990 (Shrestha, 1992).

There are recent reports of it from Arunachal Pradesh in India (Singh, 1994).

The abundance of the species is not known at this place (Singh, 1994).

No confirmed records of its come from Bhutan and Sikkim Duars Yet. There is only one recent sighting of it from Dirang, west Arunanchal Pradesh on 29 January 1994.

It is known to occur also outside the protected areas. (e.g. outside Dudhua National Park) in India where research is still being carried out (Rahamani, 1994; Kaul, 1995).

In Nepal, Baral (1996) studied formally at the first time on this bird covering 4 protected areas. He noted that abundance of francolins is in KTWR and Sukla Phanta Reserve. Chitwan National Park and Bardia National Park showed no sign of these birds existence.

Blandford (1989) wrote Swamp Francolin not occurring in the Sunderbans.

Among the four member of the genus, *Francolinus* in India, this species has the most restricted range, being confined to the tall, wet grasslands of Tarai in Utter Pradesh and Bihar, West Bengal, Assam, Meghalaya and Arunachal Pradesh (Ali & Ripley 1968 -1998, Grimmett *et al.* 1998).

An estimated total population is of 178 adult birds recorded at Koshi Tappu and Koshi Barrage in 1991-1995 (Baral, 1998).

It tolerates several different grassland structures (Javed *et al.* 1999), including tall riverine grasslands, shorter Imperata dominated grasslands and mixed short and tall grassland (Javed & Rahmani 1991, Baral 1998).

Now days population of these birds are declining due to widespread loss of tall marsh grasslands in its entire range (Dahal, 1999).

The global population was recently estimated at 1,000-10,000 individuals (McGowan et al. 1995). However, the species remains locally common in many areas and is undoubtedly more abundant than figures suggested with the population in Assam alone now thought to approach or possibly exceed 10,000 (Chaudhary, 2000).

The Swamp Francolin is also cited as a vulnerable species (Hilton - Taylor, 2000).



### **3.1 STUDY AREA**

### 3.1.1. Location and Topography

Koshi Tappu Wildlife Reserve lies within 86° 55' – 86° 05' E longitude and 26° 34' – 26° 45' N latitude, in the beautiful alluvial flood plains of the Sapta Koshi River in Saptari, Sunsari and Udaypur districts of Eastern Nepal. The eastern and western embankments of the river define the Tarai. The Sapta Koshi river which is fed by 7 major tributaries (Indrawati, Bhote Koshi, Tama Koshi, Dudh Koshi, Likhu, Arun and Tamor rivers).

Koshi Tappu Wildlife Reserve (KTWR) was established and gazetted in July 1976, after the enhancement of the NWPC Act 1973, primarily for the protection of the last remnant population of wild water buffalo (*Bubalus bubalis arnee*) and their habitat.

KTWR is a rectangular shaped reserve approximately 175 km<sup>2</sup> stretching northward from the Nepal – India boarder along the Sapta Koshi River. Because of its divestment during monsoon floods an attempt has been made to control the waters by constructing a 5 – 7 m. high embankment parallel to the river. These prevent lateral spread of the enormous monsoon flow of water.

Realizing the importance of the site, Koshi Tappu Wildlife Reserve was designated as wetland of international importance and added to Ramsar list on 17 December 1987 (IUCN, 1990). This Reserve is the only Ramsar site of Nepal. The criteria for the inclusion of the site in the Ramsar list areas are follow (Scott, 1989):

- the wetland regularly supports more then 20,000 waterfowls,
- the wetland is of special value or maintaining the genetic and ecological diversity of a region because of the peculiarities of its flora and fauna.

Despite the declaration for its conservation, illegal activities such as trapping, hunting and poisoning of birds are common in the barrage area. This has led various researchers / scientists and institutions to advocate an extension of the protected area's boundaries (Suwal 1993; WMI/IUCN Nepal, 1994). However, the area between the southern boundary of the reserve and the Koshi barrage has been leased to the Indian Government (Scott, 1989) and this presents a legal complication requiring inter - Governmental co-operation on wildlife conservation.

The reserve is characterized by sand and silky soil with patches of scrub and deciduous mixed riverine forest. The river changes its course from one season to another due to heavy flood. So, there is no large tree except some riverine forests inside the reserve. About 70 % of reserve vegetation is dominated by tall grass species of *Saccharum*, *Phragmites* and *Typha* and mixed forest of *Bombax*. *Dalbergia* and *Acacia* make up the remainder (Dahmer, 1978). The reserve offers important habitat for a variety of wildlife. About 150 individuals of wild buffalo are found there (Chalise, 2000, 2008). The Wildlife Reserve and Koshi barrage comprise an important staging and resting site for several bird species. Fourteen species present within the area are found nowhere else in Nepal while 87 species are winter visitors and Trans- Himalayan migrants (Sah, 1997).

### **3.1.2. Geology and Soil**

Geologically, Koshi Tappu lies in a low- lying area and its alluvial deposits are mainly composed of thin fine sand, silt and clay which frequently alternate in different proportions (Ohta and Akiba, 1973). The nutrient content in the soil varies greatly, depending upon the time of sedimentation and the establishment of vegetation on it in subsequent years. During the course of a reconnaissance soil survey in Saptari district, part of which is now included in Sunsari district the following five different types of soil viz. sandy, sandy loam, loam, sandy clay loam and clay loam were described in the village surrounding Koshi Tappu area (Pradhan *et. al.*, 1967).

### 3.1.3. Climate

Climate of Koshi Tappu Wildlife Reserve is sub-tropical type and experiences three distinct seasons.

- a. **Summer:** It commences on February and continues up to May. Summer is intensely hot with minimal precipitation and mean annual maximum temperatures reaching up to 35.3 °C from mid May to June (Fig.1). From March to mid-June, local conventional heating is an everyday phenomenon because of the large area sand and water. As a result, strong wind blows daily during the afternoon. Fine, loose light dust particles from the riverbed, floodplains and adjacent barren fields are easily blown away by the turbulent air and thereby reducing visibility.

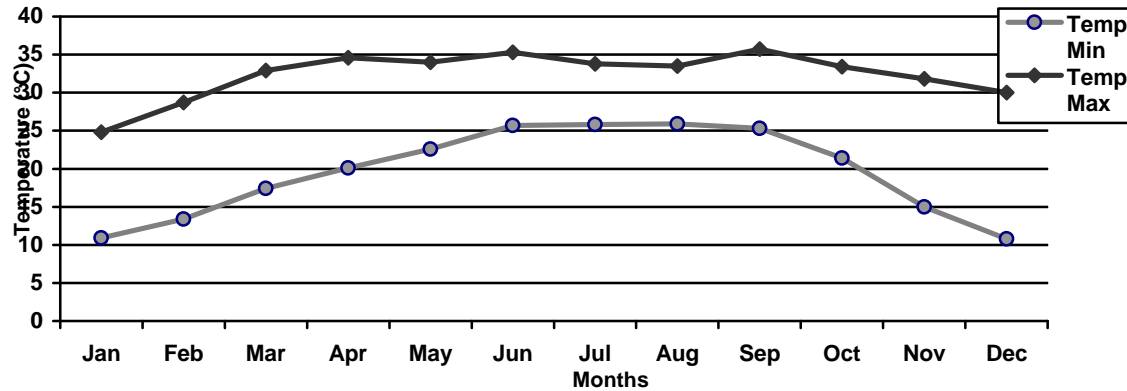


Figure1: Average monthly maximum and minimum temperature (°C) of Fatehpur meteorological station (2005)

- b. **Winter:** Winter lasts from October through January with unclouded skies and modest temperature. January is the coldest month. Morning is quite cold but the days are warm. Mean annual minimum temperature is around 10 °C. The lowest temperature recorded in December is 10.8 °C at Fatehpur (fig.2). The area receives a small amount of rain brought by

southwardly winds from the Arabian Sea. °C. Humidity remains high all the year round. Annual relative humidity was recorded between 52.5 % to 83.5 % for the year 2005 (Fig.2)

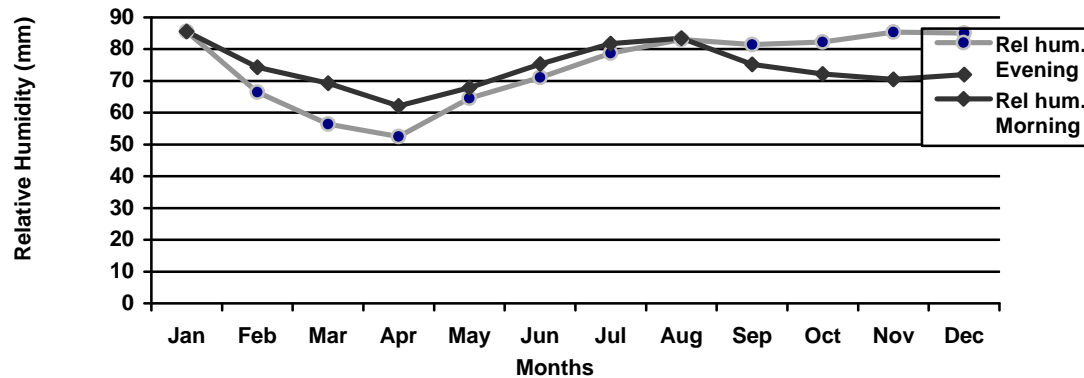


Figure 2: Average monthly morning and evening relative humidity of Fatehpur meteorological station (2005)

- c. **Monsoon:** The monsoon commences on the late May or early June with frequent and violent thunderstorm. Rainfall is the greatest during July but high humidity and high temperatures are experienced throughout the seasons. Due to moisture laden winds from the Bay of Bengal, 80-85 % of the total rainfall occurs during the monsoon period, from mid June to last September. The maximum annual rainfall recorded at Chatara is 506.5 mm on August for the year of 2005 (Fig.3).

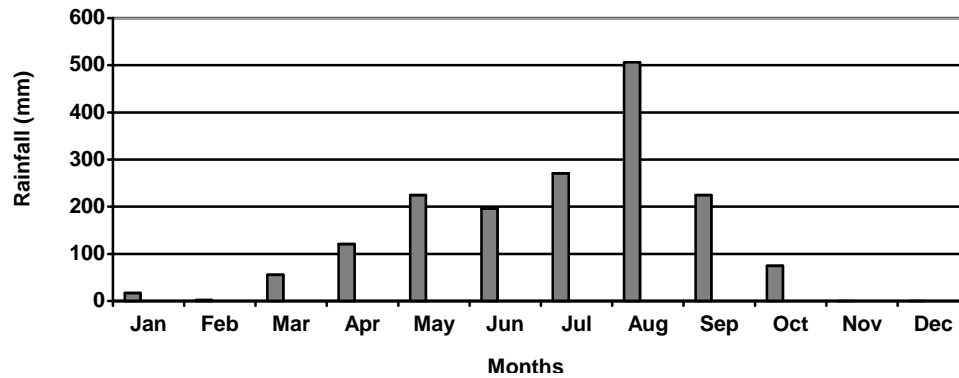


Figure 3: Average monthly rainfall of

Chatara meteorological station (2005)

### 3.1.4. Flora

The vegetation of the reserve is mainly characterized by the mixed deciduous riverine forest, *Dalbergia sissoo* / *Acacia catechu* mixed forest, grasslands and marshy vegetation (Annex II). The eastern part of Koshi, vegetation was classified into four major types: woody vegetation, tall grassland, dry grassland and woody mixed (Dahal and McGown, 2005). In Koshi Tappu Wildlife Reserve, the forests are mostly open and degraded and form isolated patches of woodlands, dominated by one or more of three species, *Acacia catechu*, *Bombax ceiba* and *Dalergia sissoo*. Based on the importance value index of the tree species, the following associations of the riverine forests are described by Sah (1997) and WMI/IUCN (1994).

**a. *Acacia catechu* – *Dalbergia sissoo* forest:** Locally known as Khair-sissoo forest, this typical riverine forest found mostly near the banks of rivers and on islands surrounded by segments of river. *Acacia catechu* and *Dalergia sissoo* form the first. Seral stand of trees along the river course because they are able to withstand flooding.

**b. *Dalbergia sissoo* forest:** In *Dalbergia sissoo* dominated forest the crown ranged between 10-40 %. The relatively low density of *A. catechu* was due to the fact that the species is selectively filled and that *D. sissoo* grows relatively faster in dry condition. In this forest, ground vegetation consists of *Arundirella* sp., *Crisicum wallichii*, *Cyperus dichotoms*, *Empatorium adenophorum*, *E. odoratum* and *Solanum indicum*.

**c. *Acacia catechu* forest:** In the western part of the reserve, the forest is dominated by *A. catechu*. The stratification of the canopy layer was found more prominent in this forest than in *D. sissoo* forest. In this forest, ground vegetation consists of *Cynoglossum zeylecum*, *Cynodon dactylon*, *Euphatorium odoratum*, *Persicularia barbatum*, *Solanum nigrum*, *S. tortum* and *Vernonia cinera*.

**d. Mixed deciduous riverine forest:** In Koshi Tappu, this type of forest 2.87 % of area in 1991 and characterized by *Bombax ceiba* (Simal). It has large buttressed trunk and scarlet flowers on leafless branches. *Bombax ceiba* is usually associated with a number of other tree species but in Koshi Tappu Wildlife Reserve, the growth of *Artemisa vulgaris*, *Calotropis gigantea*, *Eupatorium adenophorum*, *Lantana indica* as understorey and *Solena heterophylla*, *Boerhavia diffusa* and *Momordica charantia* as climbers, indicates the relatively dry conditions of the forest.

**e. Grassland / Savanna:** In Tappu, Savanna is 41.6% of the total area found covered by a grassland / Savanna type of vegetation which is flooded annually during monsoons and is dominated by *Saccharum-Phragmites* association. The grassland is locally called “Phant”. Major species present in different proportions include *Imperata cylindrica*, *Phragmites karka*, *Saccharum spontaneous*, *Typha augustifolia* and *Vetiveria zizanoides*. Trees of other species like *Albezia chineum* and *Trewia nudiflora* are also present. On the flood plain, *Tamarix dioica* grow first and become the dominant species. In swampy grassland, *Typha-Vetiveria* association is dominant and other plants, which are present in this area, include *Crotolaria* sp., *Persicaria barbata* and *Urena lobata*.

### 3.1.5. Fauna

Koshi Tappu Wildlife Reserve is a small reserve but it offers important habitat for a variety of wildlife (Annex IV). The reserve was established primarily for the protection of last remnant population of wild water buffalo (*Bubalus bubalis arnee*) and their habitat. Now about more than 150 individuals of wild buffalo is found there. Among other animals wild boar (*Sus scrofa*) is common. Large animals like gaur (*Bos gaurus*) and nilgai (*Boselaphus tragocamelus*), which are considered as vulnerable species. Spotted deer (*Axis axis*), swamp deer (*Cervus duvauceli*) and all three Nepalese otter species (*Lutea lutea*, *Lutrogate persipicillata* and *Aonyx cinerea*) are still found in small numbers, small carnivores including the fishing cat (*Felis viverrina*), jungle cat (*Felis chaus*), Indian fox (*Vulpes vulpes*) and the jackal (*Canis aureus*) are also found in Koshi Tappu (Sah, 1997). Other mammals include the Rufus-tailed hare (*Lepus ruficandatus*), Rhesus macaque (*Macaca mulatta*) and several species of bats. A small population of Gangetic Dolphin (*Platanista gangetica*) is found in the river.

The endangered Gharial crocodile (*Gavialis gangeticus*) have been recorded in the Sapta-Koshi River. The rare fresh water marsh crocodile (*Crocodylis palustris*) has also been reported from the Koshi River (Shrestha, 1994). The monitor lizard (*Varanus bengalensis*), garden lizard (*Calotes versicolor*) and roofed turtle (*Kachuga kachuga*) are also found there (WMI/IUCN, 1994).

The Koshi Tappu area is rich in avifauna and declared as first Ramsar site of Nepal. The Koshi barrage is extremely important as a resting place or migratory birds and many species recorded here are seen nowhere else in Nepal (DNPWC, 1998). Among them, migratory waterfowl are notable and include the common pintail, the number of which exceeds 50,000 (Sah, 1997). Migration of birds starts in late December, reaches a peak between mid-February and mid-March. Some bird species such as Graylag goose (*Anser*



*anser*), Dart (*Anhinga melangaster*), Swamp Francolin (*Francolinus gularis*), Bengal Florican (*Euphidotis bengalensis*), Eurasian tree sparrow (*Passer montanus*) and little cormorant (*Phalacrocorax niger*) have become either endangered or uncommon in the area (Heinen, 1987). Other noteworthy species, which have been recorded in small number, include black stork (*Ciconia nigra*), black-necked stork (*Ephippior asiaticus*), greater adjutant stork (*Leptosptilos dubius*), lesser adjutant stork (*L. javanicus*), painted stork (*Ibis leucocephalus*), spoonbill (*Platalia leucorodia*), white tailed stonechat (*Saxicola leucura*) and striated marsh warbler (*Megalurus palustris*) (Scott 1989; Inskipp 1989).

Koshi Tappu and Koshi Barrage comprise one of Nepal's 27 Important Bird Areas where a total of 485 bird species, including residents and migrants has been listed representing 61 bird families of the world (Baral and Inskipp, 2005; Annex III). A high total of 200 species are wetland dependent and most of these birds are regular and passage migrants over 8 species are globally threatened. Apart the birds diversity, Koshi Tappu is the host of about 31 species of mammals, 34 species of reptiles, 117 species of fish, 77 species of butterflies, 11 species of amphibians and 21 species of insects (Bhandari, 1998). In the study of (WMI/IUCN, 1994) 83 species of fish comprising 24 families were recorded from 13 different sites of the reserve and surrounding area. The most common species in the Koshi River are *Puntius conchoniis*, *P. ticto*, *Barilus barna* and *Badis badis*. *Chanda nama* and *Esomus danricus* are common in marshes and swamps.

## **3.2 RESEARCH METHODOLOGY**

### **3.2.1. Reconnaissance Survey**

A preliminary survey was carried out in October 2006 to select the sampling sites. Survey method included site visit and interaction with local people and Reserve staffs. A discussion was conducted with local experts and bird watchers that helped to know the proper location and other aspects of the targeted bird species. This survey was also beneficial to understand and acquaint the geophysical and climatic condition along with topography of the area.

**Block Design:** The total intensive study area was divided into four parts and each part was called as a block or sector namely, A, B, C and D. Although the habitat was not significantly different among the blocks it was done only for the sake of making the study more convenient and area wise clarity.

### **3.2.2. Questionnaire Survey**

A format of questionnaire set (Annex I) was prepared to get information about different aspects of Swamp Francolin and to understand local's opinion towards the bird.

Most of the questions were closed type in the questionnaire, but some open ended questions were also included to get more explorative approach from the respondents. The respondents from the different places were chosen at random but proportionately, based on the distance of their settlement from the reserve boundary. The surveyed localities lie in the eastern part of the reserve and near by villages were Prakashpur, Madhuban, Kushaha and Haripur.

### **3.2.3. Field Survey**

#### **Direct Observation**

After getting information about Swamp Francolin roosting and foraging site through questionnaire as well as personal communication with locals, Reserve staffs and other bird watchers and experts, direct observations were made through binoculars and naked eyes as well. Study was done walking on foot inside the reserve but sometimes elephant backs, bicycles and boat / rafts were used as per need. Using bicycles was best for counting the population at the length of eastern embankment from Haripur to Prakashpur. Field visits were made on June 11 to July 16 counting total 396 hours.

The eastern side of the reserve was divided into 4 major sectors and for the intensive study, 11 transect were laid demarcating artificially in Kilometer on the basis of source of the Koshi Project Biratnagar, Morang. The latitude and longitude at the beginning point and the end point of the transects were also noted down with the help of GPS.

### 3.2.4. Francolin Population Census

The population census was carried out in single season. The thorough counting method was used to establish the number of Francolins inside the Reserve grassland. Three times census was carried out in each transect for a single season.

### 3.2.5. Population Density

Population density is defined as total number of animal per unit area they occupy. It is necessarily a positive number, but may be a whole number or a fraction.

The generalized formula to obtain the crude density is:

$$\text{Crude density (D)} = \frac{\text{Total Number of Individual in an Area (N)}}{\text{Total Area (A)}}$$

Ecological or Realized density is the total number of individuals present in the actual area of habitat available to the species and is given by:

The generalized formula to obtain the crude density is:

$$\text{Ecological Density (E.D.)} = \frac{\text{Total Number of Individual (N)}}{\text{Area of the Actual Habitat (A)}}$$

### 3.2.6. Distribution Pattern

#### 1. Variance to mean ratio ( $S^2/X$ )

The number of francolins recorded at four sectors was used to determine the distribution pattern. The distribution pattern of Swamp Francolin was calculated by Variance to mean ratio (Odum, 1971) which is based on the fact that in poison distribution, the variance ( $S^2$ ) = X (mean).

If  $S^2/X < 1$ , uniform distribution;

If  $S^2/X = 1$ , random distribution;

If  $S^2/X > 1$ , clumped distribution.

#### 2. Distribution of Swamp Francolin in the reserve was analyzed by the statistical methods

during the transect surveys by using  $\chi^2$  - test at 5% level of significance.

$$\chi^2 = \frac{(O - E)^2}{E}, \text{ Where, } O = \text{observed value}$$

E = expected value

#### 3. Two way ANOVA (F-test) was done to find out the effect of different sectors and encroachment on the distribution of the species in different sectors.

H<sub>0</sub>: □ The population distribution due to various encroachment is insignificant.

H<sub>0</sub>: □ The population distribution due to various sectors is insignificant

### **3.2.7. Vegetation Sampling**

A quadrat method was adopted for vegetation analysis of the Swamp Francolin habitat. A total of three sectors were sampled at the Eastern part of Koshi Tappu. Random sampling method was applied rather than systematic sampling one. At each sector two different sized quadrates were used for herbs and shrubs sampling. The sizes of the quadrat were 1×1 and 2.5×2.5 respectively. Collected plant species were noted and pressed in herbarium sheet and were identified consulting with local people, different literatures, Central Department of Botany, T.U. and National Herbarium, Godavari.

### **3.2.8. Library Survey**

All the available literature about KTWR birds and Swamp Francolins were reviewed to understand about the Swamp Francolin. Mainly literatures available in TUCL, BCN, MTNC, ICIMOD, WWF, Head Quarter (DNPWC) and other libraries were reviewed.

## **4 RESULTS**

### **4.1. Total population status**

Francolins were found foraging and feeding with sub-adults in the group. Only a few times they were counted when flying and resting. The birds seemed to be at alert position when reached near 200 m. or less. The birds were seen flying for about 200 m only when

suddenly disturbed. The maximum population of Francolin counted in the eastern part of KTWR was 87 where the minimum population sighted was 58 and the mean population of francolin was computed to be 71. The maximum number of sub-adults counted was 24, the minimum number counted was 11 where the mean population of sub-adults was calculated to be 17 (Table 1).

Table 1: Major study route, sites and francolins observed in eastern KTWR

S. N	Major Study route/sites	Area (km <sup>2</sup> )	Intensive Study Sites	No. of Francolin observed			Sub-adults		
				Max	Mean	Min	Max	Mean	Min
1.	6.7km to 9.804km (Bhantabari – 0 Km)	0.84	(Haripur) 6.7km to 8.252km	5	6	3	1	0.33	0
			8.252km to 9.804km	3		2			
2.	9.804km to 14.46km (Haripur Kushaha)	1.252	9.804km to 11.356km	11	35.66	9	13	9.3	6
			11.356km to 12.908km	20		9			
			12.908km to 14.46km	13		10			
3.	14.46km to 19.116km (Kushaha - Madhuban)	1.252	14.46km to 16.012km	11	27.66	8	10	7.2	5
			16.012km to 17.564km	10		8			
			17.564km to 19.116km	10		8			
4.	19.116km to 23.08km (Madhuban - Prakashpur)	1.252	19.116km to 20.668km	2	1.33	1	0	0	0
			20.668km to 22.224km	1		0			



			22.224km to 23.08km	1		0			
Grand Total				87	71	58	24	16.83	11

#### 4. 1.1. Population density

The maximum observed population of francolin was 87, and the total area of study was 175 Km<sup>2</sup>. Therefore, the maximum crude density in the study area was calculated to be 0.497 individuals/Km<sup>2</sup>. However, the realized habitat and actual area covered in the eastern side excluding the flooded area with no access of Swamp Francolin was only 4.596 Km<sup>2</sup> therefore the maximum ecological density was calculated to be 18.93 = 19 individual/Km<sup>2</sup>.

The survey was concluded at least three times for each sector or block so that more accurate data can be obtained. All these data were used to calculate the mean population density of Francolin of which, mean crude density was computed to be 0.41 individual/ Km<sup>2</sup> and the mean ecological density was calculated as 15.45 individuals/Km<sup>2</sup>.

Similarly, the minimum crude density, for N = 58 was calculated as 0.33 individuals/Km<sup>2</sup> and the minimum ecological density was computed to be 12.62 individuals/Km<sup>2</sup> (Table 1 and 2).

Table 2: Crude and ecological density of francolins in the total area

Population of Francolin	Total area (km <sup>2</sup> )	Crude density (per km <sup>2</sup> )	Actual study area	Ecological density	
Maximum	87	175	0.5	4.596	18.93
Mean	71	175	0.4	“	15.45
Minimum	58	175	0.33	“	12.62

#### 4.1.2. Population density at four sectors

At the maximum level of population, the ecological density was found to be the highest at sector B (Kushaha /Titrigachhi area) i.e. 35.14 individuals/Km<sup>2</sup> and the lowest density was calculated to be 3.194 individuals/Km<sup>2</sup> at sector D in Prakashpur area.

The density was calculated to be 24.76 individuals/Km<sup>2</sup> at sector C (Hawamahal / Madhuban area) and 9.52 Km<sup>2</sup> at sector A i.e. at Haripur side. Similarly, the density at its mean population level was computed to be 7.14 individual/Km<sup>2</sup> in sector A while B 28.48 individuals/Km<sup>2</sup>, in sector C found to be 22.1 individual /Km<sup>2</sup> and 1.06 individuals/Km<sup>2</sup> in sector D.

Again, the density at its minimum population level was calculated to be 5.95 individuals/Km<sup>2</sup> for sector A, 22.36 individuals/Km<sup>2</sup> for sector B, 19.17 individuals/Km<sup>2</sup> for sector C and 0.8 individuals/km<sup>2</sup> for sector D. The lowest density of francolins was recorded in (Prakashpur area) Sector D (Table 3).

Table 3: Population of francolins with its maximum and minimum presence in study sites

Study Site (sectors)	Population of Francolins observed					
	Maximum		Mean		Minimum	
	No.	Density	No.	Density	No.	Density
A	8	9.52	6	7.14	5	5.95
B	44	35.14	35.66	28.48	28	22.36
C	31	24.76	27.66	22.1	24	19.17
D	4	3.194	1.33	1.06	1	0.8
Total	87	18.929	71	15.448	58	12.619

#### 4.2. Density of sub-adult at four sectors

The maximum number of sub-adults observed was 24, therefore the ecological density for this was calculated to be 5.22 individuals/Km<sup>2</sup>. Mean ecological density for sub-adults (N =17) was calculated to be 3.7 individuals/Km<sup>2</sup>. Similarly, for the minimum population of sub-adults (i.e., N = 11) ecological density was calculated to be 2.39 individuals/Km<sup>2</sup>.

At the maximum level of population of sub-adult, the ecological density was found to be the highest at sector B i.e. 10.38 individual/Km<sup>2</sup>. At sector C it was found to be 7.987 individual/Km<sup>2</sup>, 1.19 individual/Km<sup>2</sup> at sector A and there was no record of sub-adult francolin at sector D. The ecological density at its mean population level was calculated to be 0.39 individual/Km<sup>2</sup> for sector A, 7.428 individual/Km<sup>2</sup> for sector B and 5.75 individual/Km<sup>2</sup> for sector C (Table 4).

Table 4: Population of sub-adults and its ecological density in study sites

Study Site (sectors)	No. of sub-adult observed					
	Maximum		Mean		Minimum	
	No.	Ecological Density	No.	Ecological Density	No.	Ecological Density
A	1	1.19	0.33	0.39	0	0
B	13	10.38	9.3	7.428	6	4.79
C	10	7.987	7.2	5.75	5	3.99
D	0	0	0	0	0	0

Total	24	5.22	17	3.698	11	2.39
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#### 4.2.1. Adult - sub-adult structure

There was no significant marking to differentiate the sub-adults from adults. Only size of the species was taken in consideration. At the time of field work, chickens were already grown up to little more than half size of an adult. The wings were also developed but were not seen flying during the field work rather were seen following their parents to the bushes when disturbed. Even though one could easily distinguish a sub-adult foraging with its parent at the time due to its smaller size. The total maximum population of francolin observed during terminal period of study was 87, similarly, the total mean population 71, out of which only 23.94% were sub-adults and 76.05% were adults. The ratio of sub-adult to adult was computed to be 1:3.18 (Fig. 4).

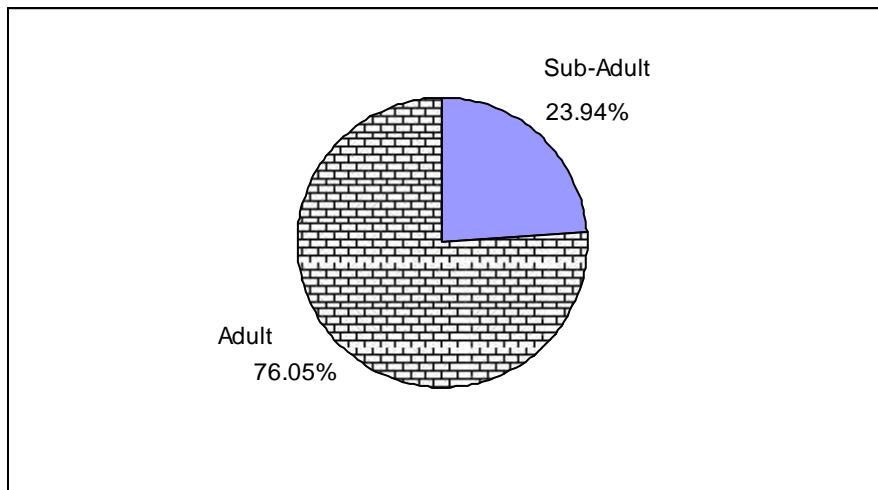


Fig 4: Structure at mean population level at study sites

#### 4.2.2. Adult - sub-adult structure at four sectors

The highest percentage of sub adult was found at sector C i.e. 32.258%. The percentage of sub-adults at sector B was found to be 29.55% while at sector A was found to be 12.5%. No sub-adults were recorded from sector D within the study period (Table 5).

Table 5: Sub-adult ratio with adult and their percentages

<b>Study Site (sectors)</b>	<b>Adult</b>	<b>Percentage</b>	<b>Sub-Adult</b>	<b>Percentage</b>	<b>Ratio</b>
A	7	87.5	1	12.5	1:7
B	31	70.45	13	29.55	1:2.4
C	21	67.74	10	32.258	1:2.1
D	4	100	-	-	-
Total	63	72.41	24	27.586	-

Similarly, the highest percentage of adult was found at sector D i.e. 100%. The percentage of adults at sector A was found to be 87.5% while at sector B was found to be 70.45%. Least adults were recorded from sector C 67.74% within the study period (Fig.5).

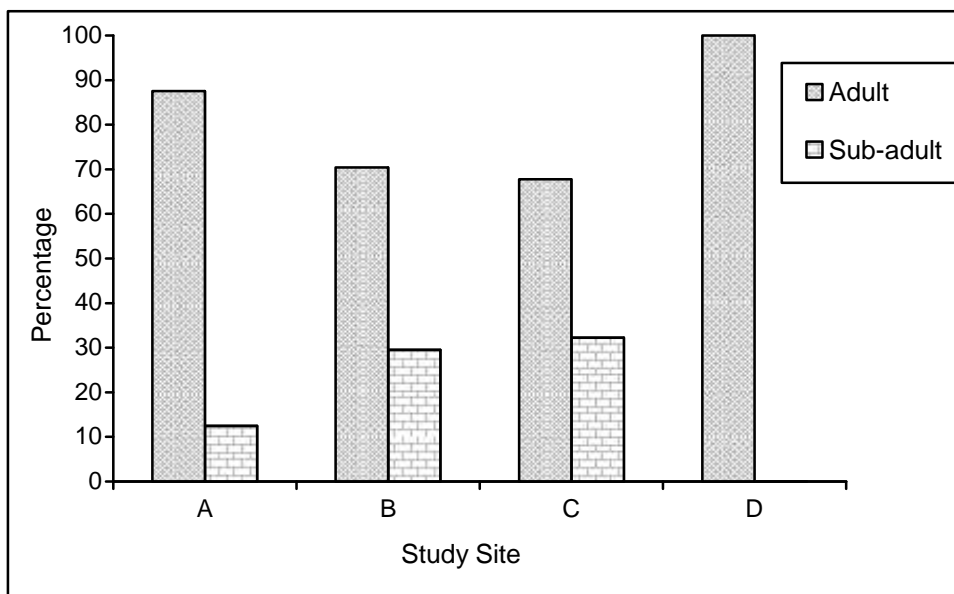


Fig 5: Structure at mean population level in three study sectors

#### 4.3. Distribution of Francolin in different sectors

Swamp Francolins were recorded from Haripur, the southern boundary of the reserve to Prakashpur, the northern boundary of the reserve at eastern side. One could encounter these birds at the dam frequently during dawn and dusk. But absence of the species at some phantasm was fragmented to some extent. The distribution of the species at eastern reserve showed clumped pattern. ( $S^2/X=12.4$ ) at standard deviation ( $=6.46$ ) at maximum level of population.

The population was clumped at sector B (Titrigachhi-Kushaha) with 50.57% population and sector C 35.63% while sector A hold 9.2% and the lowest 4.6% was found at sector D (Fig. 6).

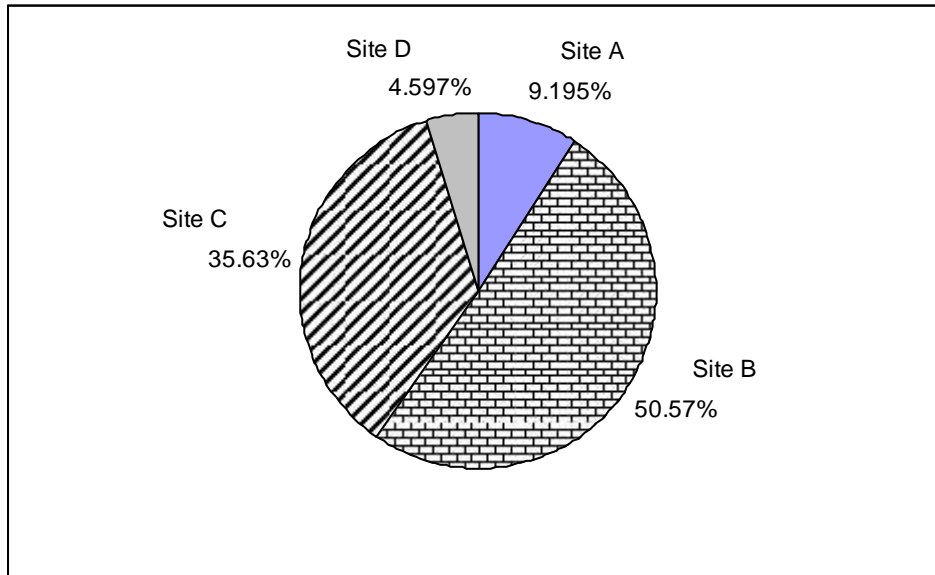


Fig 6: Distribution at maximum population level at study sites

Distribution pattern was found the same i.e. clumped when observed through minimum population level ( $S^2/X= 9.396$ ;  $\lambda=11.67$ ). Although sector C seemed to hold less than half percentage of total population at this level percentage of population differed insignificantly in both the cases (Fig. 7).

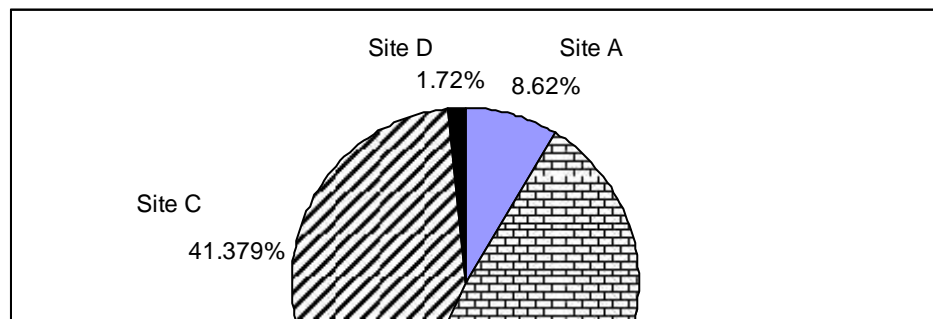


Fig 7: Distribution at minimum population level at study sites

Statistically, the null hypothesis set for the Swamp Francolin distribution in the different sectors was rejected.

Calculated  $\chi^2_{(3, 0.05)} > \text{tabulated } \chi^2_{(3, 0.05)}$  i.e.  $49.86 > 7.815$

It was concluded that the distribution of Swamp Francolin differed significantly in different sectors and hence the distribution was not regular.

#### **4.4. Threats**

Loss and alternation of habitat is considered to be the greatest indirect threat to the wildlife of Nepal (Majpuria and Majpuria, 2006).

Loss of habitat has been one of the principle reasons for the decline in number and distribution of important population in most places.

Habitat encroachment including human interference was seen as the main threats to the Swamp Francolin survival in KTWR.



#### **4.4.1. Livestock encroachment recorded at the reserve**

The result about the livestock encroachment was prepared by working only in the morning and evening daily. A heavy encroachment was observed during the field work. The only available grazing area was the reserve's grass land for the livestock which was the integral part of economy of the local community. A large number of domestic cattle were seen grazing inside the reserve illegally deteriorating the habitat.

A large number of domestic livestock can be seen grazing inside the Reserve for the most of the time. The number increases after the noon. An average of 96 domestic livestock was recorded daily. The percentage distribution of various livestock encroachment inside the reserve was also studied. Livestock recorded were commonly cattle and goats. The encroachment due to cow/ox was found the highest (59.38%) and the lowest due to goat (16.66%) (Fig. 8).

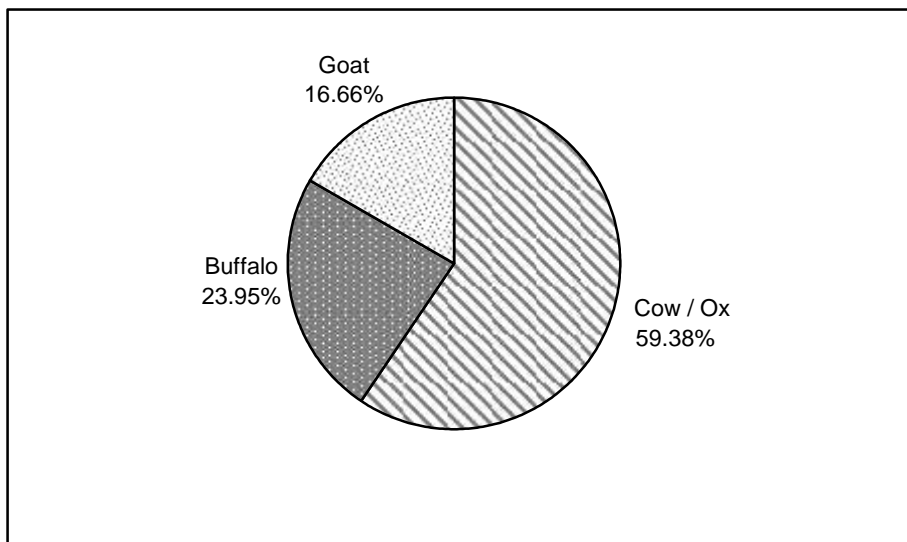


Fig 8: Percentage of distribution of various livestock grazed in the reserve

#### 4.4.2. Livestock at different sectors of the reserve

The percentage of livestock grazed at different parts of the reserve was found different. The highest encroachment was found at Haripur (sector A) with 35.42% and the lowest in Prakashpur (sector D) with 8.33%. Similarly 33.34% in Kushaha (sector C) and 22.91% in (sector B) i.e. Madhuban (Fig. 9).

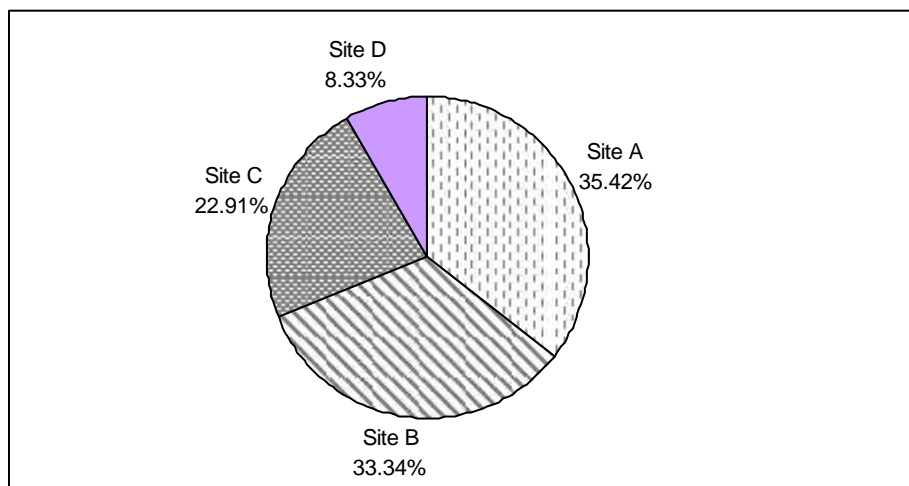


Fig 9: Percentage of distribution of livestock grazed in different sectors of the reserve

#### 4.4.3. Human interference

A more or less number of people were seen at anytime during the day time for different purposes in the reserve. The number of people gradually increased from 10:00 am onwards and became large at noon and evening. Most of them were seen fishing, collecting grasses, firewood, fodder and edible vegetable like '*Niguro*' in the grass land of the reserve (Plate 12).

For the Two way ANOVA (F-test), the null hypotheses set for 1% and 5% level of significance were accepted.

For the encroachment (treatment 1), cal. F (0.01) at d.f. (1,3) < tab. F i.e. 0.22 < 34.12

Cal. F (0.05) at d.f. (1,3) < tab. F i.e. 0.22 < 10.13

For the sectors (treatment 2), cal. F (0.01) at d.f. (3,3) < tab. F i.e. 1.75 < 29.46

Cal. F (0.05) at d.f. (3,3) < tab. F i.e. 1.75 < 9.28

Hence, it was concluded that various encroachments on the distribution of the species in different sectors were not only the factors causing irregular distribution. The Population distribution due to different encroachments and sectors were insignificant.

Average number of encroachment of people inside the reserve was found to be 86. This was obtained by working for a total of 4 hours daily at morning and evening. In sector C, the highest encroachment of people was found (30.24%) proceeding by sector A (25.59%), sector B (24.41%) and the lowest (19.76%) in sector D (Fig. 10).

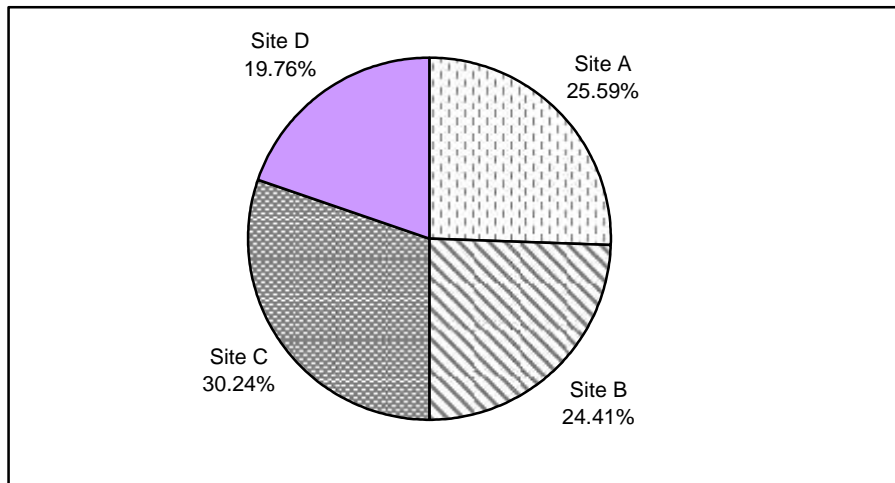


Fig 10: Percentage of people encroachment in different sectors of the reserve

#### **4.4.4. Flood**

Although the flood plain of Koshi is the most important area providing habitat for a number of flora and fauna and being a Ramsar site, it is the ideal place for Asiatic wild water buffalo. It has some adverse effects mostly during rainy season. It is the meeting point of seven rivers arising from the Himalayas which damages and destroys the habitat of the bird species hence sweeping down them towards south. The size of grassland has been decreasing in the eastern reserve due to the river action (Plate 5).

#### **4.4.5. Hunting**

According to Mr. Rana, the Senior Game Scout, at Prakashpur Post, people used to taste the species frequently in the past. Nowadays the species has become rare and is not easily available hence difficult to hunt due to the scarcity and security problem. It is not completely stopped so far but is hunted for flesh often.

## **5 DISCUSSION**

Swamp Francolin (*Francolinus gularis*) is known to occur only inside the protected areas in Nepal. In KTWR, Swamp Francolins were found to be concentrated along the eastern embankment and are reported from western edge of reserve as well. Although locals have heavy activities in these areas regularly, Swamp Francolins have been reported since early 1990s (Inskipp and inskipp, 1991; Lama, 1992; Shrestha, 1992; Baral, 1998 and Dahal 1999). Baral (1998) and Dahal (1999) reported Swamp Francolins in Haripur in the southern side of eastern reserve outside the boarder of protected areas. However, I found the area heavily disturbed by the locals and Swamp Francolins were not recorded in the present study. It may also be due to the loss of suitable habitat. Northern side of

eastern reserve was not preferred by the francolins due to lack of suitable grassland habitat. The area was highly impacted by regular flood. Active human disturbance, heavy grass cutting, frequent livestock grazing and movement of people and activities throughout the reserve made them on the verge of extinction. Baral (1998) has pointed out and Dahal (1999) has mentioned the fact of declining of francolins at KTWR due to all these reasons.

Swamp Francolins were always in frightening condition by hundreds of livestock grazing inside the reserve disturbing them in all aspects of their lives. Misuse of the buffer zone by the park staffs and army, very poor economic condition of locals, free using of grassland resource, causal flooding rivers were the major cause for losing the Swamp Francolins at the eastern and western sectors of the reserve. Due to inaccessibility to visit there, the western side of the reserve is in shade regarding any such type of research work in comparison to facilitated eastern side. Baral (1996) could not explore this sector for the same reason during his research work. While Dahal (1999) has explored only few points of this side.

The total counted population of Swamp Francolin during this study was 87 at maximum level and 58 francolins were recorded at the minimum level. The mean population of francolin is computed as 71 individuals. This value includes number of sub-adults as well. The mean population of only sub-adults was found as 17 individuals while they were computed to be 24 and 11 individuals at maximum level and minimum level respectively.

The population of Swamp Francolins described above does not differ very much with Dahal (1999), he counted a total of 80-90 individuals in KTWR as his count includes only 60-72 individuals in eastern part of KTWR and Koshi Barrage area. However, the population number is much less if compared to 178 individuals recorded by Baral (1996) at the reserve. Similarly, Shrestha (1991) has

mentioned records of 45-75 francolins at Koshi Tappu in 1989 and 1990 which is doubtful (Baral, 1996). The variation in population of francolins seems to be due to the different research sites of the researcher.

Mostly, these birds were seen foraging around the dam or the grassland inside the reserve. They were also seen on the branches of Kadmero (*Litsea monopetalea*), lower branches of Sissoo (*Dalbergia sissoo*), Khair (*Acacia catechu*) used as roosting site. Jhauwa species was also preferred which were found scattered on swampy grassland making them easy for roosting after foraging and feeling disturbance by the movement of people, livestock etc. Swamp Francolins were mostly seen frequently during the field work. A very few number of calls were heard, especially during dawn and dusk. Sometimes calls were heard at midnight, more interestingly near the reserve quarter. The calls were also recorded at noon during the very sunny days in a very less number.

Rand and Fleming (1957) as well as Rana described its call as “kaw-care” while Baral (1996) described it as “chuckeroo chuckeroo”. When calling starts the neck is very erect with up stretched. I heard the calls of this bird as “kaw-care” and an occasional loud “qua-qua-qua” in an ascending tone. The different sound production might be seasonal nature of bird, however still unknown about the fact.

The ecological density was found the highest at Titrigachhi and upwards at Kushaha sector. Despite local disturbances, this area containing the phantas and grasslands as suitable habitat for francolins. In this study period, Swamp Francolins were not seen much more at the Prakashpur area. This may be due to the grassland in this area was regularly flooded and suitable habitat was damaged by the Koshi River. Dahal (1999) has recorded 11 francolins at this site. In the Haripur (sector A), Dahal has recorded 12 francolins. During my study period, it was only 8. This may be due to the difference in area of study site. Dahal (1999) has found 12 francolins in an area of 1.26 sq. Km. but during my research period, 8 were counted in an area of 0.84 sq. Km. as the remaining part of this area i.e. included in sector B in my study period. Another reason for less number in this area may be due to the disturbance caused by a large

herd of cattle seen frequently in this area. Those do not belong to local people but driven to graze there from India according to the local source.

In the sector B (Haripur – Kushaha sector), total count in my study period, i.e. 44 francolins seem larger than Dahal, i.e. 32 francolins but my study area was much larger. If seen very microscopically, in the upper equal area of Dahal (1999) and mine (from 11.35 Km. to 14.46 Km. length), number of francolins recorded was equal, i.e. 32 and 33 respectively. The francolins at sector C (i.e. Kushaha – Madhuban) were found much denser i.e. 31 francolins than Dahal (1999) recorded i.e. 7 francolins in an area of 1.252 sq. Km. and 1.16 sq. Km. respectively. All these records show that the population of francolins was distributed throughout the eastern Reserve from Haripur to Prakashpur. The main population was found in and around Kushaha, although local disturbance was high.

Density of sub-adult was found higher at the same area where the total population was found higher, i.e. at sector B of the study area consisted of 13 sub-adults. No sub-adult was seen with their parents at Prakashpur aea. The only one sub-adult with parent was seen once at Haripur area. The ratio of adult to sub-adult should be proper. (Dahal personal communication). But very interestingly the number of sub-adult recorded was very low in comparison to the number of adult either in total or in a flock. The closest ratio found was 2.1:1 in sector C, i.e. upper Kushaha to Madhuban area. The species is continuing to threatened state due to the heavy disturbances and habitat degradation in KTWR. The large movement of people for fodder collection and grass harvesting and heavy grazing of livestock inside the reserve are found as the main causes to threats for the species to extinction. Besides, flood by the Koshi River is another serious problem in the eastern part. Hunting and tourism are also as important role playing in declination of the species to some extent.



Grazing, cutting, burning, hunting, fishing in shallow pools within grassland and claiming lands for agricultural purposes are the main threats to the survival of Swamp Francolin in Nepal. Some of these factors disturb the bird while others directly contribute to deterioration of the habitat (Kalsi *et. al.*, 2000). Virtually all remaining grass land within the species's range are subjected to intense pressures from encroachment by people, domestic livestock, grass harvesting, forest fire and hydrological schemes (Javed and Rahmani, 1991, Peet, 1997). The grasslands are generally poorly presented in protected area systems (Baral, 1998). All these factors and opinions are found to support my study.

Among the different livestock grazing inside the reserve the number of cow/ox is found higher. This is because the local people have less number of buffaloes than cow/ox in the community. The number of goat is little more but they collect grasses for goat from the Reserve to feed rather grazing goat directly in the Reserve. Still little number of goats could be seen in the Reserve. The number of livestock grazing inside the reserve has decreased towards northern boundary, Prakashpur. People living in the northern side are found more aware of conservation of natural environment than the ethnic groups living southern side of the reserve. Hence, there is less encroachment by people at northern sector. Therefore, degradation and claiming of grassland in the habitat of francolins seems to be major threats of their habitat and ultimately their survival.

## 6 CONCLUSION

Koshi Tappu Wildlife Reserve and Shukla Phanta Wildlife Reserve are the two isolated pockets supporting the population of Swamp Francolins in Nepal. The former holding the second largest population of the species in the world. A maximum of 87 individuals were recorded during 33 days of the field survey by the direct observation method in the months of June and July. The population of the species were seen distributed in a little it fragmented fashion in swampy grassland of eastern reserve although a more or less number of francolins were encountered throughout the way from Haripur to Prakashpur but some phantas in between were found completely out of the species.

Destruction of habitat is the major problem in the KTWR, either by the encroachment or by the flood in Koshi River. Another major problem is the disturbance either by human interference or by cattle / livestock. Overgrazing vegetation, cutting of trees, active human pressure and worse management reflected critical situation of overall KTWR. There must be restriction of livestock grazing, good management programme must be introduced. Illegally entered domesticated animals should be removed out and the owner of them should be given certain punishment or fined strictly according to the rules and regulations of DNPWC act 1973.

Roosting sites are decreasing due to the cutting of shrubs for the domestic purpose. There is an urgent need to plant the roosting shrubs. The grassland is dominated by *Saccharum-Phragmites* and other associated of vegetation in Koshi Tappu. Major species

present in different proportions include *Imperta cylindrica*, *Phragmites karka*, *Saccharum spontaneum*, *Typha aungustifolia* and *Vetiveria zizanoides*. The presence of *Typha-Vetiveria* association serve as an indicator of swampy grass land in Koshi Tappu.

Many facts revealed from such study have direct benefit for the future conservation and management of this bird. Awareness on this bird conservation should be started as soon as possible. Potential habitats and existing places which support francolins should be protected. Among the two protected areas containing the remaining population of Swamp Francolins in Nepal, KTWR contains even higher number than the other, although they are facing many problems and have come to verge of extinction if prevailing threats are accelerated more.

Among the 87 individuals counted in this research, a maximum of 24 were sub-adults. The adult to sub-adult ratio was found improper. This ratio is not a satisfied one. The population of Swamp Francolin was found dense in and around Kushaha along the eastern reserve and is distributed throughout the eastern length of the Reserve in Haripur, Titrigachhi, Kushaha, Hawamahal, Aapgachhi, Madhuban, Sukrabare and Prakashpur. The grassland near Sukrabare Wildlife Camp and Prakashpur area was flooded by Koshi River and hence in these areas only a few numbers of francolins were possible to record.

Human interference and livestock encroachment both are in high level inside the Reserve and hence both deteriorating the habitat of Swamp Francolin. Hunting has also decreased the population although in less extent. Natural phenomena like predators (wild cat and jackal) may also be responsible for decreasing its population. The population of sub-adults seems less in comparison to the adults that may be due to high mortality rate or predator pressure? It can not be solved due to lack of a series of data. However, such figure and information desparating the survival future of the bird species.

The degradation of habitat quality and the loss of space are not supporting the viable self sustaining population of Swamp Francolin at natural condition. For in-Situ conservation of Swamp Francolin restoration maintenance and extension of existing habitat at KTWR is important.

## **7 RECOMMENDATION**

Seminars and talk programme on this bird will not be major way to solve the problems. Making a management plan in an equipped room will not be succeeded if it is not implemented practically in the field. So field research involving local people is necessary to carry out the action plan to conserve this endangered bird species.

I have some recommendation below for the conservation of Swamp Francolin.

- ) A long term research with the study on birds' ecological behavioral aspects of should be given higher priority.
- ) Annual firing of grasses and cutting of trees should be strictly prohibited.
- ) The core area of these birds where the population is fairly high should not be disturbed by any reason.

- ) Active human activities, frequent movement of vehicles, occasional picnic programme should be outside at the pasture land.
- ) Captive breeding should be carried out to breed this species in large number and set free in natural habitat.
- ) Reintroduction programme should be carried out to their natural habitat.
- ) Swamp Francolin should be listed as a protected bird species in Nepal.
- ) A comprehensive management plan should be formulated and implemented.
- ) Grass cutting and burning should be restricted outside birds' breeding site.
- ) All domestic livestock living in the Reserve should be completely evicted.
- ) Local people, opinion leaders and reserve users should be aware on the status of Swamp Partridge.

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**Annex I**  
**Questionnaire Set**

Name: ..... Age..... Sex: M / F Date:.....

Occupation:..... Address:.....

1. Have you ever seen Swamp Francolin? How does it look like?

- a) Yes
- b) No

If yes, please describe .....

2. Where did you see it? Place/Habitat.....

.....

3. How frequently have you seen? (Write time and period)

- a) Daily at all time.....    b) Sometime at.....    c) Once at.....

4. What is the size of flock you have seen?

- a) Single ...    b) Flock..... ( i. Adult.....ii. Sub adult..... iii. Chicks.....)

5. Have you ever heard the calling Francolin?

- a) No.    b) Yes

If yes, at what time (dawn, morning, noon, dusk, night)?

6. Do you know the current status of Swamp Francolin?

- a) Yes (About.....)    b) No.

7. If there is any value or use of Swamp Francolin?

- a) No    b) Yes

If yes, than what are the uses? ..... (General)

- i) Commercial trade    ii) Medicinal  
iii) Mythological    iv) Others

8. Whether there is any harm by this bird related with your livelihood?

- a) No
- b) Yes

If yes, then what are they? ..... (General)

Specify.....

9. Do you think this bird is important?

- a) No
- b) Yes

If yes, then what are they? ..... (General)

Specify.....

10. Is there any relation with the ethnicity / community / religion / tradition etc.?

- a) No
- b) Yes

If yes, than what are they? ..... (General)

Specify the relation.....

11. Have you ever tasted the flesh?

- a) Yes
- b) No

12. What you think, whether population of the bird is increased recently? Why?

.....

13. If decreased, what may be the cause? .....

- a) Commercial trade      b) Hunting for meat      c) Habitat loss      d) Others

14. What should be done for the Protection of this bird?

- a) Awareness                  b) Strengthening the legislation                  c) Others.....

15. Any other information on these birds? .....

.....

## **Annex-II**

### **Plant species found at intensive study area**

<b>S.N.</b>	<b>Name of the plant species</b>		<b>Family</b>
	Local Name	Scientific Name	
1	Asuro	<i>Justicia adhatoda</i>	Acanthaceae
2	Babiyo	<i>Eulaliopsis binata</i>	Graminae
3	Babul	<i>Acacia arabica</i>	Leguminosae
4	Bair	<i>Zizyphus mauritiana</i>	Rhmnoceae
5	Banso	<i>Digitaria ciliaria</i>	Graminae
6	Bethe	<i>Chenopodium ambrosoides</i>	Chenopodiaceae

7	Chirchiri	<i>Achyranthes aspera</i>	Amaranthaceae
8	Chupigas	<i>Heteropogon controtus</i>	Graminae
9	Datiun	<i>Achyranthes bidentata</i>	Amaranthaceae
10	Dhurseli	<i>Colebrookea oppositifolia</i>	Labiatae
11	Dubo	<i>Cynodon dactylon</i>	Graminae
12	Jalebi	<i>Pithe cellobium dulce</i>	Leguminosae
13	Jhauwa	<i>Tamarix dioica</i>	Tamaricaceae
14	Kadmero	<i>Litsea monopetale</i>	Lauraceae
15	Kans	<i>Saccharum spontaneum</i>	Graminae
16	Katari jhar	<i>Vetiveria zizanoides</i>	Graminae
17	Khadai	<i>Arundo donax</i>	Graminae
18	Khair	<i>Acacia catechu</i>	Leguminosae
19	Khar	<i>Cympogon pendulus</i>	Graminae
20	Khari	<i>Trema orientalis</i>	Ulmanceae
21	Kurro	<i>Bidens pilosa</i>	Compositae
22	Kush	<i>Eragrestis cynosuroides</i>	Graminae
23	Lajvanti	<i>Minosa pudica</i>	Mimosaceae
24	Mirchaiya	<i>Vernonia cineria</i>	Compositae
25	Narkat	<i>Phragmites karka</i>	Graminae
26	Pater	<i>Typha angustifolia</i>	Typhaceae
27	Pithari	<i>Trewia nudiflora</i>	Euphorbiaceae
28	Rajbeli	<i>Clerodendron infortunatum</i>	Verbenaceae
29	Sama	<i>Echinochloa colonum</i>	Graminae
30	Sanai	<i>Crotolasia pallida</i>	Leguminosae
31	Siris	<i>Albizia chinensis</i>	Leguminosae
32	Siru	<i>Imperata cylindrica</i>	Graminae
33	Sissoo	<i>Dalbergia sissoo</i>	Leguminosae
34	Titepati	<i>Artemisia indica</i>	Compositae

### Annex – IV

#### Checklist of Mammals, Reptiles and Amphibians of Koshi Tappu Wildlife Reserve

S.N.	Common Name	Scientific Name
	<u>Mammals</u>	
1.	Blue Bull	<i>Boselaphus tragocamelus</i>
2.	Gangetic Dolphin	<i>Plantanista gangetica</i>
3.	Gaur (Bison)	<i>Bos gaurus</i>
4.	Hog Deer	<i>Axis porcinus</i>
5.	Indian Flying Fox	<i>Pteropus giganteus</i>
6.	Indian Fox	<i>Vulpes bengalensis</i>
7.	Jackal	<i>Canis aureus</i>
8.	Jungle Cat	<i>Felis chaus</i>
9.	Rhesus Monkey	<i>Macaca mulata</i>
10.	Rufous tailed Hare	<i>Lepus ruficaudatus</i>
11.	Small Indian Mongoose	<i>Herpestes auropunetatus</i>
12.	Smooth Coated Otter	<i>Lutra perspicillata</i>
13.	Spotted Deer	<i>Axis axis</i>
14.	Wild Boar	<i>Sus scrofa</i>
15.	Wild Water Buffalo	<i>Bubalus bubalis</i>

	<u>Reptiles</u>	
1.	Checkered Keelback	<i>Xenochrophis piscator</i>
2.	Garden Lizard	<i>Calotes versicolor</i>
3.	Gharial Crocodile	<i>Gavialis gangeticus</i>
4.	Monitor Lizard	<i>Varanus bengalensis</i>
5.	Soft Shell Turtle	<i>Trionyx bengalensis</i>
	<u>Amphibians</u>	
1.	Indian Bull Frog	<i>Rana tigrina</i>
2.	Toad	<i>Bufo melanosticus</i>

Source: Koshi Tappu Wildlife Reserve (KTWR)

### Annex – V

Annual Temperature (°C) of Fatehpur for the year 2005											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Max	24.8	28.7	32.9	34.6	34.0	35.3	33.8	33.5	35.7	33.4	31.8	30.0
Min.	10.9	13.4	17.4	20.1	22.6	25.7	25.8	25.9	25.3	21.4	15.0	10.8
Annual Relative Humidity (%) of Fatehpur for the year 2005												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mor	85.6	74.3	69.3	62.1	67.9	75.3	81.8	83.5	75.2	72.2	70.5	72.0
Eve	85.6	66.5	56.4	52.5	64.6	71.1	78.7	83.1	81.5	82.3	85.4	85.1
Annual Rainfall (mm) of Fatehpur for the year 2005												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
16.7	2.0	55.8	120.6	224.8	196.2	270.5	506.5	225.0	74.6	0.0	0.0	

*Source: Department of Hydrology & Meteorology*



**Annex-V**

Annual Temperature (°C) of Fatehpur for the year 2005												
Months	January	February	March	April	May	June	July	August	September	October	November	December
Maximum	24.8	28.7	32.9	34.6	34.0	35.3	33.8	33.5	35.7	33.4	31.8	30.0
Minimum	10.9	13.4	17.4	20.1	22.6	25.7	25.8	25.9	25.3	21.4	15.0	10.8
Annual Relative Humidity (%) of Fatehpur for the year 2005												
Months	January	February	March	April	May	June	July	August	September	October	November	December
Morning	85.6	74.3	69.3	62.1	67.9	75.3	81.8	83.5	75.2	72.2	70.5	72.0
Evening	85.6	66.5	56.4	52.5	64.6	71.1	78.7	83.1	81.5	82.3	85.4	85.1
Annual Rainfall (mm) of Chatara for the year 2005												
Months	January	February	March	April	May	June	July	August	September	October	November	December
	16.7	2.0	55.8	120.6	224.8	196.2	270.5	506.5	225.0	74.6	0.0	0.0

*Source: Department of Hydrology & Meteorology*

**Annex - III**  
**Checklist of Birds of Koshi Tappu Wildlife Reserve**

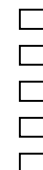
Order/Family/English name	Scientific Name	Status	References
<b>GALLIFORMES</b>			
<b>Phasianidae</b>			
Black Francolin	<i>Francolinus francolinus</i>	br, 3	<input type="checkbox"/>
Grey Francolin	<i>Francolinus pondicerianus</i>	r?, 4	<input type="checkbox"/>
*Swamp Francolin	* <i>Francolinus gularis</i>	br, 2	<input type="checkbox"/>
Common Quail	<i>Coturnix chinensis</i>	m?, 4	<input type="checkbox"/>
Blue-breasted Quail	<i>Coturnix chinensis</i>	m, 4	<input type="checkbox"/>
Red Junglefowl	<i>Gallus gallus</i>	br, 4	<input type="checkbox"/>
Indian Peafowl	<i>Pavo cristatus</i>	br, 4	<input type="checkbox"/>
<b>ANSERIFORMES</b>			
<b>Dendrocygnidae</b>			
Fulvous Whistling Duck	<i>Dendrocygna bicolor</i>	m, 5	<input type="checkbox"/>
Lesser Whistling Duck	<i>Dendrocygna javanica</i>	br, 1	<input type="checkbox"/>
<b>Anatidae</b>			
Greylag Goose	<i>Anser anser</i>	m, 4	<input type="checkbox"/>
Greater White-fronted Goose	<i>Anser albifrons</i>	m, 5	13, 14 <input type="checkbox"/>
Bar-headed Goose	<i>Anser indicus</i>	m, 3	<input type="checkbox"/>
Ruddy Shelduck	<i>Tadorna ferruginea</i>	w, 1	<input type="checkbox"/>
Common Shelduck	<i>Tadorna todorna</i>	w, 5	<input type="checkbox"/>
Comb Duck	<i>Sarkidiornis melanotos</i>	s, 3	<input type="checkbox"/>
Cotton Pygmy-goose	<i>Nettapus coromandelianus</i>	r, s, 3	<input type="checkbox"/>
Gadwall	<i>Anas strepera</i>	w, 1	<input type="checkbox"/>
Falcat Duck	<i>Anas falcata</i>	w, 3	<input type="checkbox"/>
Eurasian Wigeon	<i>Anas penelope</i>	w, 2	<input type="checkbox"/>
Mallard	<i>Anas platyrhynchos</i>	w, 1	<input type="checkbox"/>
Spot-billed Duck	<i>Anas poecilorhyncha</i>	r, w, 2	<input type="checkbox"/>
Northern Shoveler	<i>Anas clypeata</i>	w, 1	<input type="checkbox"/>
Northern Pintail	<i>Anas acuta</i>	w, 1	<input type="checkbox"/>

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Garganey	<i>Anas querquedula</i>	w, 3	
*Baikal Teal	* <i>Anas formosa</i>	v	
Common Teal	<i>Anas crecca</i>	w, 1	
Red-crested Pochard	<i>Rhodonessa rufina</i>	w, 2	
Common Pochard	<i>Aythya ferina</i>	w, 1	
Ferruginous Pochard	<i>Aythya nyroca</i>	w, 1	
*Baer's Pochard	* <i>Aythya baeri</i>	w, 4	
Tufted Duck	<i>Aythya fulgula</i>	w, 3	
Greater Scaup	<i>Aythya marila</i>	v	
Long-tailed Duck	<i>Clangula hyemalis</i>	v	
Common Goldeneye	<i>Bucephala clangula</i>	v	
Smew	<i>Mergellus albellus</i>	v	
Red-breasted Merganser	<i>Mergus serrator</i>	v	
Common Merganser	<i>Mergus merganser</i>	w, 4	
<b>TURNICIFORMES</b>			
<b>Turnicidae</b>			
Yellow-legged Buttonquail	<i>Turnix tanki</i>	r, 3	
Barred Buttonquail	<i>Turnix suscitator</i>	r, 3	
<b>PICIFORMES</b>			
<b>Picidae</b>			
Eurasian Wryneck	<i>Jynx torquilla</i>	w, m, 3	<input type="checkbox"/>
Brown-capped Pygmy Woodpecker	<i>Dendrocopos nanus</i>	s? 5	<input type="checkbox"/>
Grey-capped Pygmy Woodpecker	<i>Dendrocopos canicapillus</i>	r?, 4	<input type="checkbox"/>
Gulvous-breasted Woodpecker	<i>Dendrocopos macei</i>	br, 2	<input type="checkbox"/>
Rufous Woodpecker	<i>Celeus brachyurus</i>	r, 4	<input type="checkbox"/>
Streak-throated Woodpecker	<i>Picus xathopygaeus</i>	br, 3	<input type="checkbox"/>
Grey-headed Woodpecker	<i>Picus canus</i>	r, 4	<input type="checkbox"/>
Black-rumped Flameback	<i>Dinopium Benghalense</i>	br, 1	<input type="checkbox"/>
			<input type="checkbox"/>
<b>Megalaimidae</b>			<input type="checkbox"/>

Lineated Barbet	<i>Megalaima lineata</i>	br, 4	
Blue-throated Barbet	<i>Megalaima asiatica</i>	br, 2	
Coppersmith Barbet	<i>Megalaima haemacephala</i>	br, 2	
<b>BUCEROTIFORMES</b>			
<b>Buceratidae</b>			
Indian Grey Hornbill	<i>Ocyceros birostris</i>	r, 4	
Oriental Pied Hornbill	<i>Anthracoceros albirostris</i>	r?, 5	3
<b>UPUPIFORMES</b>			
<b>Upupidae</b>			
Common Hoopoe	<i>Upupa epops</i>	s, w, m, 1	
<b>CORACIIFORMES</b>			
<b>Coraciidae</b>			
Indian Roller	<i>Coracias benghalensis</i>	br, 1	
Dollarbird	<i>Euryustomus orientalis</i>	s, 3	
<b>Alcedinidae</b>			
Common Kingfisher	<i>Alcedo atthis</i>	br, 1	
<b>Dacelonidae</b>			
Stork-billed Kingfisher	<i>Pelargopsis capensis</i>	br, 1	
White-throated Kingfisher	<i>Halcyon smymensis</i>	br, 1	
Black-capped Kingfisher	<i>Halcyan pileata</i>	m, 4	
<b>Cerylidae</b>			
Pied Kingfisher	<i>Ceryle rudis</i>	br, 1	<input type="checkbox"/>
<b>Meropidae</b>			
Blue-bearded Bee-eater	<i>Nyctornis athertoni</i>	r?, 3	<input type="checkbox"/>
Green Bee-eater	<i>Merops orientalis</i>	br, 1	<input type="checkbox"/>

Blue-tailed Bee-eater	<i>Merops philippinus</i>	s, br, 1	
Chestnut-headed Bee-eater	<i>Merops, leschenaulti</i>	s, br, 2	
<b>CUCULIFORMES</b>			
<b>Cuculidae</b>			
Pied Cuckoo	<i>Clamator jacobinus</i>	s, br, 3	
Chestnut-winged Cuckoo	<i>Clamator coromandus</i>	s, br, 5	<input type="checkbox"/>
Common Hawk Cuckoo	<i>Hierococcyx varius</i>	br, 2	<input type="checkbox"/>
Hodgson's Hawk Cuckoo	<i>Hierococcyx fugax</i>	v	<input type="checkbox"/>
Indian Cuckoo	<i>Cuculus micropterus</i>	s, br, 1	<input type="checkbox"/>
Eurasian Cuckoo	<i>Cuculus canorus</i>	s, 3	<input type="checkbox"/>
Oriental Cuckoo	<i>Cuculus saturatus</i>	m, 5	<input type="checkbox"/>
Grey-bellied Cuckoo	<i>Cacomantis passerinus</i>	s, 4	<input type="checkbox"/>
Plaintive Cuckoo	<i>Cacomantis merulinus</i>	s, 5	<input type="checkbox"/>
Drongo Cuckoo	<i>Surniculus lugubris</i>	s, 5	<input type="checkbox"/>
Asian Koel	<i>Eudynamys scolopacea</i>	r, s, br, 1	<input type="checkbox"/>
Green-billed Malkoha	<i>Phaenicophaeus tristis</i>	r, 4	<input type="checkbox"/>
Sirkeer Malkoha	<i>Phaenicophaeus leschenaultii</i>	br, 4	<input type="checkbox"/>
<b>Centropodidae</b>			
Greater Coucal	<i>Centropus sinensis</i>	br, 1	<input type="checkbox"/>
Lesser Coucal	<i>Centropus bengalensis</i>	r, s, br, 2	<input type="checkbox"/>
<b>PSITTACIFORMES</b>			
<b>Psittacidae</b>			
Alexandrine Parakeet	<i>Psittacula eupatria</i>	br, 3	<input type="checkbox"/>
Rose-ringed Parakeet	<i>Psittacula krameri</i>	br, 1	<input type="checkbox"/>
Slaty-headed Parakeet	<i>Psittacula himalayana</i>	w, 5	<input type="checkbox"/>
Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	br, 1	<input type="checkbox"/>
Blossom-headed Parakeet	<i>Psittacula roseata</i>	r?, 5	<input type="checkbox"/>
Red-breasted Parakeet	<i>Psittacula alexandri</i>	r, 4	<input type="checkbox"/>



<b>APODIFORMES</b>			
<b>Apodidae</b>			
Himalayan Swiftlet	<i>Collocalia brevirostris</i>	w, 3	
Asian Palm-Swift	<i>Cypsiurus balasiensis</i>	r, 3	
Alpine Swift	<i>Tachymarptis melba</i>	w, 3	
Fork-tailed Swift	<i>Apus pacificus</i>	w, 5	
House Swift	<i>Apus affinis</i>	w, 3	
<b>Hemiprocnidae</b>			
Crested Treeswift	<i>Hemiproctne coronata</i>	r, 4	<input type="checkbox"/>
<b>STRIGIFORMES</b>			
<b>Tytonidae</b>			
Grass Owl	<i>Tyto capensis</i>	r, 5	8 <input type="checkbox"/>
<b>Strigidae</b>			
Collared Scops Owl	<i>Otus bakkamoena</i>	br, 2	<input type="checkbox"/>
Dusky Eagle Owl	<i>Bubo coromandus</i>	r, 5	<input type="checkbox"/>
Brown Fish Owl	<i>Ketupa zeylonensis</i>	r, 2	<input type="checkbox"/>
Jungle Owlet	<i>Glaucidium radiatum</i>	br, 2	<input type="checkbox"/>
Spotted Owlet	<i>Athene Brama</i>	br, 1	<input type="checkbox"/>
Brown Hawk-Owl	<i>Ninox scutulata</i>	r, 2	<input type="checkbox"/>
Short-eared Owl	<i>Asio flammeus</i>	w?, 4	<input type="checkbox"/>
<b>Caprimulgidae</b>			
Large-tailed Nightjar	<i>Caprimulgus macrurus</i>	r, 2	<input type="checkbox"/>
Indian Nightjar	<i>Caprimulgus asiaticus</i>	s, 3	<input type="checkbox"/>
Savanna Nightjar	<i>Caprimulgus affinis</i>	s, 3	<input type="checkbox"/>
<b>COLUMBIFORMES</b>			
<b>Columbidae</b>			

Rock Pigeon	<i>Columba livia</i>	br, 4		<input type="checkbox"/>
Common Wood Pigeon	<i>Columba palumbus</i>	v	12	<input type="checkbox"/>
Oriental Turtle Dove	<i>Streptopelia orientalis</i>	w, 2		<input type="checkbox"/>
Laughing Dove	<i>Streptopelia senegalensis</i>	r?, m, 4		<input type="checkbox"/>
Spotted Dove	<i>Streptopelia chinensis</i>	br, 1		<input type="checkbox"/>
Red Collared Dove	<i>Streptopelia tranquebarica</i>	br, 2		<input type="checkbox"/>
Eurasian Collared Dove	<i>Streptopelia decaocto</i>	br, 1		<input type="checkbox"/>
Emerald Dove	<i>Chalcophaps indica</i>	br, 3		<input type="checkbox"/>
Orange-breasted Green Pigeon	<i>Treron bicincta</i>	br, 2		<input type="checkbox"/>
Pompadour Green Pigeon	<i>Treron pompadora</i>	r, 3		<input type="checkbox"/>
Thick-billed Green Pigeon	<i>Treron curvirostra</i>	r?, 5		<input type="checkbox"/>
Yellow-footed Green Pigeon	<i>Treron phoenicoptera</i>	br, 2		<input type="checkbox"/>
Wedge-tailed Green Pigeon	<i>Treron sphenura</i>	w, 5	7	<input type="checkbox"/>
<b>GRUIFORMES</b>				
<b>Otididae</b>				
*Bengal Florican	* <i>Houbaropsis bengalensis</i>	s, 4		<input type="checkbox"/>
*Lesser Florican	* <i>Sypheotides indica</i>	s, 5		<input type="checkbox"/>
<b>Gruidae</b>				
Demoiselle Crane	<i>Grus virgo</i>	m, 3		<input type="checkbox"/>
Common Crane	<i>Grus grus</i>	m, 3		<input type="checkbox"/>
<b>Rallidae</b>				
Water Rail	<i>Rallus aquaticus</i>	w, 4		<input type="checkbox"/>
Brown Crake	<i>Amaurornis akool</i>	br, 4		<input type="checkbox"/>
White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	br, 1		<input type="checkbox"/>
Baillon's Crake	<i>Porzana pusilla</i>	w, br, 3		<input type="checkbox"/>
Ruddy-breasted Crake	<i>Porzana fusca</i>	br, 1		<input type="checkbox"/>
Spotted Crake	<i>Porzana porzana</i>	v		<input type="checkbox"/>
Watercock	<i>Gallix cinerea</i>	s, br, 3		<input type="checkbox"/>
Purple Swamphen	<i>Porphyrio porphyrio</i>	br, w, 2		<input type="checkbox"/>

Common Moorhen	<i>Gallinula chloropus</i>	w, 1	
Common Coot	<i>Fulica atra</i>	w, 1	
<b>CICONIFORMES</b>			
<b>Scolopacidae</b>			
Pintail Snipe	<i>Gallinago stenura</i>	w, 1	
Common Snipe	<i>Gallinago gallinago</i>	w, 2	
Black-tailed Godwit	<i>Limosa limosa</i>	m, 3	
Whimbrel	<i>Numenius phaeopus</i>	m, 3	
Eurasian Curlew	<i>Numenius arquata</i>	w, 2	
Spotted Redshank	<i>Tringa erythropus</i>	w, 4	
Common Redshank	<i>Tringa totanus</i>	w, 2	
Marsh Sandpiper	<i>Tringa stagnatilis</i>	m, 2	
Common Greenshank	<i>Tringa nebularia</i>	w, 1	
Green Sandpiper	<i>Tringa ochropus</i>	w, 1	
Wood Sandpiper	<i>Tringa glareola</i>	w, 2	
Terek Sandpiper	<i>Xenus cinereus</i>	m, 5	
Common Sandpiper	<i>Actitis hypoleucos</i>	w, 1	
Red Knot	<i>Calidris canutus</i>	m, 5	
Sanderling	<i>Calidris alba</i>	m, 5	
Little Stint	<i>Calidris minuta</i>	w, 2	
Temminck's Stint	<i>Calidris temminckii</i>	w, 1	<input type="checkbox"/>
Dunlin	<i>Calidris alpina</i>	w, 3	<input type="checkbox"/>
Curlew Sandpiper	<i>Calidris ferruginea</i>	m, 4	<input type="checkbox"/>
Ruff	<i>Philomachus pugnax</i>	m, 3	<input type="checkbox"/>
<b>Rostratulidae</b>			
Greater Painted-snipe	<i>Rostratula benghalensis</i>	br, 2	<input type="checkbox"/>
<b>Jacanidae</b>			
Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>	br, 3	<input type="checkbox"/>
Bronze-winged Jacana	<i>Metopidius indicus</i>	br, 1	<input type="checkbox"/>



<b>Burhinidae</b>			
Eurasian Thick-knee	<i>Burhinus oedicephalus</i>	r, 2	
Great Thick-knee	<i>Burhinus recurvirostris</i>	r, 3	
<b>Charadriidae</b>			
Black-winged Stilt	<i>Himantopus himantopus</i>	m, 4	
Pied Avocet	<i>Recurvirostra avosetta</i>	m, 4	
Pacific Golden Plover	<i>Pluvialis fulva</i>	m, 3	
Grey Plover	<i>Pluvialis squatarola</i>	m, 3	
Little Ringed Plover	<i>Charadrius dubius</i>	br, 1	
Kentish Plover	<i>Charadrius alexandrinus</i>	w, 2	
Lesser Sand Plover	<i>Charadrius mongolus</i>	m, 4	
Greater Sand Plover	<i>Charadrius leschenaultii</i>	m, 5	
Northern Lapwing	<i>Vanellus vanellus</i>	w, 3	<input type="checkbox"/>
Yellow-wattled Lapwing	<i>Vanellus malarbaricus</i>	r?, w, 3	<input type="checkbox"/>
River Lapwing	<i>Vanellus duvaucelii</i>	br, 3	<input type="checkbox"/>
Grey-headed Lapwing	<i>Vanellus cinereus</i>	w, 3	<input type="checkbox"/>
Red-wattled Lapwing	<i>Vanellus indicus</i>	br, 1	<input type="checkbox"/>
<b>Glareolidae</b>			
Indian Courser	<i>Cursorius coromandelicus</i>	br, 4	<input type="checkbox"/>
Oriental Pratincole	<i>Glareola maldivarum</i>	s, 4	<input type="checkbox"/>
Small Pratincole	<i>Glareola lactea</i>	br, 2	<input type="checkbox"/>
<b>Laridae</b>			
*Indian Skimmer	* <i>Rynchops albicollis</i>	s, 4	<input type="checkbox"/>
Mew Gull	<i>Larus canus</i>	m, 5	<input type="checkbox"/>
Yellow-legged Gull	<i>Larus chachinnans</i>	m, 3	<input type="checkbox"/>
Heuglin's Gull	<i>Larus heuglini</i>	m, 5	<input type="checkbox"/>
Pallas's Gull	<i>Larus ichthyaetus</i>	w, 2	<input type="checkbox"/>
Brown-headed Gull	<i>Larus brunnicephalus</i>	w, 3	<input type="checkbox"/>

Black-headed Gull	<i>Larus ridibundus</i>	w, 3	
Slender-billed Gull	<i>Larus genei</i>	w, 4	
Gull-billed Tern	<i>Gelochelidon nilotica</i>	w, 4	
Caspian Tern	<i>Sterna caspia</i>	w, 4	
River Tern	<i>Sterna aurantia</i>	br, 3	
Common Tern	<i>Sterna hirundo</i>	m, 5	
Little Tern	<i>Sterna albifrons</i>	s, 2	
Black-bellied Tern	<i>Sterna acuticauda</i>	br, 2	
Whiskered Tern	<i>Chidonias hybridus</i>	m, 3	
White-winged Tern	<i>Chidonias leucopterus</i>	m, 4	
<b>Accipitridae</b>			
Osprey	<i>Pandion haliaetus</i>	w, 2	<input type="checkbox"/>
Black Baza	<i>Aviceda leuphotes</i>	s, 4	<input type="checkbox"/>
Oriental Honey-buzzard	<i>Pernis ptilorhyncus</i>	r, 2	<input type="checkbox"/>
Black-shouldered Kite	<i>Elanus caeruleus</i>	r, 2	<input type="checkbox"/>
Black Kite	<i>Milvus migrans</i>	r, 3	<input type="checkbox"/>
Brahminy Kite	<i>Haliastur indus</i>	w, 4	<input type="checkbox"/>
*Pallas's Fish Eagle	* <i>Haliaeetus leucoryphus</i>	w, 3	<input type="checkbox"/>
White-tailed Eagle	<i>Haliaeetus albicilla</i>	w, 3	<input type="checkbox"/>
Grey-headed Fish Eagle	<i>Ichthyophaga ichthyaetus</i>	r?, 5	<input type="checkbox"/>
Egyptian Vulture	<i>Neophron percnopterus</i>	r, 4	<input type="checkbox"/>
*White-rumped Vulture	* <i>Gyps bengalensis</i>	br?, 4	<input type="checkbox"/>
*Slender-billed Vulture	* <i>Gyps tenuirostris</i>	r?, 4	<input type="checkbox"/>
Himalayan Griffon	<i>Gyps himalayensis</i>	w, 2	<input type="checkbox"/>
Eurasian Griffon	<i>Gyps fulvus</i>	w, 4	<input type="checkbox"/>
Cinereous Vulture	<i>Aegypius monachus</i>	w, 3	<input type="checkbox"/>
Red-headed Vulture	<i>Sarcogyps calvus</i>	w, 4	<input type="checkbox"/>
Short-toed Snake Eagle	<i>Circaetus gallicus</i>	w, 3	<input type="checkbox"/>
Crested Serpent Eagle	<i>Spilornis cheela</i>	r, 2	<input type="checkbox"/>
Curasian Marsh Harrier	<i>Circus aeruginosus</i>	w, 2	<input type="checkbox"/>
Hen Harrier	<i>Circus cyaneus</i>	w, 2	<input type="checkbox"/>

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Pallid Harrier	<i>Circus macrourus</i>	w, 4	
Pied Harrier	<i>Circus melanoleucos</i>	w, 1	
Montagu's Harrier	<i>Circus pygargus</i>	w, 4	
Crested Goshawk	<i>Accipiter trivirgatus</i>	w?, 3	
Shikra	<i>Accipiter badius</i>	br, 1	<input type="checkbox"/>
Besra	<i>Accipiter virgatus</i>	r, 3	<input type="checkbox"/>
Eurasian Sparrowhawk	<i>Accipiter nisus</i>	w, 4	<input type="checkbox"/>
Northern Goshawk	<i>Accipiter gentilis</i>	w, 3	<input type="checkbox"/>
White-eyed Buzzard	<i>Butastur teesa</i>	br, 2	<input type="checkbox"/>
Common Buzzard	<i>Buteo buteo</i>	w, 2	<input type="checkbox"/>
Long-legged Buzzard	<i>Buteo rufinus</i>	w, 3	<input type="checkbox"/>
Black Eagle	<i>Ictinaetus malayensis</i>	w, 5	<input type="checkbox"/>
*Indian Spotted Eagle	* <i>Aquila hastata</i>	r, 3	<input type="checkbox"/>
*Greater Spotted Eagle	* <i>Aquila clanga</i>	w, 2	<input type="checkbox"/>
Tawny Eagle	<i>Aquila rapax</i>	r?, 4	<input type="checkbox"/>
Steppe Eagle	<i>Aquila nipalensis</i>	w, 2	<input type="checkbox"/>
*Imperial Eagle	* <i>Aquila heliaca</i>	w, 3	<input type="checkbox"/>
Golden Eagle	<i>Aquila chrysaetos</i>	w, 5	<input type="checkbox"/>
Booted Eagle	<i>Hieraaetus pennatus</i>	w, 3	<input type="checkbox"/>
Rufous-bellied Eagle	<i>Hieraaetus kienerii</i>	m?, 5	<input type="checkbox"/>
Changeable Hawk Eagle	<i>Spizaetus cirrhatius</i>	r, 3	<input type="checkbox"/>
Mountain Hawk Eagle	<i>Spizaetus nipalensis</i>	w, 4	<input type="checkbox"/>
<b>Falconidae</b>			
Collared Falconet	<i>Microhierax caerulescens</i>	r, 4	<input type="checkbox"/>
*Lesser Kestrel	* <i>Falco naumanni</i>	w, 3	<input type="checkbox"/>
Common Kestrel	<i>Falco tinnunculus</i>	w, 1	<input type="checkbox"/>
Red-necked Falcon	<i>Falco chicquera</i>	r, 3	<input type="checkbox"/>
Amur Falcon	<i>Falco amurensis</i>	w, 3	<input type="checkbox"/>
Merlin	<i>Falco columbarius</i>	m, 4	<input type="checkbox"/>
Eurasian Hobby	<i>Falco subbuteo</i>	m, 4	<input type="checkbox"/>
Oriental Hobby	<i>Falco severus</i>	s?, 4	<input type="checkbox"/>

Laggar Falcon	<i>Falco jugger</i>	m, 5	
Peregrine Falcon	<i>Falco peregrinus</i>	w, 3	
<b>Podicipedidae</b>			
Little Grebe	<i>Tachybaptus ruficollis</i>	br, 1	
Great Crested Grebe	<i>Podiceps cristatus</i>	w, 2	
Black-necked Grebe	<i>Podiceps nigricollis</i>	m, 5	
<b>Anhingidae</b>			
Oriental Darter	<i>Anhinga melanogaster</i>	br, 2	<input type="checkbox"/>
<b>Phalacrocoracidae</b>			
Little Cormorant	<i>Phalacrocorax niger</i>	br, 1	<input type="checkbox"/>
Great Cormorant	<i>Phalacrocorax carbo</i>	w, 2	<input type="checkbox"/>
<b>Ardeidae</b>			
Little Egret	<i>Egretta garzetta</i>	br, 1	<input type="checkbox"/>
Grey Heron	<i>Ardea cinerea</i>	br, 2	<input type="checkbox"/>
Purple Heron	<i>Ardea purpurea</i>	br, 2	<input type="checkbox"/>
Great Egret	<i>Casmerodius albus</i>	br, 1	<input type="checkbox"/>
Intermediate Egret	<i>Mesophoyx intermedia</i>	br, 1	<input type="checkbox"/>
Cattle Egret	<i>Bubulcus ibis</i>	br, 1	<input type="checkbox"/>
Indian Pond Heron	<i>Ardeola grayii</i>	br, 1	<input type="checkbox"/>
Little Heron	<i>Butorides striatus</i>	r, 2	<input type="checkbox"/>
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	br, 1	<input type="checkbox"/>
Yellow Bittern	<i>Ixobrychus sinensis</i>	br, 2	<input type="checkbox"/>
Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i>	br, 2	<input type="checkbox"/>
Black Bittern	<i>Dupetor flavicollis</i>	br, 3	<input type="checkbox"/>
Great Bittern	<i>Botaurus stellaris</i>	w, 4	
<b>Phoenicopteridae</b>			
Greater Flamingo	<i>Phoenicopterus ruber</i>	m, 5	<input type="checkbox"/>

<b>Threskiornithidae</b>				
Glossy Ibis	<i>Plegadis falcinellus</i>	m, 5		
Black-headed Ibis	<i>Threskiornis melanocephalus</i>	r, 2		
Black Ibis	<i>Pseudibis papillosa</i>	br, 2		
Eurasian Spoonbill	<i>Platalea leucorodia</i>	w, 3		
<b>Pelecanidae</b>				
Great White Pelican	<i>Pelecanus onocrotalus</i>	m, 4		
*Spot-billed Pelican	<i>*Pelecanus philippensis</i>	m, 4		
<b>Ciconiidae</b>				
Painted Stork	<i>Mycteria leucocephala</i>	s, 4		
Asian Openbill	<i>Anastomus oscitans</i>	br, 2		
Black Stork	<i>Ciconia nigro</i>	b		
Woolly-necked Stork	<i>Ciconia episcopus</i>	r, 3		
White Stork	<i>Ciconia ciconia</i>	m, 5		<input type="checkbox"/>
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	br, 3		<input type="checkbox"/>
*Lesser Adjutant	<i>*Leptoptilos javanicus</i>	br, 3		<input type="checkbox"/>
*Greater Adjutant	<i>*Leptoptilos dubius</i>	s, 4		<input type="checkbox"/>
<b>Gaviidae</b>				
Red-throated Loon	<i>Gavia stellata</i>	m, 5	15	<input type="checkbox"/>
<b>PASSERIFORMES</b>				
<b>Pittidae</b>				
Hooded Pitta	<i>Pitta sordida</i>	s, 5		<input type="checkbox"/>
Indian Pitta	<i>Pitta brachyura</i>	s, 5		<input type="checkbox"/>
<b>Irenidae</b>				
Golden-fronted Leafbird	<i>Chloropsis aurifrons</i>	r?, 4		<input type="checkbox"/>

<b>Laniidae</b>			
Rufous-tailed Shrike	<i>Lanius isabellinus</i>	m, 4	
Brown Shrike	<i>Lanius cristatus</i>	w, 1	
Bay-backed Shrike	<i>Lanius vittatus</i>	m, 4	
Long-tailed Shrike	<i>Lanius schach</i>	br, 1	<input type="checkbox"/>
Grey-backed Shrike	<i>Lanius tephronotus</i>	w, 2	<input type="checkbox"/>
Southern Grey Shrike	<i>Lanius meridionalis</i>	r?, 4	
<b>Corvidae</b>			
Red-billed Blue Magpie	<i>Urocissa erythrorhyncha</i>	r?, 5	
Rufous Treepie	<i>Dendrocitta vagabunda</i>	br, 1	
Grey Treepie	<i>Dendrocitta formosae</i>	w, 4	
House Crow	<i>Corvus splendens</i>	br, 1	
Large-billed Crow	<i>Corvus macrochynchos</i>	br, 1	
Ashy Woodswallow	<i>Artamus fuscus</i>	br, 2	
Eurasian Golden Oriole	<i>Oriolus ariolus</i>	s, br, 2	
Black-naped Oriole	<i>Oriolus chinensis</i>	w, 4	
Slender-billed Oriole	<i>Oriolus tenuirostris</i>	w, 4	
Black-hooded Oriole	<i>Oriolus xanthornus</i>	br, 1	
Maroon Oriole	<i>Oriolus traillii</i>	w, 5	
Large Cuckooshrike	<i>Coracina macei</i>	r, 2	
Black-winged Cuckooshrike	<i>Coracina melaschistos</i>	br, 2	
Black-headed Cuckooshrike	<i>Coracina melanoptera</i>	s, 4	
Rosy Minivet	<i>Pericrocotus roseus</i>	s, 4	
Small Minivet	<i>Pericrocotus connamomeus</i>	r, 4	
Scarlet Minivet	<i>Pericrocotus flammeus</i>	w, 3	
Bar-winged Flycatcher-shrike	<i>Hemipus picatus</i>	r, 3	
White-throated Fantail	<i>Rhipidura albicollis</i>	br, 1	
White-browed Fantail	<i>Rhipidura aureola</i>	r, 3	
Black Drongo	<i>Dicrurus macrocerucus</i>	br, 1	
Ashy Drongo	<i>Dicrurus leucophaeus</i>	s, br, 2	



Rufous-bellied Niltava	<i>Niltava sundara</i>	w, 5	14
Pale-chinned Flycatcher	<i>Cyornis poliogenys</i>	r, 4	
Blue-throated Flycatcher	<i>Cyornis rubeculoides</i>	w, 5	
Pygmy Blue Flycatcher	<i>Muscicapella hodgsoni</i>	w, 5	
Grey-headed Canary Flycatcher	<i>Culicicapa ceylonensis</i>	w, 3	
Siberian Rubythroat	<i>Luscinia calliope</i>	w, 1	
White-tailed Rubythroat	<i>Luscinia pectoralis</i>	w, 4	
Bluethroat	<i>Luscinia svecica</i>	w, 1	
Indian Blue Robin	<i>Luscinia brunnea</i>	m, 5	
White-browed Bush Robin	<i>Tarsiger indicus</i>	m, 5	12
Oriental Magpie Robin	<i>Copsychus saularis</i>	br, 1	
White-rumped Shama	<i>Copsychus malabaricus</i>	br, 3	
Indian Robin	<i>Saxicoloides fulicata</i>	m, 4	
Black Redstart	<i>Phoenicurus ochruros</i>	w, 2	
White-capped Water Redstart	<i>Chaimarrornis leucocephalus</i>	w, 4	
*Hodgson's Bushchat	* <i>Saxicola insignis</i>	w, 4	
Common Stonechat	<i>Saxicola torquata</i>	w, 1	
White-tailed Stonechat	<i>Saxicola leucura</i>	br, 3	
Pied Bushchat	<i>Saxicola caprata</i>	br, 2	
Jerdon's Bushchat	<i>Saxicola jerdoni</i>	s?, 5	
Grey Bushchat	<i>Saxicola ferrea</i>	w, 4	
Desert Wheatear	<i>Oenanthe deserti</i>	m, 5	14
Brown Rock Chat	<i>Cercomela fusca</i>	s, 5	
<b>Sturnidae</b>			
Asian Glossy Starling	<i>Aplonis panayensis</i>	v	11
Spot-winged Starling	<i>Saroglossa spiloptera</i>	w, 4	
Chestnut-tailed Starling	<i>Sturnus malabaricus</i>	br, 1	
Brahminy Starling	<i>Sturnus pagodarum</i>	br, 4	
Purple-backed Starling	<i>Sturnus sturninus</i>	v	7
Rosy Starling	<i>Sturnus roseus</i>	m, 4	

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Common Starling	<i>Sturnus vulgaris</i>	w, 3	
Asian Pied Starling	<i>Sturnus contra</i>	br, 1	
Common Myna	<i>Acridotheres tristis</i>	br, 1	
Bank Myna	<i>Acridotheres ginginianus</i>	br, 3	
Jungle Myna	<i>Acridotheres fuscus</i>	br, 2	
Hill Myna	<i>Gracula religiosa</i>	w, 3	
<b>Sittidae</b>			
Chestnut-bellied Nuthatch	<i>Sitta castanea</i>	r?, 4	
<b>Paridae</b>			
Great Tit	<i>Parus major</i>	br, 2	
<b>Hirundinidae</b>			
Sand Martin	<i>Rioparia riparia</i>	w, 4	
Plain Martin	<i>Riparia paludicola</i>	br, 2	
Barn Swallow	<i>Hirundo rustica</i>	w, 1	
Wire-tailed Swallow	<i>Hirundo smithii</i>	w?, 5	
Red-rumped Swallow	<i>Hirundo daurica</i>	r, 2	
Streak-throated Swallow	<i>Hirundo fluvicola</i>	s, 4	
Asian House Martin	<i>Delichan dasypus</i>	w, 5	7
<b>Regulidae</b>			
Goldcrest	<i>Regulus regulus</i>	v	12
<b>Pycnonotidae</b>			
Black-crested Bulbul	<i>Pycnonotus melanicterus</i>	w, 4	
Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	br, 1	
Himalayan Bulbul	<i>Pycnonotus leucogenys</i>	w, 5	10 □
Red-vented Bulbul	<i>Pycnonotus cafer</i>	br, 1	
Black Bulbul	<i>Hypsipetes leucocephalus</i>	w, 5	12

<b>Cisticolidae</b>				
Zitting Cisticola	<i>Cisticola juncidis</i>	br, 2		<input type="checkbox"/>
Bright-capped Cisticola	<i>Cisticola exilis</i>	br, 4		
Rufous-vented Prinia	<i>Prinia burnesii</i>	br?, 5	2	
Striated Prinia	<i>Prinia criniger</i>	w?, 5		
*Grey-crowned Prinia	* <i>Prinia cinereocapilla</i>	r?, 5		
Grey-breasted Prinia	<i>Prinia hodgsonii</i>	r, 3		
Graceful Prinia	<i>Prinia gracilis</i>	r, 3		
Yellow-bellied Prinia	<i>Prinia flaviventris</i>	br, 2		
Ashy Prinia	<i>Prinia socialis</i>	r?, 4		<input type="checkbox"/>
Plain Prinia	<i>Prinia inornata</i>	br, 2		<input type="checkbox"/>
<b>Zosteropidae</b>				
Oriental White-eye	<i>Zosterops palpebrosus</i>	r, 2		<input type="checkbox"/>
<b>Sylviidae</b>				
Grey-bellied Tesia	<i>Tesia cyaniventer</i>	w, 5	14	<input type="checkbox"/>
Pale-footed Bush Warbler	<i>Cettia pallidipes</i>	w, r?, 4		<input type="checkbox"/>
Chestnut-crowned Bush Warbler	<i>Cettia major</i>	w, 3		<input type="checkbox"/>
Aberrant Bush Warbler	<i>Cettia flavolivacea</i>	w, 3		<input type="checkbox"/>
Grey-sided Bush Warbler	<i>Cettia brunnifrons</i>	w, 3		<input type="checkbox"/>
Spotted Bush Warbler	<i>Bradypterus thoracicus</i>	w, 3		<input type="checkbox"/>
Chinese Bush Warbler	<i>Bradypterus taczanowskii</i>	w?, 5		<input type="checkbox"/>
Lanceolated Warbler	<i>Locustella lanceolata</i>	m, 5		<input type="checkbox"/>
Grasshopper Warbler	<i>Locustella naevia</i>	m, 5		<input type="checkbox"/>
Rusty-rumped Warbler	<i>Locustella certhiola</i>	m, 5	6	<input type="checkbox"/>
Black-browed Reed Warbler	<i>Acrocephalus bistrigiceps</i>	w?, 5		<input type="checkbox"/>
Paddyfield Warbler	<i>Acrocephalus agricola</i>	w, 3		<input type="checkbox"/>
Blunt-winged Warbler	<i>Acrocephalus concinens</i>	w, 3		<input type="checkbox"/>
Blyth's Reed Warbler	<i>Acrocephalus dumetorum</i>	w, 1		<input type="checkbox"/>
Clamorous Reed Warbler	<i>Acrocephalus stentoreus</i>	w, 2		<input type="checkbox"/>
Thick-billed Warbler	<i>Acrocephalus aedon</i>	w, 2		<input type="checkbox"/>

Booted Warbler	<i>Hippolais caligata</i>	w, 4	<input type="checkbox"/>
Common Tailorbird	<i>Orthotomus sutorius</i>	br, 1	<input type="checkbox"/>
Common Chiffchaff	<i>Phylloscopus collybita</i>	w, 2	
Dusky Warbler	<i>Phylloscopus fuscatus</i>	w, 1	
Smoky Warbler	<i>Phylloscopus fulgiventis</i>	w, 2	
Tickell's Leaf Warbler	<i>Phylloscopus affinis</i>	w, 2	
Sulphur-bellied Warbler	<i>Phylloscopus griseolus</i>	m, 4	
Yellow-browed Warbler	<i>Phylloscopus inornatus</i>	w, 5	4
Hume's Warbler	<i>Phylloscopus humei</i>	w, 2	
Greenish Warbler	<i>Phylloscopus trochiloides</i>	w, 1	
Large-billed Leaf Warbler	<i>Phylloscopus magnirostris</i>	m, 4	
Western Crowned Warbler	<i>Phylloscopus occipitalis</i>	m, 4	
Blyth's Leaf Warbler	<i>Phylloscopus reguloides</i>	w, 3	
Yellow-vented Warbler	<i>Phylloscopus cantator</i>	w, 5	
Golden-spectacled Warbler	<i>Seicercus burkii</i>	w, 2	
Striated Grassbird	<i>Megalurus palustris</i>	br, 3	
*Bristled Grassbird	* <i>Chaetornis striatus</i>	s, br, 2	
Abbott's Babbler	<i>Malacocincla abbotti</i>	r?, 5	
Striped Tit Babbler	<i>Macronous gularis</i>	r, 4	
Yellow-eyed Babbler	<i>Chrysomma sinense</i>	r?, 5	5
Striated Babbler	<i>Turdoides earlei</i>	br, 2	
Jungle Babbler	<i>Turdoides striatus</i>	br, 1	
Lesser Whitethroat	<i>Sylvia curruca</i>	m, 4	
Orphean Warbler	<i>Sylvia hortensis</i>	m, 5	
<b>Alaudidae</b>			
Rufous-winged Lark	<i>Mirafra assamica</i>	br, 2	
Ashy-crowned Sparrow Lark	<i>Eremopterix grisea</i>	br, 2	
Greater Short-toed Lark	<i>Calandrella brachydactyla</i>	w, 3	
Hume's Short-toed Lark	<i>Calandrella acutirostris</i>	w, 4	
Sand Lark	<i>Calandrella raytal</i>	br, 1	
Crested Lark	<i>Galerida cristata</i>	r, 3	

Oriental Skylark	<i>Alauda gulgula</i>	r, 3	
<b>Nectariniidae</b>			
Thick-billed Flowerpecker	<i>Dicaeum agile</i>	r, 4	
Pale-billed Flowerpecker	<i>Dicaeum erythrorhynchos</i>	r, 4	
Purple Sunbird	<i>Nectarinia asiatica</i>	br, 2	
<b>Passeridae</b>			
House Sparrow	<i>Passer domesticus</i>	br, 1	<input type="checkbox"/>
Spanish Sparrow	<i>Passer hispaniolensis</i>	m, 4	<input type="checkbox"/>
Russet Sparrow	<i>Passer rutilans</i>	v	6 <input type="checkbox"/>
Eurasian Tree Sparrow	<i>Passer montanus</i>	w, 4	<input type="checkbox"/>
Chestnut-shouldered Petronia	<i>Petronia xanthocollis</i>	r, 3	<input type="checkbox"/>
Forest Wagtail	<i>Dendronanthus indicus</i>	w, 4	<input type="checkbox"/>
White Wagtail	<i>Motacilla alba</i>	w, 1	<input type="checkbox"/>
White-browed Wagtail	<i>Motacilla maderaspatensis</i>	br, 2	<input type="checkbox"/>
Citrine Wagtail	<i>Motacilla citreola</i>	w, 1	<input type="checkbox"/>
Yellow Wagtail	<i>Motacilla flava</i>	w, 2	<input type="checkbox"/>
Grey Wagtail	<i>Motacilla cinerea</i>	w, 3	<input type="checkbox"/>
Richard's Pipit	<i>Anthus richardi</i>	w, 2	<input type="checkbox"/>
Paddyfield Pipit	<i>Anthus rufulus</i>	br, 1	<input type="checkbox"/>
Tawny Pipit	<i>Anthus campestris</i>	w, 4	<input type="checkbox"/>
Blyth's Pipit	<i>Anthus godlewskii</i>	w, 4	<input type="checkbox"/>
Long-billed Pipit	<i>Anthus similis</i>	m, 5	<input type="checkbox"/>
Tree Pipit	<i>Anthus trivialis</i>	w, 4	<input type="checkbox"/>
Olive-backed Pipit	<i>Anthus hodgsoni</i>	w, 2	<input type="checkbox"/>
Red-throated Pipit	<i>Anthus cervinus</i>	w, 3	<input type="checkbox"/>
Rosy Pipit	<i>Anthus roseatus</i>	w, 2	<input type="checkbox"/>
Water Pipit	<i>Anthus spinoletta</i>	m, 3	<input type="checkbox"/>
Buff-bellied Pipit	<i>Anthus rubescens</i>	m, 3	<input type="checkbox"/>
Black-breasted Weaver	<i>Ploceus benghalensis</i>	br, 3	<input type="checkbox"/>
Streaked Weaver	<i>Ploceus manyar</i>	r, 4	<input type="checkbox"/>

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Baya Weaver	<i>Ploceus philippinus</i>	br, 2	
*Finn's Weaver	* <i>Ploceus megarhynchus</i>	s?, 5	9
Red Avadavat	<i>Amandava amandava</i>	br, 2	
Indian Silverbill	<i>Lonchura malabarica</i>	r, 3	
White-rumped Munia	<i>Lonchura striata</i>	r, 4	<input type="checkbox"/>
Scaly-breasted Munia	<i>Lonchura punctulata</i>	br, 1	<input type="checkbox"/>
Black-headed Munia	<i>Lonchura malacca</i>	br, 3	<input type="checkbox"/>
<b>Fringillidae</b>			
Common Rosefinch	<i>Carpodacus erythrinus</i>	w, 3	<input type="checkbox"/>
Crested Bunting	<i>Melophus lathami</i>	w, 2	<input type="checkbox"/>
Chestnut-eared Bunting	<i>Emberiza fucata</i>	w, 4	<input type="checkbox"/>
Little Bunting	<i>Emberiza pusilla</i>	w, 4	<input type="checkbox"/>
Yellow-breasted Bunting	<i>Emberiza aureola</i>	w, 1	<input type="checkbox"/>
Black-headed Bunting	<i>Emberiza melanocephala</i>	w, 2	<input type="checkbox"/>
Red-headed Bunting	<i>Emberiza bruniceps</i>	w, 5	7 <input type="checkbox"/>
Black-faced Bunting	<i>Emberiza spodocephala</i>	w, 2	<input type="checkbox"/>
Pallas's Bunting	<i>Emberiza pallasi</i>	w, 5	<input type="checkbox"/>

Key to the codes:

globally threatened	*	resident, seen all the year round	r
common, >75% chance	1	summer visitor	s
fairly common, >50% chance	2	winter visitor	w
occasional, >25% chance	3	passage migrant	m
rare, 5% chance	4	vagrant	v
less than 5 seconds at Koshi	5		
breeding confirmed (resident if no other status is given)	br		

Source: Hem Sagar Baral, *Birds of Koshi (BCN)*, 2005.