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Birds Diversity and Composition on Bamboo Clumps of Rong and Mechinagar

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Abstract

This study assessed avian diversityand composition on bamboo clumps across different habitats in Rong Rural Municipality and Mechinagar Municipality, eastern Nepal. To determine birddiversity associated with bamboo and to understand the contribution of bamboo to aviandiversity,pointcount method was used to collect data and analyzed by using MS Excel 2019.Atotal of39 species having 255 individuals from 28 families and 8 orders were observed onbamboo clumps.Amongst them 28 identified species of birds, 199individuals belonged to the Passeriformes, 5 species with 66 individuals belonged to the family Sturnidae. The highest diversity was found on bamboo clumpsof forest area.Altogether, 14 species were migratory and 25 species were residential bird with a greater number of individuals i.e.,212. Out of 39 species, 12 species with 23 individuals of insectivore bird found in forest area followed by 7 omnivorous species with 36 individuals found in human settlement area.

Keywords: Bamboo, avifaunal diversity, feeding behavior, habitat, richness, Nepal

Introduction

Almost 1000 individual species of bamboo are found in natural forests of Asia-pacific region. The China had the largest national complement of 626 described species followed by India (102 species) and Japan (184 species), and Nepal-25 species (Bystriakova et al., 2003)**.**Bamboos are the important plant species of Nepal and are native to all the ecological zones of Nepal, 12 genera and more than 50 species of bamboos have been recorded on these zones (TISC, 2004). They are found on home yard, unproductive land and forest areas. People use bamboo for different purposes, for example; furniture, basket, house fencing, ladder, musical instruments, water pipes and other different products (Das, 1990).

Bamboo is cultivated in both rural and urban areas due to its high regenerative capacity, fast growth, short rotation, and it also controls soil erosion. Farmers from three districts (Siraha, Saptari and Udaypur) use bamboo to make dams and protect the farmland from rain and soil erosion. During February to April, 50,000-60,000 clumpsare transported per month and one million clumps annually to the local markets of Nepal and India (Karki et al, 1998) so that bamboo also provides good income for rural people, Products and sales are dependent on the season; the highest sales occurred during October to December (Bajracharya et al., 2012).Bamboo crafts can contribute 74% of the total annual household income (Das, 2002). Bamboo diversity is mainly high in eastern Nepal (from the Annapurna to the Kanchenjunga range). The rural economy is mainly dependent on bamboo and agriculture. Bamboo contributes 1-2% of Nepal's GDP (Karki & Karki, 1997). For around four million people, bamboo farming is an important source of income in southern China.

Bamboo is habitat and resource for wildlife, many birds are specialized on bamboo. Dusky headed parakeet flocks, Amazonian parrotlet flocks, Magpie tanager, blue black grosbeak and shiny cowbirds were eating the Guadua bamboo seed. A group of pale winged trumpeters were also seen on the ground to forage Guadua seed (Lebbin, 2006).11 bamboo species contribute to the red panda diet and contribute approximately 98.95% of the total diet constituent (Bista et al., 2022).Similarly, giant pandas also rely on bamboo; it consumes up to 40 kgs per day. South American spectacled bear and Madagascar bamboo lemur also rely on bamboo as a source of food (INBAR, 2019). The rarest tortoise in the world, angonoka or ploughshare tortoise (*Geochelone niphora)* which is endangered is found in the bamboo forest of western Madagascar. During the dry season the endangered mountain bongo (*Tragelaphus eurycerus isaaci)* in east Africa depends on montane bamboo thickets for both food and refuge. In June and November, shoots of bamboo can account for upto 90% of gorilla's dietary habit; a male adult can consume upto 35 kilograms in a single day while female can consume roughly 18kilograms.Four bamboo-eating rodent species from South America use bamboo patches as their primary

home, including *Dactylomys dactylinus, D. peruanus, and D. boliviensis*in the Amazon *and Kannabateomys* amblyonyx in the Atlantic Forest (Bystriakova et al., 2004). In the internodes or hollow joints of thick and fresh bamboo stem, the Lesser Bamboo Bat *(Tylonycteris pachypus)* is remarkably efficient at accessing and roosting (Shek & Chan, 2006).

Ant forage on plants for food and build a nest. Bamboo culms are part of the Neotropic ecosystem and a significant source of nesting habitat for generalist as well as specialized ants (Kohout, 1988). In most cases, arboreal ants are dependent on natural caves in vegetation for nesting because few are able to dig holes in the wood (Jolivet, 1996). Ants need nesting cavities to establish their colonies, thus they are a crucial resource that limits their ability to spread. Bamboo gives the resistant shelter and protects the colony of ants from predators and helps in growth so that bamboo patches are important for ants. Distribution of ant on bamboo may be regulated by the shape, structure, and live condition of bamboo. Live clumps are more resistant to fire, and may not break easily as compared to dead clumps, so they provide stable conditions and protect from predators (Powell, 2008) but the number of nests and ant species was higher in dead clumps than in live ones. Ant builds more nests in thick clumps as compared to thinner clum (Arrudha et al., 2015).

Total 266 bird species were recorded in the bamboo dominated forest of south west Brazil, 20 of which are strictly associated with bamboo (Guilherme & Santos, 2009). There are many bamboo specialist birds that are classified based on their diet and life strategies, the first insectivorous bamboo specialist that lives on woody bamboo may be sedentary during the long growth phase. Second, seed specialists depend on an ephemeral source of food, available after a long-time interval. Availability of bamboo seeds is unpredictable. Most of the bamboo specialist birds cannot get a preferred food source. Third one is mixed strategies that are dependent on bamboo shoot, leaves, also on bamboo seed when available. (Areta & Cockle, 2012). *Amaurospiza (*seedeaters), apparently a few *Paradoxornis (*parrotbills) and *Catamblyrhynchus diadema (*plushcap) are the bird species having mixed strategies (Bertoni, 1919).Bamboo specialist birds may feed on other sources if bamboo seed is not available; it is reported that both *S. falcirostris* and *S. frontalis* feed on seeds of Cyperaceae in forest (Olmos, 1996).

Some of the bamboo specialist birds are opportunistic exploiter and some obligate. In an area within the Amazon, Bamboo specialist insectivore were categorized as obligatory, near-obligate, or facultative bamboo experts based on the frequency of their observations in bamboo sites and their use of other habitats both onsite and over a wider area of influence. Bamboo specialists who are less specialized i.e. partial and facultative rather than obligatory and near-obligate should be able to deal with die-offs (Kratter, 1997).

Large diversity of arthropods is found in bamboo stands that attract many birds, *Myrmotherula ornata,* was found on bamboo thicket (Remsen & Parker, 1984). Rufous headed woodpeckers also forage on Amazonian bamboo (Whittakar& Oren, 1999).

Cymbilaimus sanctaemariae antshrike is a strictly bamboo specialist bird which was found only in strand of *Bambusa sps.* Antshrike is an insectivorous bird like all members of its family. Main diet are small beetles, short-horned grasshoppers, small roaches, caterpillars. Typically, the birds graze in highly dense clusters of tiny bamboo branches and leaves at a height of 8 to 12 meters above the ground. *Monasa fiavirostris, Nonnula ruficapilla, Celeus spectabilis, Automolus dorsalis, A. melanopezus, Thamnophilus murinus, Drymophila devillei, Myrmotherula ornata, Empidonax euleri, Thryothorus genibarbis*were also seen partial in bamboo stands (Pierpont & Fitzpatrick, 1983).

According to the Birdlife International (2004) White-Bearded Antshrike (*Biatas nigropectus)*is susceptible globally. The species was found on *Guadua trinii* stands. All records came from mature, thick, and continuous stands of *Guadua trinii*. Near streams and on slopes (20–60%), White-bearded Antshrikes were most frequently seen.

A few individuals of Rufous tailed antthrush *(Chamaeza ruficauda)* were discovered in mature forests with a thick *Merostachys claussenii* bamboo understory; and also in degraded forests, often with a very dense understory of *Chusquea ramosissima* bamboo (Bodrati & Cockle, 2006).

Birds seen predominantly or only in bamboo thickets include the Spinetail (*Synallaxis cabanisi*), Crested Foliage-gleaner (*Automolus dorsalis*), Manu Antbird (*Cercomacra manu*), and Dusky-tailed Ratbill (*Ramphotrigon fuscicauda*) (Parker & Ramsen, 1987).

In the North of Alta Floresta, curve-billed scythebill (*Campylorhamphus procurvoides)* species was widespread in vast bamboo thickets, and it was also documented in nearby vine-rich woodlands. Red-billed scythebill, *C. trochilirostris*, and *C. procurvoides* are closely link to bamboo. The bigger bamboo patches in the forest to the north of Alta Floresta were home to a significant number of Peruvian recurvebills (*Syndactyla ucayalae*) and *Ramphotrigon megacephala*. They forage 1-6 m above the ground in dense thickets of bamboo and mixed forest. Four specimens of Striated antbird (*Drymophila devilei*) and *Poecilotriccus capitalis* were collected in bamboo from west of Cachoeira Nazare (Parker et al., 1997).

The White-collared Foliage-gleaner (*Anabazenops fuscus)* is a common ovenbird species (Furnariidae) endemic to southeastern Brazilian rainforests (Birdlife International, 2023). *A. fuscus* forages on specific substrates of bamboo, like nodes, internodes, and dead leaves. They are bamboo specialists but not regular users. The typical method used by *Anabazenops fuscus* to feed in thick vegetation with bamboo's stalk involves rising

erect over the stem and snooping and probing in rotted and aged node. They have the ability to pound on the internodes, like a woodpecker until a hole is formed. They were found mostly in pairs and in groups (Marcos et al., 1994).

Neotropical birds of 54 genera and 102 species were classified as being linked or presumably connected with bamboo microhabitats, although these classifications were based on limited field data and were mostly based on anecdotal evidence (Parker et al., 1996). On Chiloe Island in southern Chile, the bamboo, beneath the surface is reportedly a crucial natural home of rare species of five understory birds (4Rhinocryptidae and 1 Furnariidae). S*ylviorthorhynchus desmursii, Scelorchilus rubecula, Eugralla paradoxa* are commonly associated with bamboo cover (Sieving et al., 1996). The quantity and species richness of these understory birds, which are non-migratory invertebrate-eaters with limited flying skills, decline in tiny forest remnants on Chiloe Island (Willson et al., 1994). Chucao Tapaculos (*Scelorchilus rubecula)* were the most abundant bird species in the understory of Chilean temperate forests and significantly in high bamboo plot, followed by Magellanic Tapaculos (*Scytalopus magellanicus)* and Des Murs's Wiretails *(Sylviorthorhynchus desmursii).* Maximum abundance and species richness were also greater in high bamboo plots as compared to low bamboo plots (Reid et al., 2004).

The distribution of Slate-colored seedeaters (*Sporophila schistacea)* is strongly associated with the presence of seeding bamboo, so they are bamboo specialists (Neudorf & Blanchfield, 1994).

The main goal of this study was to evaluate the diversity and composition of birds inhabiting bamboo clumps across different habitats. Specifically, the study aimed to determine the number of bird species associated with bamboo and evaluate the diversity of these bird species.

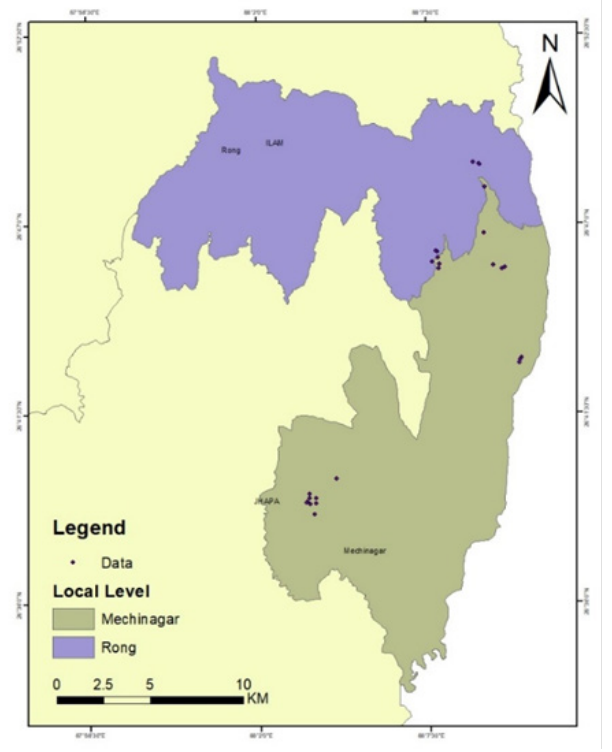
Materials and Methods

Study Area

The research has been carried out within the Rong Rural Municipality and the Mechinagar Municipality of Koshi Province, Nepal. Rong is a Rural municipality situated in Ilam district and the area coverage of this municipality is 155 sq km, with the total population of 17,367 based on the data of Nepal's Census 2021. Rong Rural municipality has India to the East, Suryodaya Municipality to the North and West and Jhapa District to South direction. Rong has great biodiversity; it has lots of opportunities for eco-tourism. Lots of moths, butterflies, birds are found in the Salakpur area of Rong Rural Municipality.

Figure 1

Map showing Study area and sampling point.



Mechinagar municipality, located in Jhapa district, has a total 15 wards. Birtamodand Arjundhara Municipality lies in the west direction of Mechinagar Municipality where Rong Rural municipality/Ilam District and Buddha Shanti Rural Municipality liesin the northern part followed by Bhadrapur Municipality in the southern part. The eastern part is surrounded by West Bengal, India. The area coverage of this municipality is 193 sq km with the total population of 133,073based on the data of Nepal's Census 2021.

Climatic Condition

Ilam has a subtropical climate with a minimum temperature of 0 degree Celsius to maximum 31 degree Celsius. Ilam is charming because it is unspoiled by modernity, pollution. In winter, there is much less rainfall in Ilam than in summer. The annual precipitation in this location is approximately 3194 mm.

Mechinagar Municipality is located on the Indo-Gangetic plain and Churia low hills. Because of its nearness with the low Himalayas, it experiences year-round mild weather and has a good distribution of seasonal monsoon. The annual precipitation of

Jhapa district is 250-300 cm.

Study Design

Three habitats were selected for sample collection of birds, like bamboo found in forests, bamboo found near human habitats, and bamboo found near agricultural areas. The point was selected from Google Earth Pro and the study was carried out in June 2023 A.D. A field visit was done prior to the data collection. Data was collected according to the selected point or nearby points.

Data Collection Methods

The primary data was gathered through field studies with the help of binoculars and the bird guidebook of Grimmett et al. 2016. The point count method was used for the data. The point count method is a widely used approach for surveying birds in different land use types, commonly used for bird surveys in tropical forests (Lee & MARSDEN, 2008).Point counts are frequently employed as a crucial technique to examine habitat relationships, bird diversity and abundance, and population responses to environmental changes or management (Thompson, 2002).In a point count, an observer uses binoculars to count all birds heard or observed over the course of a certain amount of time while standing at a particular place, often along a roadside. This technique is applied to species that very noticeable or communicative.

The study was carried out during monsoon season from 12 June to 20 June 2023 A.D. Total 29-point count locations (10 from bamboo clumps found in forest, 10 from agricultural fields, and 9 from bamboo clumps found near human settlement area) were chosen and noted every bird heard and spotted at every location. Using a field guidebook and merlin mobile application, the direct observation method was employed to identify the species. The counting process of species were conducted between 6:30 to 11:30 am. Four minutes of time was spent on each location. GPS (e-trex 10) used to mark the location of the plots. Recorded bird species are classified on feeding behavior. Records of Birds that are fed and stay on bamboo strands are kept. Flying over bamboo is excluded. Repeated observation of the same species was not counted. Each plot was surveyed two times.

Data Analysis

The data collected from survey were examined through one way Anova, Bar Diagram and tables in MS Excel. Shannon- Weiner (H) diversity index of the birds was calculated.

Shannon-Weiner (H) Diversity Index

The Shannon- Weiner Diversity Index H'(Shannon & Weaver, 1964) is widely used in ecology to quantify the diversity in community. According to this index, higher

the number of species, higher will be species diversity and lower the H' values suggest dominance by few species. It assumed that every species is represented in the sample and that individuals are drawn at random from a huge independent population. It's frequently applicable to compare diversity between different environments and across historical moments. The bird species' alpha diversity was determined using this index. It was calculated using Shannon-Weiner Diversity formula,

$$H = -\sum Pi * Ln(Pi)$$

Where, H is species diversity index, Pi is proportion of individuals in the i_{th} species ($Pi = n_i / N$), n_i is no. of individual species, N is sum number of individuals.

Species richness provides the existence of all bird species found in a specific location. Species richness is denoted by (S) and simply calculated as,

Species richness (S) = total number of species found in particular area

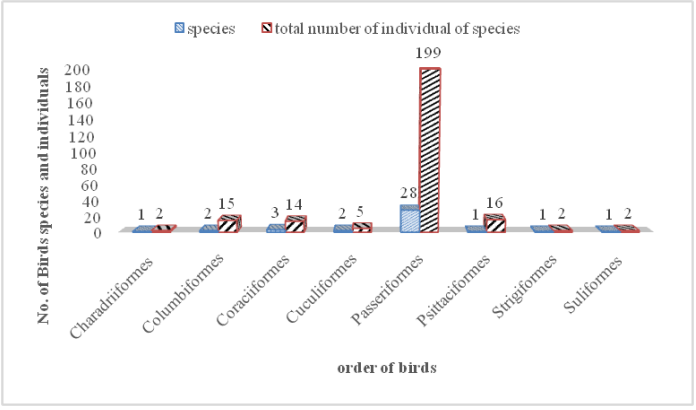
Results

Diversity

A total 255 individuals (39 species) of birds belongs to 28 families and 8 orders were listed on bamboo clumps of study sites. Amongst the listed birds, 28 bird species came under Passeriformes (199 individuals), three species (14 individuals) belong to Coraciiformes, 2 species fall under columbiformes (15 individuals), 2 species under Cuculiformes(5 individuals), 1 species belongs to Psittaciformes (16 individuals), Strigiformes (2 individuals), Suliformes (**Figure 2**).

Figure 2

Total Number of orders, species and individuals listed.

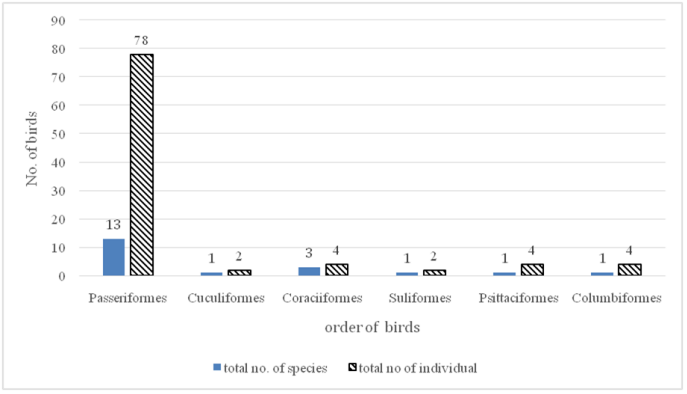


Similarly the highest number of birds species (5 species-66 individual) belongs to the family Sturnidae, 4 species belongs to the Corvidae, 3 species belongs to the Pycnonotodae, Cuculidae, Columbidae, Muscicapidae and Monarchidae (2 species), Alcedinidae, Artamidae, Campephagidae, Charadriidae, Cisticolidae, Dacelonidae,

Dicruridae, Hirundinidae, Laniidae, Leiotrichidae, Meropidae, Nectariniidae, Oriolidae, Parulidae, Phalacrocoracidae, Psittacidae, Scisticolidae, Strigidae, Sylviidae (1 species).

Figure 3

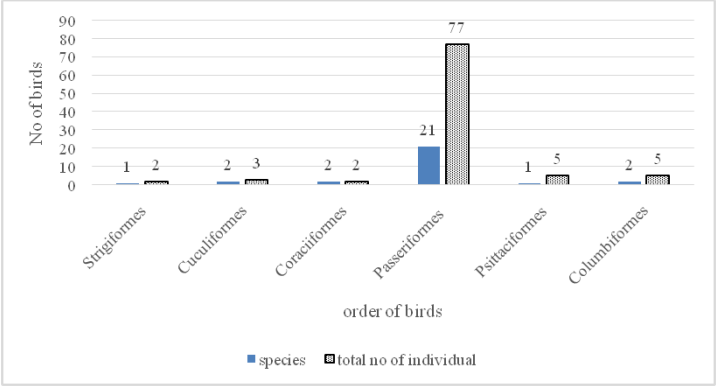
No. of bird's species and individuals found on bamboo clumps in agriculture area.



Similarly, altogether 94 individual (29 species) of birds belongs to 20 families and 6 orders were listed on the bamboo clumps found in the forest area. Among the recorded birds 21 species belong to order Passeriformes, 2 species belong to Cuculiformes, Coraciiformes, Columbiformes and 1 species belongs to Psittaciformes (**Figure 3**).

Figure 4

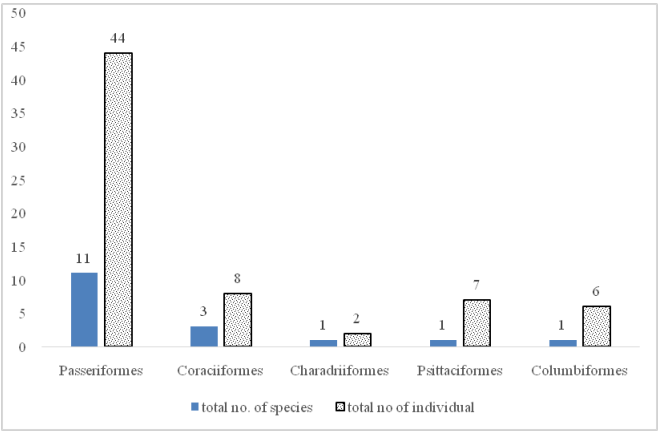
Total number of species and individuals found on bamboo clumps in forest area



94 individuals (20 species) of birds belongs to 17 families and 6 orders were listed on bamboo clumps found in agricultural areas, among the recorded data 13 species belong to the order Passeriformes, 3 species belong to Coraciiformes and 1 species belong to Cuculiformes, Suliformes, Psittaciformes, Columbiformes (**Figure 4**).

Figure 5

Number of bird species and individuals found on bamboo clumps near human settlement area



Similarly, 67 individuals (17 species) belonging to 15 families and 5 orders were recorded from the bamboo clumps found near the human settlement area. Among the recorded data 11 species (44 individuals) belong to Passeriformes, 3 species belong to Coraciiformes, 1 species belong to Charadriformes, Psittaciformes, Columbiformes (**Figure 5**).

In the study area 14 species were the visitors and 25 species were residents. More number of individuals (212 individuals) are resident birds (**Table 1**). 8 species were the visitor's birds found on the bamboo in forest area with a total of 15 individuals, and 21 species with 79 individuals were found resident. Similarly, 6 visitor bird species were found in agriculture areas. Resident bird species were higher in different habitats.

Table 1

Birds species accounts found in study area.

Species account	No. of species	No. of Individuals
Visitor	14	43
Resident	25	212

Table 2

Species richness along with diversity of birds found in bamboo clumps of different habitat.

Birds Habitat	Species Richness	Number of Individual	Shannon's Index(H')
Found in Bamboo near human settlement	17	67	3.15

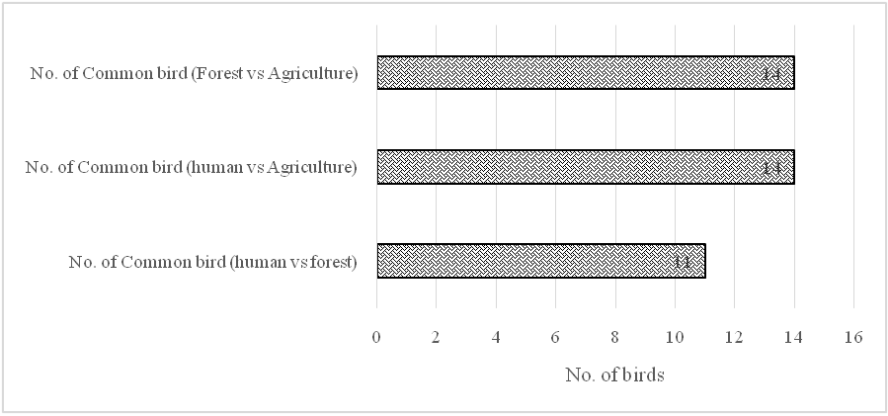
Found Bamboo in forest	29	94	3.59
Found near agriculture	21	94	3.43

In the study area, maximum richness was found in the forest area (29 species), while birds found in bamboo clumps near human settlements is low i.e.17 species (**Table 2**).The P value from One-way Anova was found 0.203688 which means that there is no significance difference between diversity of birds on different habitat.

11 bird species, *Pycnonotuscafer*, *Aegithina tiphia*, *Psittaculakrameri*, *Acridotheres tristis*, *Halcyon smrynensis*, *Spilopelia chinensis*, *Halcyon malimbica*, *Oriolusxanthornus*, *Copsycussaularis*, *Pericrocotusspeciosus*, and *Argya striata*were found common in both forest areas and on bamboo found near human settlement areas. 14 bird species were common in both habitats i.e., bamboo found near human settlements and agricultural areas; similarly, 14 species are common in bamboo clumps found in forest areas and agricultural areas (**Figure 6**).

Figure 6

Number of common birds found on different habitat.

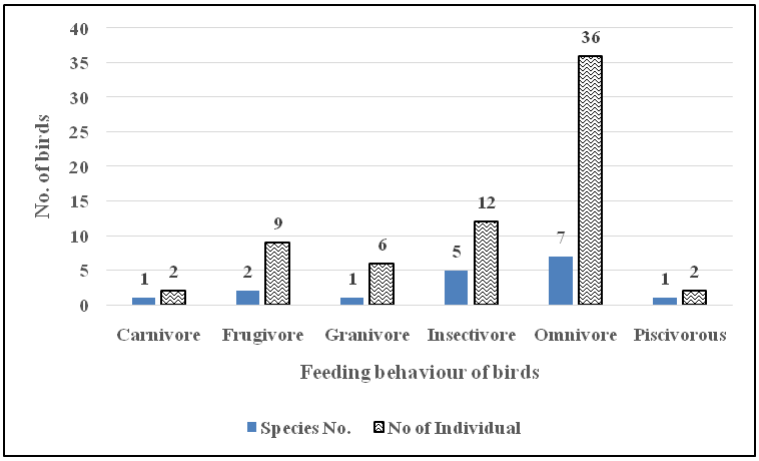


Feeding Behavior

Most of the bird species found on bamboo near human settlement areas were omnivorous birds,7 species were found omnivorous with 36 individuals, 5 species (12 individuals) were found insectivorous, 2 species (9 individuals) were found frugivorous, 1 species (2 individuals) were carnivores and piscivorous (**Figure 7**).

Figure 7

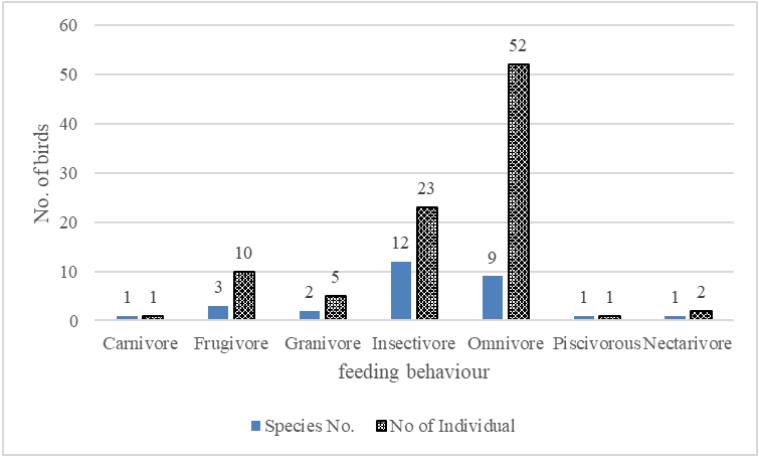
Feeding Behavior of birds found on bamboo clumps near human settlement area.



In agricultural areas, 7 species (20 individuals) of birds were found to be insectivorous, 6 species (56 individuals) were omnivorous, and 1 species (4 individuals) were granivorous.

Figure 8

Feeding behavior of birds found on bamboo clumps in forest.



In the forest areas, 12 species (23 individuals) were found to be insectivores; 9 species with 52 individuals were found to be omnivorous (**Figure 8**).

Discussions

The purpose of this research was to assess the diversity and species richness of avians in relation to the various kinds of habitat and to examine their habitat associations.

It's possible that different plant types and abundant food are the primary causes of the differences in habitat preferences across bird species. The diversity and habitat preferences of birds are connected to their species richness (Rompre et. al., 2007). According to (Wiens & Rotenberry, 1981) birds depend on vegetation for their habitat because it offers them chances for foraging, a variety of food sources, cover for nesting, and other circumstances necessary for successful reproduction. Certain bird species are limited to particular environments, such as agricultural fields, bushes, or forests. As a result of these habitat ranges providing different types of food for different birds, they are dispersed unevenly throughout the research area. In this study a greater number of omnivorous birds were found.

The majority of species were noted to be present in forests and agricultural regions (Murcia, 1995), A similar result was found in this study, 29 species found in forest area and 21 species found in agriculture area. Rimal (2006) found higher species richness in undisturbed forests than in disturbed ones. Most of the cultivated areas have high food availability and have a high edge effect with high diversity. A wider variety of Agroecosystems promotes a higher diversity of insects, which in turn benefits the existence of insectivorous bird species.

Standing crops also provide shelter to a variety of resident birds and attract migratory species (Sivaperuman et al., 2007). Variations may also be changed by environmental conditions that have a straight effect on bird's diversities and the number of individuals. Increasing the distance to the nearest water source showed a significant decrease in species richness and abundance of bird species (Tilghman, 1987). The grassland, with some forests and wetland habitats, supports a significantly high population of avian fauna in Nepal (Baral & Inskipp, 2005). In this study most of the bamboo clumps found near water sources and bird richness was high in forest area.

Some residential birds, like the Spotted Dove, Common Myna (*Acridotheres tristis*) etc., were noted to have a large population. Previous studies (Inskipp, 1989) have shown that species richness decreases from natural forest to agricultural land in different protected and unprotected areas of Nepal, a similar result was found in this study.

Red-vented Bulbul (*Pycnonotus cafer*), Rufous Treepie *(Dendrocittava gabunda)*, Rose-ringed Parakeet (*Psittacula krameri*), Black Drongo (*Dicrurus macrocercu*s), Oriental Magpie Robin (*Copsychuss aularis*), White-throated Kingfisher (*Halcyon smyrnensis*), etc. were quite prevalent in the corridor. Similarly, Black Drongo (*Dicrurusmacrocercus*), was also often found in the residential and corridor areas. Since the availability of diverse habitats for nesting and foraging, residential areas also support

a large number of bird species. According to research conducted in Bagmati river area, there are few birds in populated regions due to excessive disturbance, development and building processes, and vehicle-related sounds that create threats to bird species. Human settlement at some levels might limit avian productivity by diminishing resources, increasing nest predation, competition for resources, and brood parasitism (Marzluff et al., 2012). In this study 17 species with 67 individuals was found in human settlement area which is low as compared to the forest and agricultural areas.

In our study agricultural fields had high number of insectivorous and omnivorous birds. Insectivorous birds are drawn to the abundance of crops, vegetables and vegetable waste that are grown because they can serve as food sources for insects, frogs, lizards, mice. According to (Dyrcz & Flinks, 1995) large numbers of insectivorous birds feed on arthropods.

Omnivore birds can use a variety of accessible resources. Due to their diverse feeding habits and adaptability, Omnivorous birds have a wider range of choices. As a result, the diversity of omnivorous birds was high. Because of the fewer fruiting trees, there were lower number of frugivorous birds in the researched sites.

In this study, the order Passeriformes has the greatest number of observed birds. Globally, the order Passeriformes has a wider distribution and a higher population (Zeleke et al., 2015). The study conducted by (Chaudhari et al., 2009) the highest number of species from Passeriformes order in Khata Corridor Forest, Nepal. Passeriformes was also numerically the dominant order in the study carried out by (Jemal & Dalu, 2019) in Nansebo Forest, Southern Ethiopia. Previous studies (Kafle et al., 2008) have indicated a low abundance of birds in settlement areas because of high disturbances, construction activities, and noise due to vehicles, which pose a threat to birds. Photosynthetic activity and rates of biological processes in the environment can be changed by precipitation and temperature, which will influence birds' physiological tolerances (Hurlbert & Haskell, 2003).

Conclusion

On the basis of the study, a total 255 individuals from 39 bird species under 28 families and 8 orders were reported on bamboo clumps found in different habitat of the study area. The finding reveals that the bamboo clumps in forest area supports the highest species richness compared to only 17 species found near human settlements. This suggests that forested environments are crucial for maintaining higher level of avian diversity. Dominant order identified was Passeriformes which included 28 species with 199 individuals. Within the bamboo clumps Sturnidae was family was particularly prominent with 5 species.

The study also highlighted variations in feeding strategies among different habitat

where 7 species of omnivorous bird species were found near human settlement area, while agricultural areas hosted 7 species of insectivorous bird species with 20 individuals. In contrast the forest area demonstrated a richer insectivore presence with 12 species and 23 individuals. The P value was found 0.203688 which mean that there was no difference in diversity of birds on bamboo clumps founds in three habitats i.e. near human settlement area, forest area and agriculture area. Hence, the study highlights the importance of conserving these ecosystems to supports avian population and promote bamboo farming in rural area with mixed forest strategy also study area had great potential of Avi-tourism because we found high diversity.

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