

**DIVERSITY AND CONSERVATION STATUS OF WETLAND BIRDS  
IN JAGADISHPUR RESERVOIR RAMSAR SITE, KAPILVASTU,  
NEPAL**



Entry 30  
M.Sc. Zoo Dept. Ecology...  
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Batch: 2073/2074

A thesis submitted in partial fulfillment of the requirement for the award of the degree of  
Master of Science in Zoology with special paper ecology and environment.

**Submitted to**


Central Department of Zoology  
Institute of Science and Technology  
Tribhuvan University  
Kirtipur, Kathmandu  
Nepal

September, 2019

## DECLARATION

I hereby declare that the work presented in this thesis has been done by myself, and has not been submitted elsewhere for the award of any degree. All sources of information have been specifically acknowledged by reference to the author(s) or institution(s).

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**RECOMMENDATION**

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### LETTER OF APPROVAL

On the recommendation of supervisor Dr. Bishnu Prasad Bhattra this thesis submitted by Usha Poudel entitled **“Diversity and Conservation status of wetland birds in Jagadishpur Reservoir Ramsar site Kapilvastu Nepal”** is approved for the examination in partial fulfillment of the requirements for master’s Degree of science of Science in Zoology with Special Paper Ecology and Environment.

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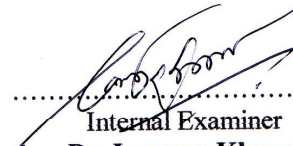
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## ACKNOWLEDGEMENTS

I would like to thank my supervisor Dr. Bishnu Prasad Bhattraï asst. professor of Central Department of Zoology, T.U for his constant momentum which made me able to bring the thesis in this shape. I am thankful to our honorable Head of Department Prof. Dr. Tej Bahadur Thapa, Central Department of Zoology, and T.U. for his kind cooperation and support.

I am grateful to all faculties and staff of Central Department of Zoology, T.U Kirtipur. Especially for their inspiration and support throughout the study period.

I am thankful to Department of Forest and Jagadishpur reservoir management community for granting research permission and necessary help during data collection.

I would like to extend deepest gratitude to my respected parents for their Support and inspiration in my entire whole academic career. Special thanks to my brother Ghanshyam Poudel and Shovakhar Poudel for their continuous support during my work.

Last but not the least I would like to acknowledge, our senior brother Aditya pal, my beloved Mahesh Ghimire, Indian friend Vikram Tiwari and my college friends Prabha Shrestha, Shreekrishna Lamichanne, Deepa Poon, Basant Gyawali, Suman Sapkota for their kind support throughout my dissertation work and all those persons who helped me directly or indirectly.

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## LIST OF ABBREVIATIONS

BCN	Bird Conservation Nepal
BES	Bird Education Society
CDZ	Central Department of Zoology
CITES	Conservation on International Trade of Endangered species of Flora and Fauna
df	Degree of freedom
GPS	Global Positioning System
IUCN	World Conservation Union
JRRS	Jagadishpur Reservoir Ramsar site
TUCL	Tribhuvan University Central Library

## ABSTRACT

This study was carried out to understand the diversity and conservation status of birds in Jagadishpur Reservoir Ramsar site and its associated areas. In order to accomplish these objectives entire habitats were categorized into three types as wetland, forest and urban areas. Bird survey was conducted in two different seasons of a single year from January to July 2019 by using point count method. There were two transects were set around the lake in which one was plotted in the immediate boundary of the lake and another was plotted 500m far from first transect that covers forest, cropland and settlement areas. Species richness and the abundance of the birds were calculated by using PAST (V.3.18), factor for species diversity and abundance factor was calculated by using R (v.3.1.6) software. Altogether 79 species of birds belonging 14 Orders and 33 Families recorded during study period. Out of 79 species, 32 winter migrant, 2 summer migrant, 2 passage migrant and 43 residential birds were recorded in the study period. Order Passeriformes represent the highest species composition (36.71%) followed by order Ciconiiformes and Anseriformes (15.18%) as compared to other. There was significant difference observed in terms of species richness ( $t = 1.5$ ,  $df = 54$ ,  $p = 0.137$ ) in both seasons. But species abundance was found to vary significantly ( $t = 2.21$ ,  $df = 54$ ,  $p = 0.031$ ). The study area supports higher abundance in winter as compared to summer season. The species richness was found higher in forest/urban area followed by wetland and forest/wetland ecotone. Altogether 73 species were least concern, 3 species vulnerable, 3 near threatened species were found to be listed in IUCN Red List. Presence of livestock pressure and human disturbance caused a negative effect on bird species richness and abundance while full of water and shallow water caused a significant relation with species richness and abundance. Illegal hunting, excessive use of pesticides and fertilizers, grazing, cattle bathing, washing clothes, developmental activities, invasive species, urbanization, over harvesting of wetland resources only aggravate deteriorating ecological condition of Jagadishpur Reservoir.

# 1. INTRODUCTION

## 1.1 General Background

The Ramsar convention on wetland of international importance (Ramsar 1971) has defined wetlands in a broader sense. The word wetland encompasses a multiplicity of environments; inland marshes, wet meadows, mudflats ponds, bogs, bottomlands, wooded swamps, fens, alpine ponds and lakes. Wetlands in Nepali called *Simsar*. According to IUCN-Nepal (1996), 'Sim' is a derivative of the Persian word 'Sih', which means low-grade land not suitable for cultivation and 'Sar' is a Sanskrit word meaning water. Thus, *Simsar* can be interpreted as land with water.

Wetlands are dynamic bionetworks that are ideal for migratory waterfowl and other vertebrate fauna (Acharya 2002). Nepal's wetland supports a wide spectrum of nationally and globally important biodiversity. Wetlands provide environmental goods and services that are vital for livelihoods. Nepal has already designated nine wetlands as Ramsar sites of international importance, including the Jagdishpur Reservoir (Sah and Heinen 2001).

Reservoirs have been constructed in many parts of the world in naturally lake less regions to increase availability of water resources. In Nepal, man-made reservoirs and ponds are mainly for hydropower and irrigation purposes. Jagdishpur Reservoir also known as Sagar Taal is one of the most important wetlands of Nepal designated as Ramsar site in 2003 and is also highlighted in the Directory of Asian Wetlands chiefly because of their support for threatened and endangered species of birds and mammals. The reservoir was constructed in the early 1970s over Jakhira Lake and agricultural land for irrigation and is fed by the Banganga River in the Churia hills catchments area. It is surrounded by cultivated land and a few smaller lakes (ICIMOD 2007). The reservoir provides important resident, wintering and stopover habitats for waders, other water birds, and small passerines. Noteworthy are the grebes, cormorants, herons and egrets (terns and gulls, birds of prey, rails, coot and waterhens, Jacanas, as well as cranes and kingfishers. The wetland supports a small population of the globally threatened Smooth-coated Otter *Lutogale perspicillata*. Like other water bodies, the reservoir has also received immense encroachment from human activities. Frequent visit for grass cutting and intensive commercial fish cultivations are being major threats for good ecological quality and sustainability of the reservoir. Wetland birds are under considerable pressure from siltation/sedimentation, eutrophication, invasion of alien species, industrial pollution and

litter disposal, intensification of agriculture, land encroachment and deforestation, over-fishing and human disturbances in the river basins (Acharya and Rajbhandari 2012).

### **1.1.1. Wetlands Birds in Nepal**

Nepal, the Himalayan country is rich in biodiversity due to its unique geographical location at the transition zone between two bio-geographic realms i.e., Palaearctic to the North and oriental (Indo-Malayan sub- realm) to the South. Nepal is also renowned for its high diversity of bird species. The country provides home for 887 species of birds due to its landscape and topographic heterogeneity. Out of 887 species recorded so far in Nepal 40 species are listed in IUCN Red list of globally threatened birds, 35 globally near threatened species and 167 are nationally threatened species (BCN and DNPWC 2018). Of these, nearly 200 species of birds are considered to be heavily dependent on wetland territories (Bhandari 1998) in which about 187 are known to be dependent on the wetlands of Terai (Thapa 2006). Among these wetland birds, 12 species are globally threatened which use the wetland as primary and secondary habitat and 44 species are threatened on a national level (BCN 2011, Baral 2008). Among the threatened birds of Nepal 25% wetland birds are the most threatened group in Nepal because of habitat loss and damage, water pollution, fish poisoning, hunting and trapping, food shortages due to over fishing and disturbance and destruction of nesting and feeding sites (Inskipp et al. 2016).

### **1.1.2 Bird Migration**

Seasonal changes in climate are an additional prominent characteristic of ecosystems that can influence the bird species richness in different place. Nepal is being transitionally lying between two realms; many bird species visit Nepal seasonally from different parts of the world such as India, China, Malaysia, Russia and Indonesia. They also migrate from one place to another inside the country to escape from scorching heat and chilling cold. These birds again return back to their original habitat when the climate will be favorable. Most of the migrating birds are found to be wetland or water birds (Shah 2000). Nepal attracts about 150 species of winter visitor birds originating mainly from northern and central Asia, some of which are also passage migrant. These include ducks, waders, birds of prey, gulls, terns, thrushes, pipits, bush warblers, *Phylloscopus warblers*, *Acrocephalus*, and wagtail and about 62 species are summer visitor or partial migrants

including species of cuckoos, swifts, bee-eaters, *Phylloscopus warblers*, flycatchers and drongos (Subedi 2015).

## **1.2 Objectives**

The main objective of this study was to explore the diversity and conservation status of wetland birds in Jagadishpur Reservoir Ramsar Site, Kapilvastu, Nepal.

### **The specific objectives were:**

- To explore the seasonal variation in diversity of wetland birds in the study area.
- To investigate factors determining diversity and abundance of birds.
- To explore the conservation status and challenges of birds in Jagadishpur reservoir Ramsar site.

## **1.3. Justification of the Study**

For a long time Jagadishpur reservoir has been an enriched habitat for many species of wildlife including resident and migratory birds. There were various formal and informal survey of birds conducted in this area. Student from different school and college visited this site with local bird guide for bird watching and conservation of lake. Bird conservation of Nepal (BCN) is the main institution that has been organized bird watching activities. DNPWC and IUCN (2003) reported a total of 37 wetland-dependent bird species from Jagdishpur lake in which 5 globally threatened species have been recorded including the Lesser Adjutant *Leptoptilos javanicus* (Baral and Inskipp 2005). And also Baral (2011) reported 118 bird species from Jagadishpur Reservoir Area (with in 500m of the dam). Of the 118 bird species reported in that area, 17 are nationally threatened, 15 are included in IUCN Red list while 10 are included in the CITES appendices (BCN 2011, Baral 2008). In this way researchers have studied on several aspects in this lake.

But the process of sedimentation, eutrophication, use of chemical fertilizers, low water level and human infringement are responsible for the change in physiochemical parameters of lakes which makes adverse habitat for the living species like fish, water birds, flora and fauna. Now this area has been established as a tourism purpose, picnic spot and other recreation activities that have created lots of problem on habitat, breeding and feeding activities of bird. Firewood collection, grazing, construction of temple inside the pond, Regular boating are the prominent human induced disturbance of this area. So,

this study supports for better management of Jagadishpur reservoir and explores problem of changing environment. Eventually helps to conserve bio-diversity of Lakes as a whole.

## 2. LITERATURE REVIEW

### 2.1 Diversity of Wetland Birds

In comparison to small mammals, invertebrates and herpetofauna, study and conservation program of birds is very high (BCN 2011). Seasonal changes often correspond to different lifestyle requirements and migratory strategies of birds (Katuwal 2013). Wiens (1989), Sharma (2004), Ghimire (2009) found that population studies have been traditionally used to monitor long term changes in avian population and to assess both habitat quality and the responses of birds to both natural and human caused environmental changes. Katuwal (2013) and Chapagain (2014) studied on relationship between species richness and factors influencing the distribution of birds in different parts of Nepal. (Basnet et al. 2006) recorded a total of 110 species of bird at Raja Rani Community forest Bhogteny, Morang. Ghimire (2009) reported the highest bird richness in Sal forest and the lowest in mix forest in a study on seasonal diversity and habitat utilization of birds in the BCF of Chitwan.

Thakuri (2007) also concluded that majority of the birds were found within forested areas than in riverine, agricultural land, marshes, urban and human settlement areas while studying in Satikhel and Dallu community forests of Seshnarayan VDC on Seasonal Diversity and Community Composition of Birds. Aryal (2013) studied on avian diversity along elevation and land use gradient in Ghunsa Valley of Kanchenjunga Conservation Area and concluded that the species richness was higher in natural forest followed by exploited forest, cultivated land and meadows. Katuwal (2013) studied the species richness of birds in different habitats of Manaslu Conservation Area and concluded that there was a significant difference in species richness of birds among habitat types.

A total of 887 bird species have been recorded in Nepal (BCN and DNPWC 2018). Kafle *et al.* (2008) studied on status and threats to water birds of Rupa Lake, Pokhara, Nepal and recorded a total of 36 species of water birds in the lake which represents about 19 percent of the total 193 wetland-dependent birds found in Nepal. Baral (2008) recorded a total of 108 bird species was recorded from the Jagdishpur Reservoir area nearly half being either winter visitors or passage migrants. (Gautam and Kafle 2018) recorded a total of 43 species of water birds in the Phewa Lake, which represents about 22% of the 193 wetland-dependent birds found in Nepal.

Patterns of bird diversity are driven by fundamental biogeographic factors, with tropical and sub-tropical countries supporting the highest species richness of bird (MacArthur and MacArthur 1961). By understanding the factors that influence the distribution of organisms, it becomes possible to use conservation tools necessary for the survival of endangered species of the geographical areas (Guisan and Zimmermann 2000). (Conner 1981, Hutto 1985, Morrison et al. 1985, Terborgh 1989, Block 1991) found that seasonal differences in habitat can range from shifts in tree-species used by resident species to the use of drastically different areas by migrant birds (Conner 1981, Hutto 1985, Morrison et al. 1985, Terborgh 1989, Block 1991). A total of 132 species of birds belonging to 34 families and 11 orders were recorded in the Lakkavalli range forest, Bhadra Wildlife Sanctuary, Western Ghat, Karnataka, India (Harisha and Hosetti 2009). The climatic condition varies to the species diversity and richness of birds. Seasonal differences in habitat can range from shifts in tree-species used by resident species to the use of drastically different areas by migrant birds (Conner 1981, Hutto 1985, Morrison et al. 1985, Terborgh 1989, Block 1991). Many studies related to the species richness of birds with different habitats have been conducted in other countries too. Avian richness peaked at moderately disturbed sites (Robert 1996, Chettri et al. 2005). In contrast, species richness was relatively higher for natural forest than for other land use types (Palomino and Carrascal 2006, Waltert et al. 2004).

## **2.2 Seasonal Variation of Birds**

Malla (2006) recorded higher species richness in winter and spring than other seasons in Nagarjun Forest, Kathmandu. Furthermore, Rimal (2006) found the highest number of species in spring and lowest in monsoon in Shivapuri National Park. Poudel (2005) observed higher number and diversity of birds in Kirtipur during winter season due to the suitable climatic condition in winter. Ghimire (2009) reported higher richness in spring than in autumn in a study done in Barandabhar corridor forest of Chitwan National Park. (Basnet et al. 2006) recorded a total of 110 species of bird at Raja Rani Community forest Bhogteny, Morang. Ghimire (2009) reported the highest bird richness in Sal forest and the lowest in mix forest in a study on seasonal diversity and habitat utilization of birds in the BCF of Chitwan. Thakuri (2007) also concluded that majority of the birds were found within forested areas than in riverine, agricultural land, marshes, urban and human settlement areas while studying in Satikhel and Dallu community forests of Seshnarayan VDC on Seasonal Diversity and Community Composition of Birds. Aryal (2013) studied

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Levey (1988) concluded that bird richness and abundance was maximum in rainy season in Costa Rica. A research on coastal woodlands in east-central Argentina shows higher density of bird recorded during spring and lower one during autumn, but species richness did not show changes during the annual cycle (Cueto and De Casenave 2000). Shah (2000) did the study work in Taudaha Lake entitled "Status and diversity of migrated birds in Taudaa Lake" The study was of one-year duration and concerned to the migratory birds. However, winter migratory birds were noted more than summer one. The objective of that dissertation was to explore migratory bird species, to state historical background of that area and to explore the scope of tourism for Taudaha. (Herzog et al. 2003) also found minimum abundance of birds in winter season in a study in central Bolivia. Murgui (2007) studied on effects of seasonality on bird species in urban parks of Valencia, Spain. He concluded that in the breeding period i.e., in spring and summer bird richness became higher than in the winter season. Raman (2001) studied the community of birds in different altitudes and the impact of fragmentation and plantations on rainforest birds in the Western Ghats. The relationships between habitat and diversity in avian communities in Panama, Illinois, Texas and Bahamas were examined by (Karr 1968, Karr and Roth 1971). Karr (1976) reported on seasonality, resource availability and community diversity in the tropical bird communities in Panama during the period 1968 and 1969. The species richness in an oak woodland avifauna was studied by (Landres and MacMahon 1980). (Wiens and Rotenberry 1981) studied the relationship between the distribution of birds, their abundance and habitat characteristics at a regional scale, using surveys conducted over three consecutive years in the shrub steppe of the northwestern Great Basin of North America. Ambuel and Temple (1983) studied the avian biogeography and habitat selection in forests of southern Wisconsin.

### **2.3. Conservation Status and Challenges**

Merriman (2017) studied on Rapid ecosystem service assessment of the impact of Koshi Tappu Wildlife Reserve on wetland benefits to local Communities and concluded that many wetlands are threatened by land-use conversion, but creating protected areas to conserve them can benefit both biodiversity and people. KMTNC Tiger/Rhino Conservation project (2005) has completed their research and monitoring on the topic "Status of the birds in Barandabar corridor Forest (BCF). Hostetler et al. (2005) studied post production effects of an urban development on migrating, resident and wintering birds. The results propose that remnant forest patch and adjacent marsh continued to attract migrating and resident species even after the development.

Study of Shrestha (2011) found that Community participation plays vital role in the development of capacity for the management and utilization of their resources in sustainable way. Wetland resources are widely used by the local communities for their sustenance and economic well-being. This research found some ideas about community participation and role of local people in wetland conservation and management, reason for conservation of wetland sites, wetland policy based on local participation, and approaches for ensuring participation in wetland conservation programs. KC et al. (2012) explores that wetlands are considered to be one of the most threatened of all major natural ecosystems and are claimed to deserve a high priority for conservation and sustainable use.

The conservation of wetlands is important because it provides a multitude of benefits i.e. ecological, economic, aesthetic, religious and socio-cultural benefits. This paper attempts to gather information about significance and classification of wetlands on the one hand and current status of lowland wetlands of Nepal and their threats on the other. Wetland dependent communities account for more than 17 % of the country's population out of which more than 90 % are of Terai origin. As a result, a close interaction takes place between local community and biological resources of the wetlands. It with increase in population causes a number of threats to wetland ecosystem and associated biodiversity. These threats can be broadly categorized as habitat destruction and degradation, loss of ecosystem integrity, and depletion of species abundance and diversity.

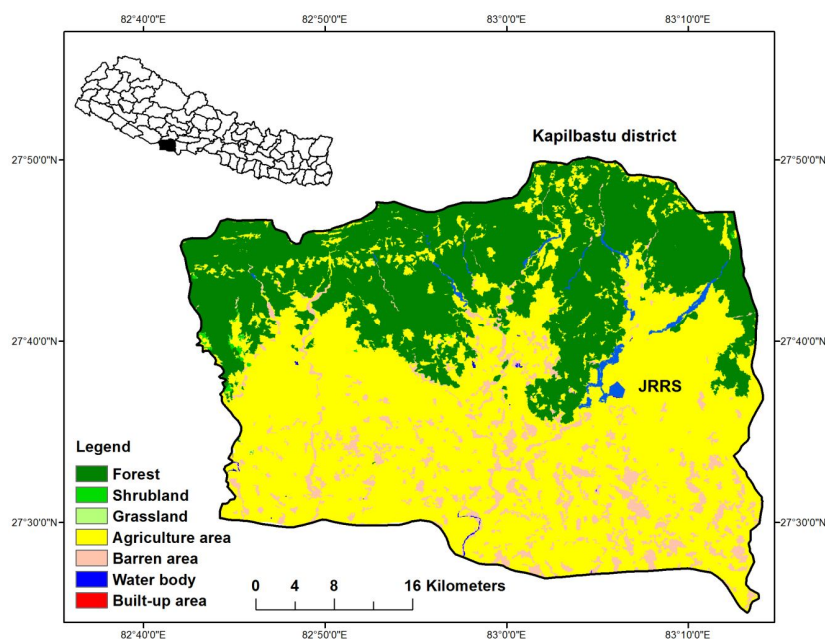
The importance of wetlands and their threats has been recognized in Nepal and different legislations have been formulated regarding Nepal Wetland Policy 2069 recently. But the

policies itself cannot manage the wetlands without its appropriate implementation. Current status of wetlands is decreasing which shows a greater need of review and strong implementation of the existing policies.

### 3. MATERIALS AND METHODS

#### 3.1 Study Area

The study was done at Jagdishpur reservoir which lies in the Indo-Malayan biogeographical realm of the Terai physiographic zone and is the extension of the Gangetic plain in the outer foothills of the Churia or Siwaliks in the Central Himalaya. The site lies 10 km north of the City Taulihawa in Kapilvastu District, Province 5 Lumbini Zone of Central Nepal as shown in Figure 1. It lies at 27° 37' 00" N latitude and 83 ° 06' 00" E longitude which covers 225 ha. The reservoir lies at an elevation of 197m and the area is characterized by its low elevation (i.e., 197m) and a tropical monsoon climate with hot rainy summers and cool, dry winters (Baral and Inskipp 2005). It was created over the location of Jakhira Lake and surrounding agricultural land in the early 1970s. The water in the reservoir is fed from the nearby Banganga River that has a catchment area in the Churia Hills. Incoming suspended silts and nutrients are deposited in the reservoir mouth. It was created in 2035 BS for irrigation purpose and declared as Ramsar site in 2003. It is the largest man made wetland of Nepal and important bird areas that have great biological and environment importance. The wetland is surrounded by cultivated land and few smaller lakes as a buffer zone for bird movement.



**Figure 1: Location map of the study area: Jagdishpur Reservoir Ramsar Site and associated areas (adapted from JRMF 2015).**

The reservoir bank is planted with Sissoo (*Dalbergia sissoo*) among them sal forest (*Shorea robusta*) is the dominant forest, followed by Tropical Riverine forest Khair (*Acacia catechu*) and simal (*Bombax ceiba*). Apart from the bank of the reservoir and natural forests, there are private Mango orchard agricultural fields which also provide suitable habitat for birds.

## **3.2 Biodiversity**

### **3.2.1. Flora**

A total of 68 plants, belonging to 35 families and 54 genera, were recorded from JRSS wetland. Out of these species, 56 are herbaceous, 7 are shrubs and 5 are trees (IUCN 2015). Kafle and Savillo (2009) reported that the wetlands are extensively covered by floating leaved species, mainly lotus (*Nelumbo nucifera*), religiously important and threatened species, are wild Rice (*Hygrorhiza aristata*).

### **3.2.2 Fauna**

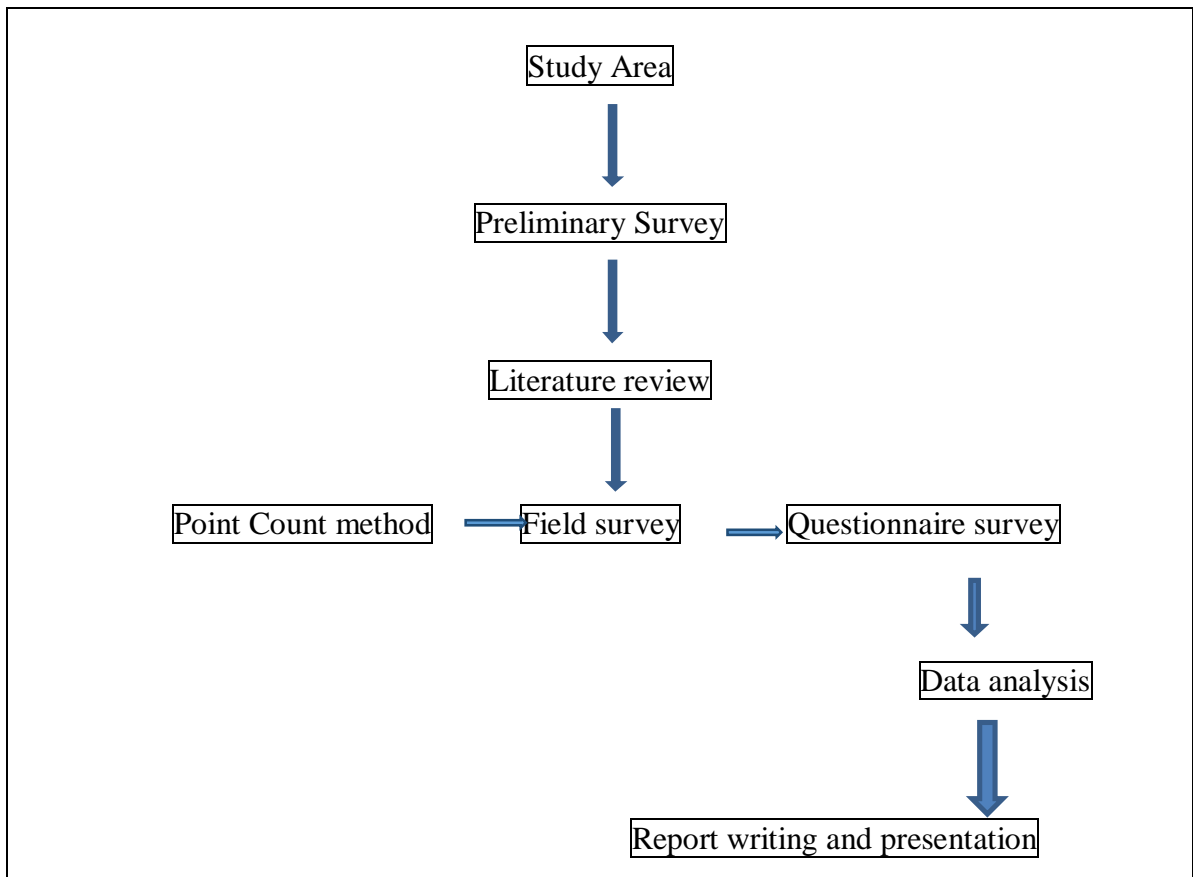
A total of 32 species of mammals were reported in that area includes Indian hare (*Lepus nigricollis*), Indian Crested Porcupine (*Hystrix indica*), Fishing cat (*Prionailurus viverrinus*) and Jungle Cat (*Felis chaus*). The area also supports 168 species of birds from 42 families and 52 species of herpetofauna and 43 species of fish were recorded in the JRSS (IUCN 2015).

### **3.2.3 Culture and Ethnicity**

The study area is surrounded by villages inhabited by Brahman and Tharu along with other ethnic group such as Cheetri, Magar, Damai, Gurung, Muslims and Madeshi. Villagers mostly depend on the wetland for irrigation followed by tourism, fishery and grazing. There is no specific wetland dependent community in the JRSS however poor and marginalized community depends on the wetland products. Agriculture is the main occupation and primary source of income. Rice (*Oryza sativa*), Wheat (*Triticum* spp.), Corn (*Zea mays*) are major crops in the area whereas mustard (*Brussica campestris*), potato (*Solanum tuberosum*) are grown as minor crops livestock is the major component of the agricultural system (IUCN 2015).

### 3.3 Data Collection Method

#### 3.3.1 Study design



**Figure 2: Flow chart showing study design**

#### 3.3.2 Preliminary Survey

Preliminary survey was carried out around the Jagadishpur Reservoir in January 2019. During survey, the sketch of the reservoir including various features such as lake condition and structure, vegetation, use of wetland, solid waste disposal, washing and bathing were reported. Observation of area and interaction with local people were the major activities of during this survey.

### **3.4 Research Design**

Bird observation was done at three different habitats such as the wetland, forest and urban areas. Two circular transect were set around the lake in which one was plotted in the immediate boundary of the reservoir and another was plotted 500m far from first transect that covers forest, cropland and settlement areas. Observation of birds was carried out by using point count method where at least 200 m intervals were maintained in each point. All together 55 points were established for the observation of birds and their habit condition including threats.

### **3.5 Bird Survey**

Bird surveys were conducted in two different seasons of a single year from January to July 2019. For the survey point count method was used.

Point count method where at least 200m intervals were maintained. At each point birds recorded within 500m far from the fixed point. Point count method between two successive points are widely used for surveying birds in different land use types (Hutto et al. 1986, Schulze et al. 2004, Waltert et al. 2004, Waltert et al. 2005, Fardila and Sjarjadi 2012) and to study the species-habitat relationships (Alldredge et al. 2007). Birds were observed from 7am to 11 am in the morning and 3pm to 6 pm in the evening. In each point, 15 minute was spent for the observation and counted the species. A pair of binocular (Bushnell 8×40) and Canon Camera (50x) was used for the effective survey of birds. A field guide book Birds of Nepal (Grimmett et al. 2016) was used for the identification of birds and GPS (e-trex 10) used to mark the location of the point. Photograph of unidentified species were identified with the help of bird expert in Kathmandu.

Group discussion was made with local people, Jagadishpur Reservoir management multi stakeholder forum to gather information about status and conservation threat of birds at that area.

### **3.6 People's Perception**

A structure questionnaire (Annex II) was prepared basically focusing on the information about bird's distribution, Habitat utilization pattern, major threats and public concept towards migratory birds and their conservation in the study area. A questionnaire survey with 100 persons was conducted of JRRS area.

### 3.6 Data Analysis

The normality test was performed before calculating the diversity indices to identify whether the data were normally distributed or not. The computer based Microsoft Excel 2010 was used to represent the collected data in tabulated form. The various indices of species diversity and dominance indices such as Shannon's index and Simpson index were calculated in PAST V 3.18 (Hammer et al. 2001), factor for species diversity and abundance factor was calculated by using R (v.3.1.6) software. Two sample t-tests were used to calculate the seasonal variation of species richness and abundance between the two seasons.

Shannon's index: The Shannon diversity index ( $H$ ) is commonly used to characterize species diversity in a community (Shannon 1948). Shannon Index

Which is calculated as:  $H' = -\sum (n_i / N) \log_e (n_i / N)$

Or, if  $P_i = n_i / N$

$H' = -\sum P_i \log_e P_i$

Where,

$n_i$  = Importance values for each species.

$N$  = Total Importance value.

#### Evenness Index

Evenness ( $e$ ): Evenness is a statistical tool that compares actual diversity value to the maximum possible diversity by using evenness. The evenness of the sample is obtained from the formula:  $\text{Evenness} = H' / H_{\text{max}}$

Or

$E = H' / \log S$

By definition,  $E$  is constrained between 0 and 1.0

Where,

$H'$  = Shannon-Wiener's diversity index.

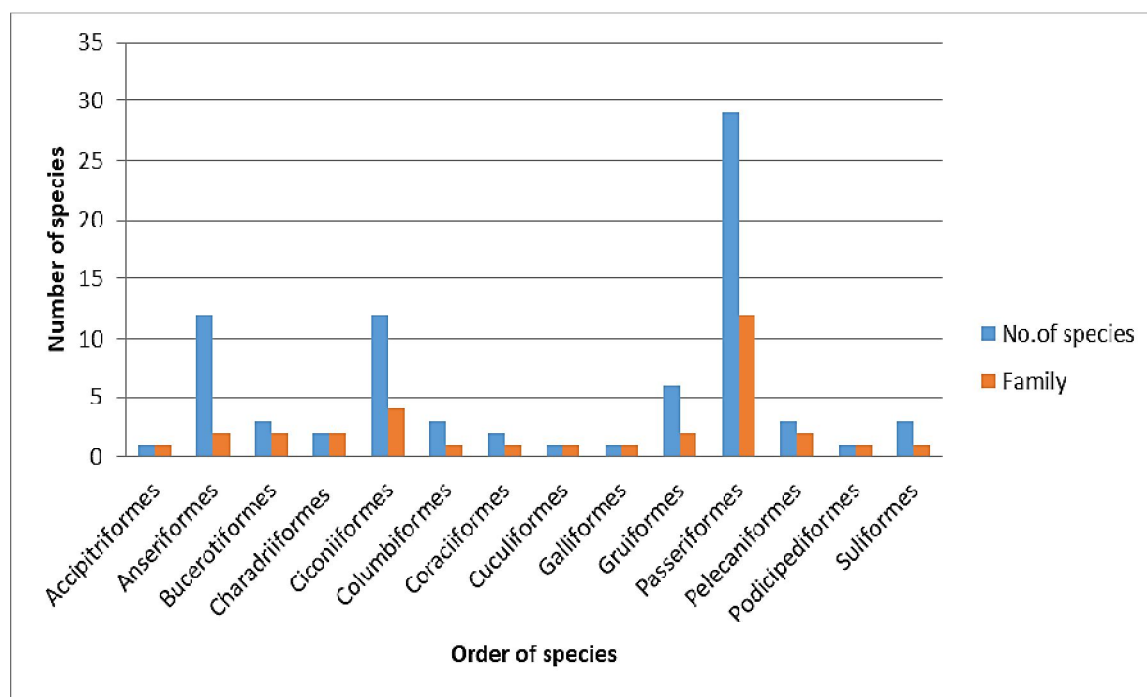
$S$  = Species richness is the number of species and is simply a count of the number of different species in a given area.

All recorded bird species were categorized into different status based on IUCN Red list status and CITES Appendix follows Bird Life International as per their migratory status such as resident, winter migrant, summer visitor and passage migrant etc.

## 4. RESULTS

### 4.1 Diversity of Birds

A total of 79 species of birds belonging to 33 Families and 14 Orders were recorded during summer and winter seasons. The highest number of species (29) was represented in the order Passeriformes along with 12 families. Other major orders in terms of species richness were Ciconiiformes (4 families and 12 species), Anseriformes (2 families and 12 species), Gruiformes (2 families and 6 species), Bucerotiformes (2 families and 3 species), Pelecaniformes (2 families and 3 species), Columbiformes and Suliformes having (1 family and 3 species), Charadriiformes (2 families and 2 species), Coraciiform (1 family and 2 species) and other orders representing 1 family and 1 species were Accipitriformes, Cuculiformes, Galliformes and Podicipediformes (Figure 3).

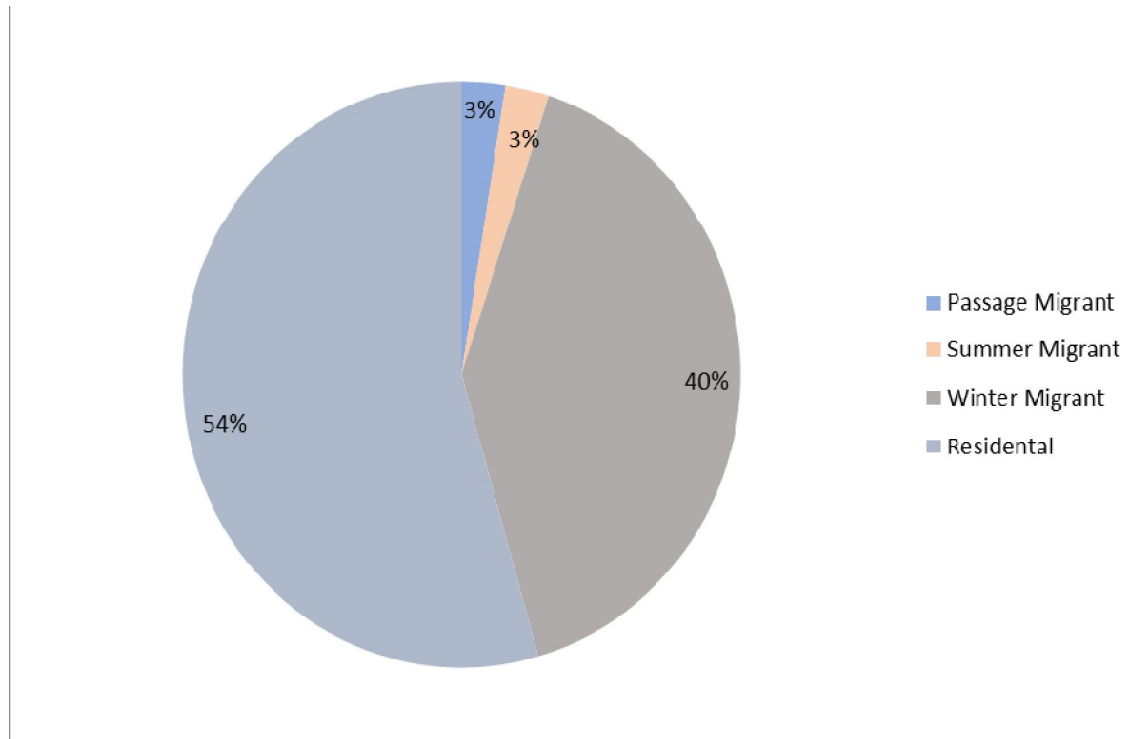


**Figure 3: Orders and families of bird's species recorded in Jagadishpur Reservoir area**

The overall Shannon wiener index (3.167) and evenness index was (0.30) obtained.

#### 4.1.1 Diversity of Migratory Status of Birds

A total of 79 species included 32 species of winter migrant, 2 species of summer migrant, 2 species of passage migrant and 43 species of resident birds were recorded (Figure 4).



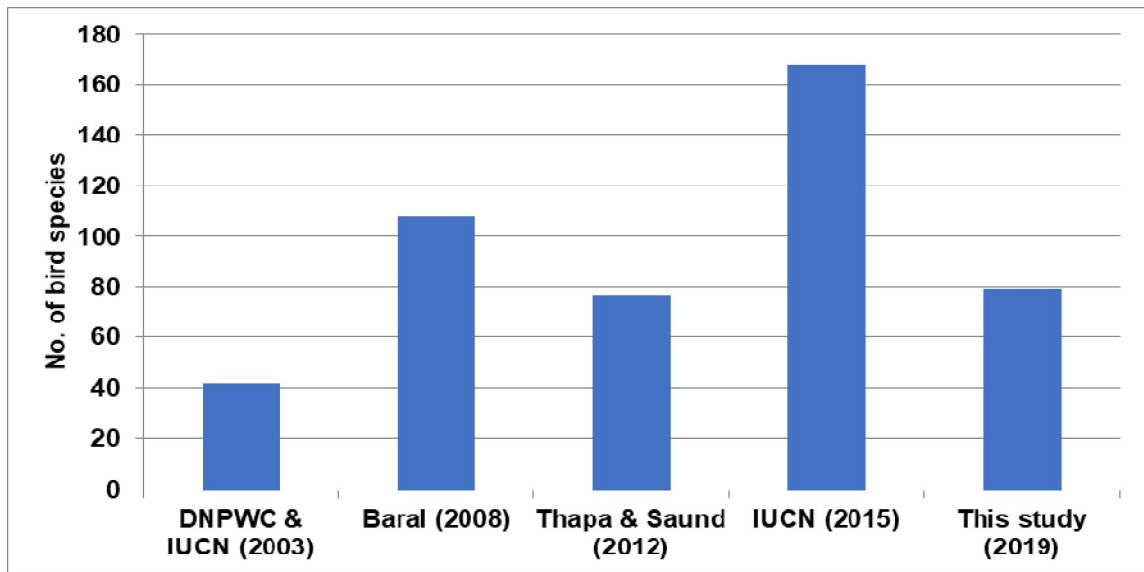
**Figure 4: Percentage of winter and summer migrant, passage migrant and residential birds in Jagadishpur Reservoir.**

#### 4.1.2 IUCN Status of Birds

A total of 79 species, included 3 vulnerable species, 3 nearly threatened and 73 species were found to be least concern.

#### Birds Status in different periods

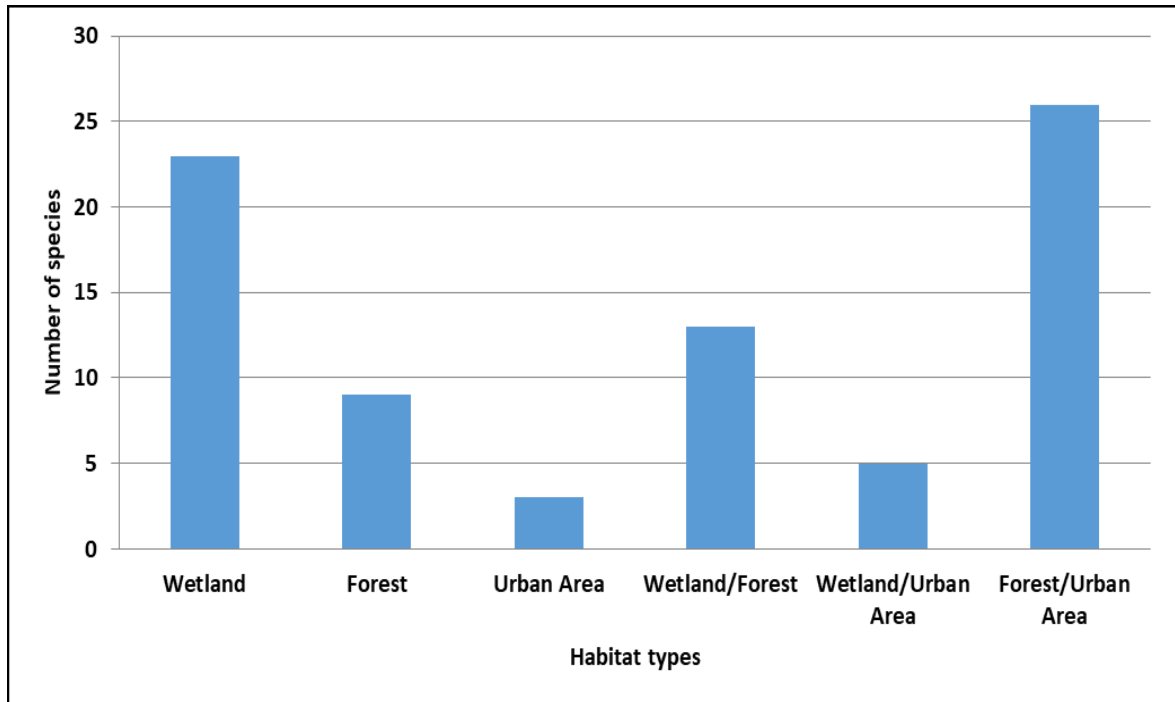
A total of 168 Bird species are recorded in 2015 which is higher as compared to other different research. A total of 42 species are recorded in 2003, 108 species are recorded in 2008, 77 species are recorded in 2012 and 79 species are recorded in this study.



**Figure 5: Bird species in Jagdishpur Reservoir in different periods**

#### **4.1.3 Birds Species in Different Habitat**

The higher species richness of birds was recorded in forest and urban both common habitat (26 species) followed by wetland (23 species), wetland and forest (13 species), Forest (9 species), followed by wetland and urban area (5 species) and urban area (3 species) (Figure7). Occurrence of different bird like Lesser Whistling Duck (*Dendrocygna javanica*), Ruddy Shelduck (*Tadorna ferruginea*), Mallard (*Anas platyrhynchos*), Pallas's Gull (*Larus ichthyaetus*) etc. were seen in wetland. Greater Coucal (*Centropus sinensis*), Large billed Crow (*Corvus macrorhynchos*), Common Myna (*Acridotheres tristis*) etc. were seen in both forest and urban area. House Sparrow (*Passer domesticus*), Smoky Warbler (*Phylloscopus fuligiventer*), Spotted Dove (*Spilopelia chinensis*) were seen only in urban area at the study period. Some important aquatic birds were Indian Pond Heron (*Ardeola grayii*), Common Teal (*Anas crecca*), Intermediate Egret (*Mesophoyx intermedia*), Little Cormorant (*Phalacrocorax niger*), Lesser Adjutant (*Leptoptilos javanicus*) etc.



**Figure 6: Birds species in different habitat types**

#### 4.1.4 Seasonal Variation in Bird Assemblage

Species richness and population size of birds was found higher in the winter season than in summer. There were 58 bird species recorded in winter season 42 species were recorded during the summer season and 16 Species were common in both seasons (Table 1). Shannon winner index was found higher in winter season than summer while Evenness index was found higher in Summer seasons in comparison to winter seasons (Table 1).

Species such as Eurasian Wigeon (*Mareca Penelope*), Barn Swallow (*Hirundo daurica*), Siberian stonechat (*Saxicola maurus*), White Wagtail (*Motacilla alba*), etc. were Seen during winter season. Blue Tailed-Bee Eater (*Merops Philippinus*), Eurasian Golden oriole (*Oriolus oriolus*) were seen only in summer seasons and Lesser Whistling Duck (*Dendrocygna Javanica*), Little Cormorant (*Phalacrocorax niger*), Sarus Crane (*Grus antigone*), Asian Openbill (*Anastomus oscitans*), House Crow (*Corvus splendens*) etc. were seen on both seasons.

**Table 1: Comparison of species richness and diversity of bird recorded during winter and summer seasons in Jagadishpur Wetland.**

Seasons	Number of species	Number of individuals	Shannon wiener index	Evenness index
Winter	58	1376	2.912	0.32
Summer	42	840	2.798	0.39

No significant difference was observed in terms of species richness ( $t = 1.5$ ,  $df = 54$ ,  $p = 0.137$ ) in both seasons. But species abundance varied significantly ( $t=2.21$ ,  $df = 54$ ,  $p = 0.031$ ). The study area supports higher abundance in winter as compared to summer season.

#### 4.2 Factor Affecting Diversity and Abundance

From the present study, livestock pressure was the major threats to birds in winter seasons. Number of livestock present in the habitats of birds in winter seasons caused a significantly negative effect on species richness and abundance of birds in Jagadishpur Reservoir ( $P= 0.45$ ,  $t=0.754$ ) while full of water is highly significance than swallow water and dry water (Table 2).

**Table 2: Factors determining bird diversity in winter season**

Models parameter	Estimate	Std. Error	t-value	Pr.(> t )
(Intercept)	1.52423	0.57445	2.653	0.010904*
Full of water	2.47456	0.67003	3.693	0.000586****
Swallow water	1.35333	0.63542	2.13	0.03857*
Marshy land	0.63193	0.62547	1.01	0.317624
Dry land	1.44659	0.61134	2.366	0.022236*
No. of people	0.01037	0.07132	0.145	0.884992
Boats	0.04924	0.05759	0.855	0.396941
Fishing	0.66068	0.3576	1.848	0.071103
Livestock	-0.07061	0.09362	-0.754	0.454563

Significance Codes: 0 '\*\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

**Table 3: Factors determining bird diversity in summer season**

	<b>Estimate</b>	<b>Std. Error</b>	<b>t – value</b>	<b>Pr.(&gt; t )</b>
(Intercept)	0.74805	0.86774	0.862	0.393027
Full of water	3.52998	0.98017	3.601	0.000761 ***
Swallow. Water	3.31545	1.03416	3.206	0.002422 **
Marshy land	1.26927	0.96224	1.319	0.193536
Dry land	1.2243	0.94485	1.296	0.201388
no.of people	-0.05759	0.03689	-1.561	0.125181
Boats	NA	NA	NA	NA
Fishing	0.12875	0.98188	0.131	0.896232
Livestock	-0.02379	0.05714	-0.416	0.679059

Significance Codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

From this study livestock pressure and human disturbance (No. of people) were the major threat to birds in summer seasons. Number of the livestock present in the habitat of birds caused a significantly negative effect on species richness and abundance of birds ( $p=0.67$ ,  $t=-0.416$ ). The presence of people (both local people and tourist) in the habitat of birds caused a significantly negative effect on the species richness and abundance of birds in JRRS (Table 3).

### 4.3 Threats to Birds

Major threats to birds includes illegal hunting, human disturbances due to collection of wetland product, grazing of domestic animals, development activities and invasive species.

**Illegal hunting:** one of the biggest threats to birdlife is illegal hunting, many species of bird, especially migratory and residential water birds such as cormorants lesser whistling duck and Ruddy Shelduck are trapped and killed for meat. Some of these birds are sold in hotels near JRRS. A total of 12 birds are found to be dead during this study.

**Human disturbance:** The collection of forest products, such as timber, firewood and fodders is leading to habitat degradation. Different type of entertaining activities of human such as picnic, boating inside the wetland, area generated the disturbances to the birds. Likewise bottle of water, cover of noodles and biscuits and other type of plastic and sewage were seen around the wetland. Some local child and young people have been

using wetland as a football and volleyball ground. A total of 211 peoples were found during this study.

**Grazing:** Domestic animals, such as cow buffalo and goat are grazing throughout the reservoir. There are no any rules and regulation to the local people to enter their livestock for grazing inside the Jagadishpur Reservoir. Most of the buffalos also used water for bathing inside the wetland. Grazing may cause food scarcity, contaminate water, degrade habitats and possibly spread contagious diseases to the birds. Therefore, many bird habitats were destroying due to the over disturbances by the human being and livestock in an around the wetland area. A total of 138 livestock were found inside the wetland during this study.

**Developmental activities:** The construction activities going on around JRRS include extension of roads, construction of many sub-roads inside the wetland, construction of wall around the reservoir, construction of temple inside the wetland (is in process), development of picnic sport and children garden. These development initiatives will also impact bird population, especially creating food scarcity, pollution and habitat destruction.

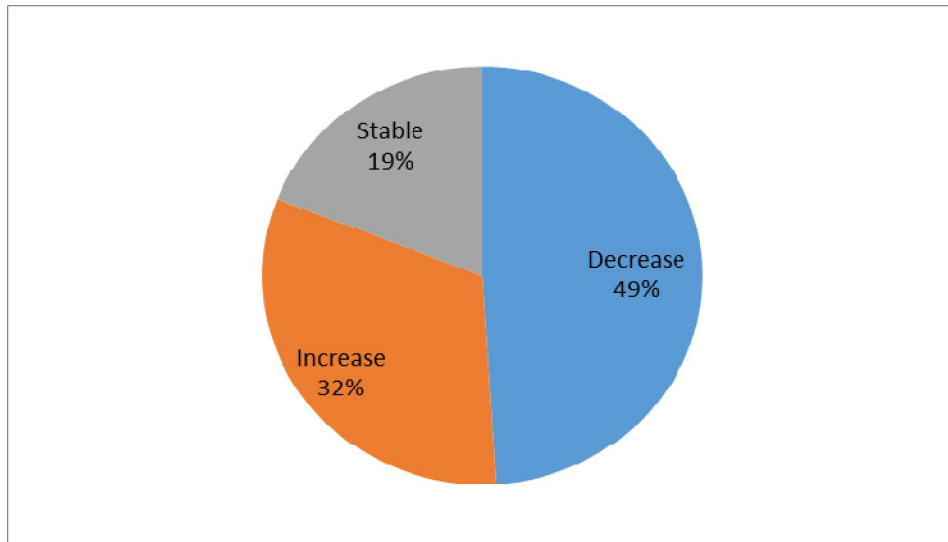
**Invasive Species:** Besharam or Dhungreful (*Ipomea carnea*) covers almost area of the wetland, causing encroachment of bird habitat. Furthermore, high deposition of aquatic macrophytes, such as lotus, nymph, hornwort and water hyacinth is negatively impacting bird population.

#### **4.3.1 Social Survey**

Total 100 households were selected for the questionnaire survey among which 45% were male and 55% were female. All surveyed populations were directly or indirectly benefitted from wetland. The literacy rate of the population was 80% (40% literate up to primary level and 40% above primary) while the illiterate population were 20%. The study area supports both summer and winter migrants in respective seasons. It was modified to obtain ecosystem services to enhance tourism industry. Due to which some of the changes were done which is believed to have direct effect on the biodiversity of Jagadishpur Reservoir.

### Status of migratory birds

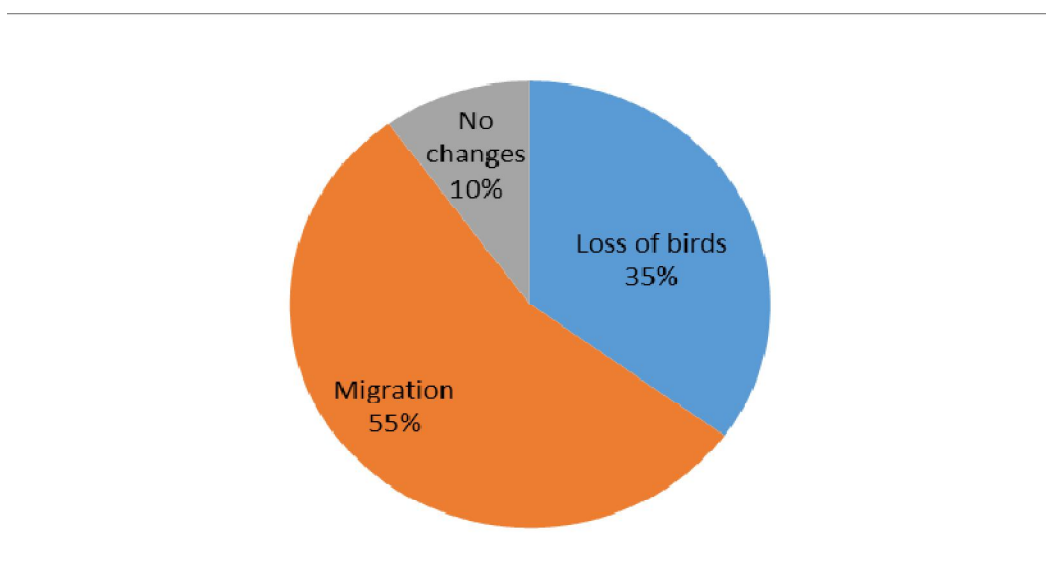
Out of the total population surveyed 49% of peoples were in view that the migratory birds are decreasing while 32% believed that the migratory birds are increasing and 19% had the neutral response (Figure 7).



**Figure 8: People perception towards status of migratory birds**

### Consequences of the wetland drying

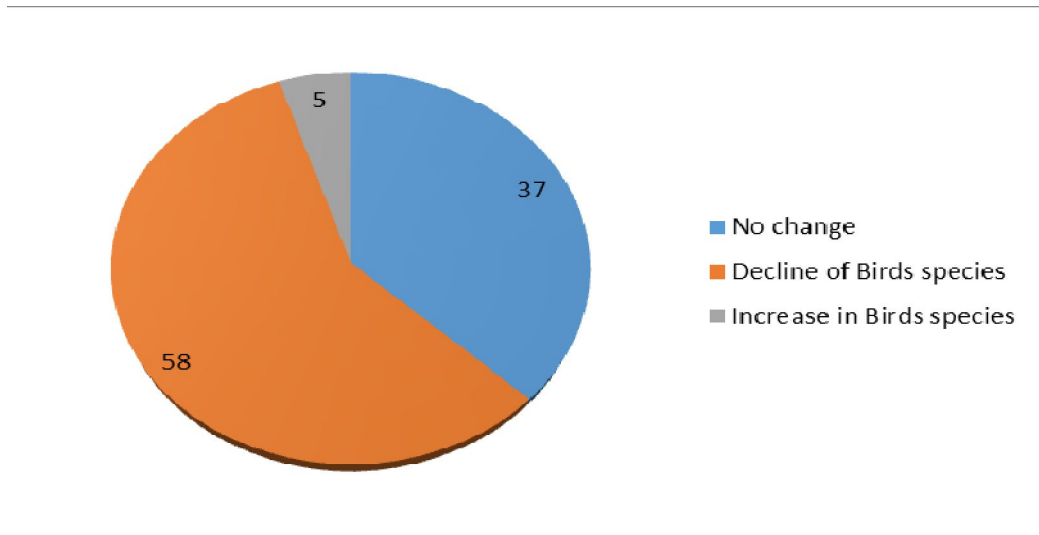
Out of the total population surveyed 55% respondent viewed that bird species migrate in another wetland or another country while 35% told that bird species were loss and 10% people viewed that there are no any changes in birds' population (Figure 9).



**Figure 8: People perception towards consequences of the wetland drying**

### Effect of Construction Activities

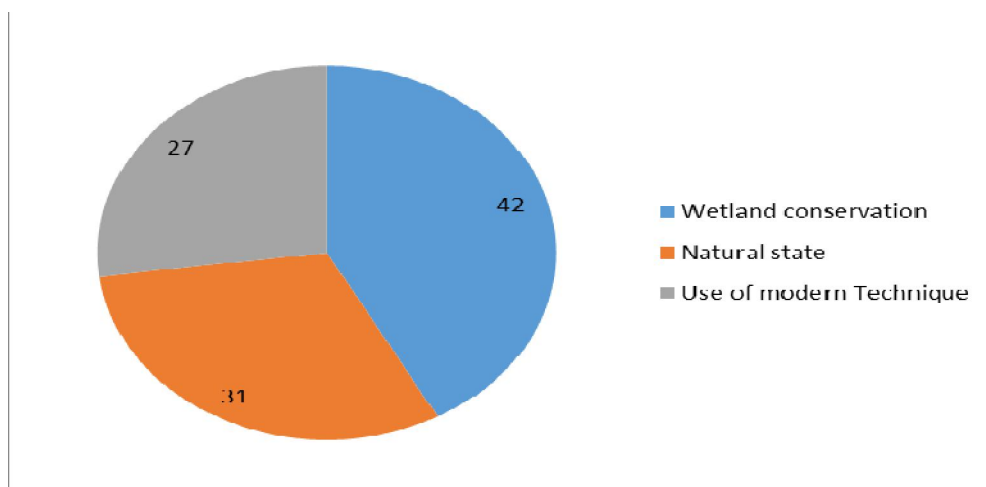
To find out people perception towards construction activities inside and outside of the wetland 58% viewed that decline of bird species, 37% respondent answered that there is no any change or effect of construction and 5% also answered that bird species may increase due to construction (Figure 10).



**Figure 9: people perception towards construction activities**

### Conservation of Birds

Out of the total population surveyed 42 % respondent answered to be conservation of wetland, while 31% respondent viewed to leave wetland as a natural state and 27% respondent focused to manage wetland by using different modern tools and technique (Figure 11).



**Figure 10: People perception towards conservation of birds**

## 5. DISCUSSION

This study focused on seasonal variation in diversity and factor determining diversity and abundance. Bird diversity in this area was good in Jagadishpur Reservoir compared to other associated wetland (Thapa and Saund 2012). This study revealed that only 9% of the total avian species of Nepal (BCN 2016) found in the Jagadishpur Reservoir.

### **Bird Diversity and Abundance**

A study conducted by DNPWC and IUCN (2003) in Jagadishpur Reservoir reported 42 species of birds during the July 1997 survey. Baral (2008) reported 108 species from Jagadishpur Reservoir area (within 500m of the dam nearly, nearly half being either winter visitor or passage migrant. And Thapa and Saund (2012) also reported 77 bird species representing 8 order and 31 families at that area. A study conducted by IUCN (2015) in Jagadishpur reservoir also reported total of 168 species of birds from 42 families. Out of 168 species, 90 were residential, seven were summer migrants, 64 were winter migrant and three are partial migrant and status of 4 species are reported to be unknown. However, a total of 79 species of birds belonging to 14 orders and 33 families were recorded within summer and winter seasons during study period. Out of 79 species included 32 species of winter migrant, 2 species of summer migrant, 2 species of passage migrant and 43 species of residential birds were recorded in the study period. Order Passeriformes represent the highest species composition (36.71%) followed by order Ciconiiformes and Anseriformes (15.18%) as compared to other.

The large bird species (79 species) indicates that the reservoir is biologically productive and has the potential to provide habitat for a diversity of birds. Birds play a vital role as indicators of nutrient status of wetland ecosystem (Patra et al. 2010). The number of bird species seems very low as compare to 168. This discrepancy may be due to time of the study period and this may also happen due to the very poor ecological water quality and heavy construction activities on around JRRS include extension of road and tourism promote. An increment in the number of bird species as compared to 42 and 77 may be attributed to a number of reasons including improvement in habitat condition and coverage area of the study site.

Species richness and abundance was higher in winter seasons than summer. Easy availability of food, suitable climate and temperature, depth of water level and migration of species might be the reason for high species richness in winter seasons. The species

richness of birds was expected to be highest during winter when the migratory population leaves the area and the residential species are engaged in the nesting activities (Deshkar et al. 2010). Birds are unable to tolerate the high temperature in summer seasons so that low species were recorded in summer. Bird migration also changes the number of bird species in different seasons and habitat (Baniya et al. 2009).

This study recorded that Jagadishpur Reservoir also supporting habitat for threatened bird species, there were all together 69 species in least concern, 3 species in vulnerable, 4 species in threatened and 3 species in nearly threatened category of IUCN Red data book. Asian Wollyneck (*Ciconia episcopus*), Sarus Crane (*Grus Antigone*), Lesser Adjutant (*Leptoptilos javanicus*) are under the vulnerable in its status while Eurassian Coot (*Fulica atra*), Black Headed Ibis (*Threskiornis melanocephalus*), Falacted Duck (*Mareca falcate*) are under nearly threatened in its status. Beside this Green Winged Tail (*Anas carolinesis*), Tundra Bean Goose (*Anser serrirostris*), Purple Headed Swamphen (*Porphyrio poliocephalus*), Oriental Skylark (*Alauda gulgula*) were also found to be threatened species (IUCN 2015).

The higher species richness of birds was recorded in forest and urban both Common habitat (26 species) followed by Wetland (23 species), wetland and forest (13 species), Forest (9 species), followed by wetland and urban area (5 species) and urban area (3 species). Most of the birds were utilized forest and urban /settlement area as the prime habitat because of the easy assessment of food materials and less amount of water level inside the wetland followed by wetland and wetland and forest. Birds are habitat specific (MacArthur et al. 1962 and MacArthur 1964) as habitat type represents the number of bird species. Studies show that complexity of bird community is usually increased with the increase of habitat complexity (MacArthur and MacArthur 1961). Wetland and forests are which support significantly high population of avian fauna in Nepal (Baral and Inskipp 2005). House Sparrow (*Passer domesticus*), Red vented Bulbul (*Pycnootus cafer*), Bluetailed- Bee Eater (*Merops Philippinus*), Green Bee Eater (*Merops orientalis*), Smoky Warbler (*Phylloscopus fuligiventer*), Larged billed Crow (*Corvus macrorhynchos*), House Crow (*Corvus splendens*) etc. were very common in forest and urban area. Similarly, Lesser Whistling Duck (*Dendrocygna Javanica*), Little Cormorant (*Phalacrocorax niger*), Ruddy Shelduck (*Tadorna ferruginea*), Mallard (*Anas platyrhynchos*), Black Headed Ibis (*Threskiornis melanocephalus*), Eurasian wigeon (*Mareca Penelope*) etc. were common in wetland habitat.

The present study should highest diversity index in winter (2.912) followed by summer (2.798). The value of Shannon diversity index varies between 0 and 1 high value of Shannon-wiener diversity indexes a low concentration of dominance (Odum 1966). The evenness index showed maximum evenness in summer (0.39) when the maximum Shannon –Wiener diversity value was noted and minimum evenness in winter (0.32). High index of species evenness in summer may be attributed to increase in community. This result indicates that winter season was more favorable for large number of population. Diversity value of winter and summer was 1.14 and 1 respectively of the bird survey in the same area JRSS and evenness index value of winter and summer was 0.61 and 0.76 respectively Thapa and Saund 2012). Similarly, Diversity value of winter and summer was 1.71 and 1.64 respectively of the bird surveyed in the Somehow range of Madi, Chitwan and evenness index value of winter and summer was 0.88 and 0.86 respectively (Thapa 2015). Diversity index values ( $H = 2.75$ ) higher during summer and lower during monsoon at silent valley and Mukkali which was attributed to the availability of more fruits (Jayson and Mathew 2000a). There was an increase in the diversity and number of bird in December (Jayson and Mathew 2000b) in the silent valley of Kerala No significant difference was observed in terms of species richness ( $t = 1.5$ ,  $df = 54$ ,  $p = 0.137$ ) in both seasons. But species abundance was found to be statistically significant ( $t = 2.21$ ,  $df = 54$ ,  $p = 0.031$ ). The study area supports higher abundance in winter as compared to summer season.

### **Factor Determining Diversity and Abundance**

The presence of livestock and people in the habitats of birds caused a significantly negative effect on species richness and abundance in both winter and summer seasons. The diversity and abundance of birds were significantly low nearer to human contact. Distribution of birds was highly affected by disturbance variable such as level of water depth, no of people (both local people and tourist), number of boat, number of fishing person, no of livestock pressure. The level of water inside reservoir is reducing due to rolling mud from the canals. The reservoir is seen as dumping site due waste entered through canals which somehow were preventing through introduction of net at the entrance. The birds were facing disturb of construction work operated into the reservoir for lake cleaning process. In other hand birds were also disturbing from the boats operated for the promotion of ecotourism of this site. Adhikari et al. (2019) also reported the lower diversity of threatened birds was reported near human settlement that

experienced higher disturbance. Presence of livestock and people caused significantly negative effect on species richness and abundance of threatened birds. Distance from roads and village also had a negative effect on the diversity and abundance of most of the threatened birds. Similarly, Jia et al. (2018) reported flooding phenology, human disturbance, habitat loss and degradation and declining water quality caused by eutrophication and pollutions as the major threat of water bird community in Yangtze River floodplain lakes. The empirical finding show that there is negative impact of livestock pressure and no of people (both local and tourist) on birds' species while depth of water level has a positive significance relation with species diversity and abundance.

### **Threats to Birds**

Questionnaire survey was conducted with 100 respondents including Farmer, Laborer, Business man, students, management unit and other fields of different age group from different religions. Among them only 16.39% of respondent were aware about the reservoir being listed in Ramsar site as wetland of international importance and while 83.61% did not know the fact. About 60.66% believed that the water level of reservoir is fluctuating and drying, 34.43% said that the water level is drying only for few days to complete construction activities and wetland management and 4.91% did not know anything about it.

Due to habitat fragmentation, human encroachment, water drying, water poisoning are key factors for aquatic bird diversity decline. News published in Butwal Today (2019) on the headline of "birds are unsafe in wetland area". During this study, birds are killed by using chemical, pesticides for their illegal sales and hunting. In this way this study focused on the damaging safe habitat of birds in JRSS area. Similarly, Poudel (2019) reported encroachment of Jagadishpur Reservoir going to destroy bird's habitat. According to its report the peoples of that area were forgetting that they are losing original beauty of lake, and its bird diversity with the planning of making it beautiful through different artificial means.

Paracuellos and Telleria (2004) reported morphological, geographical hydrological, vegetative and temporal parameter of the pond as well as characteristics of the species is the major factor for bird species and abundance. Kafle et al. (2015) reported that trapping, hunting, fish farming using nets, habitat destruction by soil erosion, human disturbance,

and water pollution and eutrophication were the major threat to water birds of Rupa Lake, Pokhara.

Therefore, the study suggests that maintaining heterogeneous habitats (forest, grassland and wetland) with low human disturbance should be implemented. In this study anthropogenic factors are the root cause or major threat for lake degradation and habitat destruction of water bird. Therefore, conservation education and awareness programs are essential for local farmers, students, fishing community and visitors to the lake in order to main its natural habits.

## 6. CONCLUSION AND RECOMMENDATIONS

### 6.1 Conclusion

The species richness of birds in different habitat types of Jagadishpur Reservoir during two different seasons (winter and summer) showed that there are altogether 79 species of birds belonging 33 Families and 14 Orders during study period. Out of 79 species, 32 species are winter migrant, 2 are summer migrant, 2 migrants and 43 residential birds were recorded in the study period. Order Passeriformes represent the highest species composition (36.71%) followed by order Ciconiiformes and Anseriformes which occupy 15.18% both.

The higher number of bird species was recorded during winter season than summer showing the seasonal variation in species richness of avifauna. Similarly, no significant difference was observed in terms of species richness ( $t = 1.5$ ,  $df = 54$ ,  $p = 0.137$ ) in both seasons. But species abundance varied significantly ( $t = 2.21$ ,  $df = 54$ ,  $p = 0.031$ ). The study area supports higher abundance in winter as compared to summer season. All together 69 species in least concern, 3 species in vulnerable, 4 species in threatened and 3 species in nearly threatened species found to be listed in IUCN Red data book.

Livestock and human disturbance are the major factor determining significantly negative effect on species diversity and abundance to the birds in Jagadishpur reservoir. While full of water level had highly significant relation with species richness and abundance of birds.

It is concluded that human is the key factor for degrading the wetland. Human activities like Illegal hunting, excessive use of pesticides and fertilizers, grazing, bathing, cattle bathing, washing clothes, developmental activities, Invasive species, population urbanization, over harvesting of wetland resources only aggravate deteriorating ecological condition of Jagadishpur Reservoir.

## **6.2 Recommendations**

Based on the present study, some major recommendations are as follows:

- This study suggests that maintaining heterogeneous habitats (forest, grassland and wetland) with low human disturbance should be implemented.
- For sustainable management, a frequent research should be conducted to understand utilization of reservoir, biodiversity, physical, cultural and other impact of human activities.
- Organic farming should be promoted in surrounding farmland of Jagadishpur Reservoir.
- Awareness campaign should be launched to local people by different government and nongovernment organization on value of wetland resources and sustainable utilization of the resources.

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**ANNEX-I**  
**DATA SHEET**

SN	GPS-N	GPS-E	Bird Route	Point No.	Bird Species	Count	Activities	Habitat type	No of people	With boats	Fishing	Livestock	Remarks
1													
2													
3													
4													
5													
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## ANNEX-II

### Questioners

Questionnaire for survey of people perception toward wetland status and conservation practices of Niglihawa ,Kapilvastu.

#### A. Respondent located near Jagadishpur Reservoir

Date

1. Name of respondent 2.Is respondent.....owner/employer/relative.

3. Gender.....Male/Female.

4. Level of education.....Illiterate/literate/primary/SLC/Intermediate/Over.

5. Do you know about the birds?

- Yes...
- No...

6. Do you know present status of birds in Jagadishpur Reservoir?

- Yes.....
- No.....
- Decrease
- Increase
- Stable

7. Do you know what happen if the wetland is dries?

- Yes.....
- No.....
- Loss of birds
- Migration of birds
- No change

11. Do you know about the effect after Construction near wetland?

- No Change
- Decline of Birds Species
- Increase

12. What is your perception towards conservation of birds?

- Wetland conservation
- Natural state
- Use of Modern Technique

### ANNEX - III

S. N	Scientific Name	English Name	Order	Family	IUCN Threat Status	Migration Pattern	Habitat
1	<i>Ictinaetus malaiensis</i> (Temminck, 1822)	Black eagle	Accipitriformes	Accipitridae	LC	R	2
2	<i>Spatula clypeata</i> ((Linnaeus, 1758)	Northern Shoveler	Anseriformes	Anatidae	LC	W	1
3	<i>Anas platyrhynchos</i> Linnaeus, 1758	Mallard	Anseriformes	Anatidae	LC	W	1
4	<i>Anser serrirostris</i> (Gould, 1852)	Tundra Bean Goose	Anseriformes	Anatidae	LC	W	2
5	<i>Mareca penelope</i> (Linnaeus, 1758)	Eurasian Wigeon	Anseriformes	Anatidae	LC	W	1
6	<i>Dendrocygna Javanica</i> ((Horsfield, 1821))	Lesser Whistling Duck	Anseriformes	Phasianidae	LC	R	1
7	<i>Tadorna ferruginea</i> ((Pallas, 1764))	Ruddy Shelduck	Anseriformes	Anatidae	LC	W	1
8	<i>Aythya ferina</i> ((Linnaeus, 1758)	Common Pochard	Anseriformes	Anatidae	LC	W	1
9	<i>Anas strepera</i> (Linnaeus, 1758)	Gadwall	Anseriformes	Anatidae	LC	W	1
10	<i>Aythya fuligula</i> (Linnaeus, 1758)	Tufted Duck	Anseriformes	Anatidae	LC	W	1
11	<i>Netta rufina</i> (Pallas, 1773)	Red Crested Pochard	Anseriformes	Anatidae	LC	W	1
12	<i>Anas carolinensis</i> Gmelin, 1789	Green Winged Teal	Anseriformes	Anatidae	LC	W	1
13	<i>Mareca falcata</i> (Georgi, 1775)	Falacted Duck	Anseriformes	Anatidae	NT	W	1
14	<i>Ocyrceros birostris</i> (Scopoli, 1786)	Indian gray Hornbill	Bucerotiformes	Bucerotidae	LC	R	2,3
15	<i>Merops Orientalis</i> (Latham , 1801)	Green Bee Eater	Bucerotiformes	Meropidae	LC	R	2,3
16	<i>Merops Philippinus</i> (Linnaeus, 1766)	Blue tailed bee eater	Bucerotiformes	Meropidae	LC	S	2,3
17	<i>Vanellus indicus</i> (Boddaert, 1783)	Red Watted Lapwing	Charadriiformes	Charadriidae	LC	R	2,3
18	<i>Metopidius indicus</i> (Latham, 1790)	Winged - Jacana	Charadriiformes	Jacaniidae	LC	R	1,2
19	<i>Leptoptilos javanicus</i> Horsfield, 1821	Lesser Adjutant	Ciconiiformes	Ciconiidae	VU	R	1,2
20	<i>Anastomus oscitans</i> (Boddaert, 1783)	Asian Openbill	Ciconiiformes	Ciconiidae	LC	R	1,2
21	<i>Ciconia episcopus</i> (Boddaert, 1783)	Asian Wollyneck	Ciconiiformes	Ciconiidae	VU	R	1,2
22	<i>Egretta garzetta</i> (Linnaeus, 1766)	Little Egret	ciconiiformes	Ardeidae	LC	R	1,2

S. N	Scientific Name	English Name	Order	Family	IUCN Threat Status	Migration Pattern	Habitat
23	<i>Casmerodius albus</i> (Linnaeus, 1758)	Great Egret	ciconiiformes	Ardeidae	LC	R	1,2
24	<i>Mesophoyx intermedia</i> (Wagler, 1827)	Intermediate Egret	ciconiiformes	Ardeidae	LC	R	1,2
25	<i>Pseudibis papillosa</i> (Temminck, 1824)	Red naped Ibis	Ciconiiformes	Threskiornithidae	LC	R	1,3
26	<i>Bubulcus ibis</i> (Linnaeus, 1758)	Cattle Egret	ciconiiformes	Ardeidae	LC	R	1,2
27	<i>Ciconia nigra</i> (Linnaeus, 1758)	White stork	Ciconiiformes	Ciconiidae	LC	PM	1,3
28	<i>Fulica Atr</i> (Linnaeus, 1758)	Black Shoulder kite	Ciconiiformes	scolopacidae	LC	R	2,3
29	<i>Hydrophasianus chirurgus</i> (Scopoli, 1786)	Pheasant tailed Jacana	Ciconiiformes	scolopacidae	LC	R	1
30	<i>Larus ichthyaetus</i> (Pallas, 1773)	Pallas's Gull	Ciconiiformes	scolopacidae	LC	PM	1
31	<i>Spilopelia chinensis</i> (Scopoli, 1768)	Spotted Dove	Columbiformes	Columbidae	LC	W	3
32	<i>Streptopelia decaocto</i> (Frisvaldszky, 1838)	Eurasian Collared Dove	Columbiformes	Columbidae	LC	W	2,3
33	<i>Columba livia</i> (Gmelin, 1789)	Common Pigeon	Columbiformes	Columbidae	LC	R	2,3
34	<i>Halcyon smyrnensis</i> (Linnaeus, 1758)	White Throated Kingfisher	Coraciiformes	Alcedinidae	LC	R	1,2
35	<i>Ceryle rudis</i> (Linnaeus, 1758)	Pied Kingfisher	Coraciiformes	Alcedinidae	LC	R	1,2
36	<i>Centropus sinensis</i> (Stephens, 1815)	Greater Coucal	Cuculiformes	Cuculidae	LC	R	2,3
37	<i>Nettapus coromandelianus</i> (Gmelin, 1789)	Cotton Pigmy goose	Galliformes	Anatidae	LC	R	1
38	<i>Grus grus</i> (Linnaeus, 1758)	Common Crane	Gruiformes	Gruidae	LC	W	1,3
39	<i>Grus antigone</i> (Linnaeus, 1758)	Sarus Crane	Gruiformes	Gruidae	VU	R	1,3
40	<i>Fulica atra</i> (Linnaeus, 1758)	Eurasian Coot	Gruiformes	Rallidae	NT	W	1
41	<i>Gallinula chloropus</i> (Linnaeus, 1758)	Common Moorhn	Gruiformes	Rallidae	LC	W	1
42	<i>Porphyrio poliocephalus</i> (Latham, 1801)	Purple headed swaphen	Gruiformes	Rallidae	LC	R	1
43	<i>Amaurornis phoenicurus</i> (Pennant, 1769)	White breasted waterhen	Gruiformes	Rallidae	LC	R	1,3
44	<i>Lanius schach</i> Linnaeus, 1758	Long Tailed Shrike	Passeriformes	Laniidae	LC	R	2,3
45	<i>Corvus macrorhynchos</i> Wagler, 1827	Larged billed Crow	Passeriformes	Corvidae	LC	R	2,3
<b>S.</b>	<b>Scientific Name</b>	<b>English Name</b>	<b>Order</b>	<b>Family</b>	<b>IUCN</b>	<b>Migration</b>	<b>Hab</b>

N					Threat Status	Pattern	itat
46	<i>Anthus hodgsoni</i> (Richmond, 1907)	Olive backed Pipit	Passeriformes	Motacillidae	LC	W	2,3
47	<i>Corvus splendens</i> (Vieillot, 1817)	House Crow	Passeriformes	Corvidae	LC	R	2
48	<i>Motacilla alba</i> (Linnaeus, 1758)	White Wagtail	Passeriformes	Motacillidae	LC	W	1,2
49	<i>Cecropis daurica</i> (Laxmann, 1769)	Red rumped swallow	Passeriformes	Hirundinidae	LC	W	2
50	<i>Acridotheres tristis</i> (Linnaeus, 1766)	Common Myna	Passeriformes	Sturnidae	LC	R	2,3
51	<i>Prinia socialis</i> (Sykes, 1832)	Ashy Prinia	Passeriformes	Cisticolidae	LC	R	2,3
52	<i>Dendrocitta vagabunda</i> (Latham, 1790)	Rufous Treepie	Passeriformes	Corvidae	LC	R	2
53	<i>Hirundo rustica</i> (Linnaeus, 1758)	Barn Swallow	Passeriformes	Hirundinidae	LC	W	2
54	<i>Mirafra assamica</i> (Horsfield, 1840)	Bengal Bushlark	Passeriformes	Alaudidae	LC	R	1,2
55	<i>Lanius cristatus</i> (Linnaeus, 1758)	Brown Shrike	Passeriformes	Laniidae	LC	W	2
56	<i>Gracupica contra</i> (Linnaeus, 1758)	Asian pied starling	Passeriformes	Sturnidae	LC	R	2,3
57	<i>Ficedula parva</i> (Bechstein, 1792)	Red throated flycatcher	Passeriformes	Muscicapidae	LC	W	2,3
58	<i>Luscinia svecica</i> (Linnaeus, 1758)	Bluethroat	Passeriformes	Muscicapidae	LC	W	2
59	<i>Saxicola caprata</i> (Linnaeus, 1766)	Pied Bushchat	Passeriformes	Muscicapidae	LC	R	2,3
60	<i>Saxicola torquata</i> (Linnaeus, 1766)	Common Stonechat	Passeriformes	Muscicapidae	LC	W	2,3
61	<i>Saxicola maurus</i> (Pallas, 1773)	Siberian stonechat	Passeriformes	Muscicapidae	LC	W	2,3
62	<i>Alauda gulgula</i> (Franklin, 1831)	Oriental skylark	Passeriformes	Alaudidae	LC	R	2,3
63	<i>Prinia inornata</i> (Sykes, 1832)	Plain Prinia	Passeriformes	Cisticolidae	LC	R	2,3
64	<i>Dicrurus macrocercus</i> (Vieillot, 1817)	Black Drongo	Passeriformes	Dicruridae	LC	R	2
65	<i>Phylloscopus fuligiventer</i> (Hodgson, 1845)	Smoky Warbler	Passeriformes	Phylloscopidae	LC	W	3
66	<i>Anthus rufulus</i> (Vieillot, 1818)	Paddyfield Pipit	Passeriformes	Passeridae	LC	R	2,3
67	<i>Lonchura malacca</i> (Linnaeus, 1766)	Black headed Munia	Passeriformes	Passeridae	LC	R	2,3
68	<i>Oriolus oriolus</i> (Linnaeus, 1758)	Eurasian Golden oriole	Passeriformes	Laniidae	LC	S	2,3
69	<i>Turdoides striatus</i> (Dumont, 1823)	Jungle Babbler	Passeriformes	Cisticolidae	LC	R	2,3
<b>S. N</b>	<b>Scientific Name</b>	<b>English Name</b>	<b>Order</b>	<b>Family</b>	<b>IUCN Threat</b>	<b>Migration Pattern</b>	<b>Habitat</b>

					Status		
70	<i>Passer domesticus</i> (Linnaeus, 1758)	House Sparrow	Passeriformes	Passeridae	LC	R	3
71	<i>Eremopterix grisea</i>	Ashy-crowned sparrow lark	Passeriformes	Alaudidae	LC	R	2,3
72	<i>Pycnonotus cafer</i> (Linnaeus, 1766)	Red vented Bulbul	Passeriformes	pycononitidae	LC	R	2,3
73	<i>Threskiornis melanocephalus</i> (Latham, 1790)	Black Headed Ibis	Pelecaniformes	Threskiornithidae	NT	W	1
74	<i>Ardeola grayii</i> (Sykes, 1832)	Indian Pond Heron	Pelecaniformes	Ardeidae	LC	R	1,2
75	<i>Ardea purpurea</i> (Linnaeus, 1766)	Purple Heron	Pelecaniformes	Ardeidae	LC	W	1
76	<i>Tachybaptus ruficollis</i> (Pallas, 1764)	Little Grebes	Podicipediformes	Podicipedidae	LC	R	1
77	<i>Phalacrocorax carbo</i> ((Linnaeus, 1758)	Great Cormorant	Suliformes	Phalacrocoracidae	LC	W	1
78	<i>Phalacrocorax carbo</i> (Linnaeus, 1758)	Intermediate Cormorant	Suliformes	Phalacrocoracidae	LC	W	1
79	<i>Microcarbo niger</i> (Vieillot, 1817)	Little Cormorant	Suliformes	Phalacrocoracidae	LC	R	1

## Photo Plates



Plate 1: Common Pochard



Plate 2: Lesser Adjutant



Plate 3: Eurasian Coot



Plates 4: Common Moorhen



Plate 5: Asian Openbill



Plate 6: Great Coucal

**Photo plates**



Plate 7: Eurasian wigeon



Plate 8: Mallard



Plate 9: Northern shoveler



Plate 10: Great Cormorant



Plate 11: Intermediate Egret



Plate 12: Purple Swamp hen

## Photo Plates



Plate 13: Cattle Bathing



Plate14: Cattle grazing



Plate 15: Waste material inside lake



Plate16: Invasie species inside lake



Plate 17:Boat inside the lake



Plate 18:Invasive plant



Plate 19: News published about impact factor In JRRS



Plate 20: News about construction work in JRRS

# बिथोलिँदै चराको घर

■ **जोषज पौडेल** (अर्थशास्त्र)

विश्व विमसार क्षेत्रमा सुदूरपश्चिम जगदीशपुर तालमा मानवीय सौभाग्य बढ्दै गएको छ। यहाँको सध्या भवन बन्नेको छ। चराको बसोबास रूपाका विभिन्न तालमा बस्नेको मानवीय विकाससँगै संश्लेषकमी पनि चिन्तित बन्न थालेको छ। मुसुकी आगन्तुक चरालाई राम्रो आश्रय दिइरहेको तालमा ढुंगा चलाउन सुरु गरिएको छ। ढुंगाका कारण चराले अत्यान्त मानसु सोचेका छन्। ढुंगा कारण नयाँ जस्तैले चरालाई विचारजस्तै र सवाल सोझ्छन्।

‘रामसार क्षेत्रमा नुकीचा झार्छु’ अर्थात् मानवीय चरालाई बस्नु नुकीचा, ‘चरालिँदै छ। हेमासागर बराले भने, ‘चराले उन्मुक्त आवागमन नगर्नेछ। उनीहरूका लागि जगदीशपुर ताल अस्मिता बन्दै गएको छ। ‘चरा चरा चरा घडिने र चरा पछिपछि मानव सोचको ढुङ्गा यस्तो नुन चिन्ताको विषय बनेको उन्मुक्त भए। यस्तैले चरा पछिपछि लागि नैसर्गमा भएको आकषण घटाउँछ। अहम जहाँ बढी चरा बस्छन्, त्यही क्षेत्रमा ढुंगा चलाएको छ। अहिले तालमा परिचय क्षेत्रको वीथोलिँदै उत्ररहेको ढुंगा चलाएको छ। ढुंगा देलासाय चरा आफैँ सोचो छ।

तालमा कसैले नगर्नेछ। १ र १० नम्बर बहालै सलुक रूपमा ६ घटा ढुंगा चलाएको छ। अहम २२ घाट चलाएका ढुंगाका कारण चरा घडिन्छ। तालमा चरा चलाउँदै २२ हजारभन्दा बढी चरा मानव गरिएको छ। ‘चरालिँदै प्रकृत चरा क्षेत्र फेकियो। हुन्छन् भने विभिन्न चरा विचार आएको छ। ‘चरालिँदै सोच बढिने भने, ‘तालमा चरा चलाउँदै (पानी) पानी कम छ, हाम्रोको सध्यामा रक्षित चरा चलाउँदै घडिन्छ। ‘विचार चलाउँदै चलाउँदै जगदीशपुर तालको आकषणमा यसले राम्रो पछिपछि पुगेको उन्मुक्त भए।



कसैले नगर्नेछ। १ र १० नम्बर बहालै सलुक रूपमा ६ घटा ढुंगा चलाएको छ। अहम २२ घाट चलाएका ढुंगाका कारण चरा घडिन्छ। तालमा चरा चलाउँदै २२ हजारभन्दा बढी चरा मानव गरिएको छ। ‘चरालिँदै प्रकृत चरा क्षेत्र फेकियो। हुन्छन् भने विभिन्न चरा विचार आएको छ। ‘चरालिँदै सोच बढिने भने, ‘तालमा चरा चलाउँदै (पानी) पानी कम छ, हाम्रोको सध्यामा रक्षित चरा चलाउँदै घडिन्छ। ‘विचार चलाउँदै चलाउँदै जगदीशपुर तालको आकषणमा यसले राम्रो पछिपछि पुगेको उन्मुक्त भए।

मोसाइ माटोको दिक्को बनाएको छ। दिक्को १५ फिट उचाइको छ। त्यसमा जानका लागि उत्तर र दक्षिणबाट पक्की सिँधी बनाएको छ। त्यसमा ढुङ्गाको मुनि राखेको छ। मुनि राखिएको ढुंगाबाट बीचमा रहेको रिक्कोसम्म आवागमन हुने विचारमा आउने चरा चलाउँदै हुनेछ।

कसैले नगर्नेछ। १ र १० नम्बर बहालै सलुक रूपमा ६ घटा ढुंगा चलाएको छ। अहम २२ घाट चलाएका ढुंगाका कारण चरा घडिन्छ। तालमा चरा चलाउँदै २२ हजारभन्दा बढी चरा मानव गरिएको छ। ‘चरालिँदै प्रकृत चरा क्षेत्र फेकियो। हुन्छन् भने विभिन्न चरा विचार आएको छ। ‘चरालिँदै सोच बढिने भने, ‘तालमा चरा चलाउँदै (पानी) पानी कम छ, हाम्रोको सध्यामा रक्षित चरा चलाउँदै घडिन्छ। ‘विचार चलाउँदै चलाउँदै जगदीशपुर तालको आकषणमा यसले राम्रो पछिपछि पुगेको उन्मुक्त भए।

Plate 21: News about birds habitat loss in JRRS