Bird diversity along an elevational gradient in Shivapuri Nagarjun National Park, Nepal

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Abstract
Shivapuri Nagarjun National Park (SNNP) plays an important role in global biodiversity conservation, but research based on avian diversity along elevation gradients has not been studied yet. Therefore, this study aims to explore avian diversity, its pattern, and environmental variables affecting bird species richness along elevation gradients. The point count method was carried out in the monsoon season (June and July) in 2019. Data for environmental variables including elevation, distance to settlement, distance to nearest water sources, temperature, and precipitation were assessed with respect to the feeding guild. A total of 130 species of bird belonging to 40 families and 12 orders were recorded including the Steppe eagle (endangered species) and Spiny Babbler (only endemic bird of Nepal), which indicate that SNNP supports avian diversity. Diversity indices showed diverse bird community assemblage such as the Shannon-Weiner diversity index (H'=2.65), Simpson diversity index (0.92), and evenness index E=0.94. Our study revealed insectivores were dominating among others and the order Passeriformes had the high species richness. Our observation revealed that the bird species richness was significantly greater at lower elevations than at mid and high elevations, showing a clear monotonic decline in species richness and diversity with increasing elevation. In the case of feeding guild (insectivores, omnivores, frugivores, and carnivores), most of the bird species showed a significant relationship with environmental variables (elevation, distance to settlement, distance to nearest water sources, temperature, and precipitation). It was concluded that not only environmental factors are responsible for affecting avian diversity but elevational gradients consisting of heterogeneous habitats can also play an important role in shaping avian diversity patterns.

Keywords: Diversity, elevation, environmental variable, feeding guild, monotonic

Introduction
Bird diversity act as a strong bio-indicator signal (Bhatt and Joshi, 2011). They represent the health of ecosystem as they are sensitive to environmental change and status of biodiversity as a whole (Chettri, 2010; Pierson, Barton, Lane and Lindenmayer, 2015). Understanding the different species including bird diversity is an integral part of biodiversity conservation (Kremen, 1992). An extensive study on diversity of bird have been done in global label (Hawkins and Porter, 2001; McCain, 2009). The existence of an elevational gradient of species richness has long been recognized and been studying in ecology (Lomolino, 2001; Stevens, 1992). Bird species richness along the elevational gradient has been found to reveal four distinct patterns i.e. decreasing richness with increasing elevation, low-elevation plateaus, low-elevation plateaus with mid elevational peak and mid-elevational peaks (McCain, 2009). Among them,

DOI: https://doi.org/10.3126/on.v21i1.50756

Manuscript details: Received: 21.07.2022 / Accepted: 23.11.2022


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the most common patterns seem to be either decreasing richness with increasing elevation or a hump-shaped pattern, in which diversity peaks at mid-elevations (McCain, 2009; Rahbek, 1995, 2005). Several factors like climate, productivity, mass effects, species-area relationships, Mid-Domain Effects, geomorphic constraints, evolutionary history, habitat structure and human-induced disturbances play an important role in avian elevational diversity pattern (Colwell, Rahbek and Gotelli, 2004). Species richness and the composition of birds often change rapidly with elevation (Blake and Loiselle, 2000; Williams, Shoo, Henriod and Pearson, 2010) which makes these gradients well suited for studying the responses of bird communities to different environmental factors (Korner, 2007; McCain, 2009).

The study of avian diversity, corresponding to their feeding guilds plays an important role in understanding the complexity of ecosystem structure and also provides information on different types of habitats (Azman et al., 2011). Knowledge of feeding guild is important for improving effectiveness in maintaining bird diversity (Li et al., 2019). Variation in vegetation structure affects the distribution of bird diversity and their feeding guilds (Pearman, 2002). Some birds, especially insectivores, are habitat specialists and are sedentary (Hu et al., 2018; Zhang, Kissling and He, 2013).

Understanding the relationship between species richness and different environmental factors is an integral part of avian conservation and protection (Mittelbach et al., 2001). The greatest number of bird diversity was recorded in slopes which consist of heterogeneous habitats and monotonic decline in species richness in the Central Himalayas (Basnet, Rokaya, Bhattarai and Münzbergová, 2016). Bird species richness in Eastern Himalaya gradient was high at mid-elevational range and was found significantly correlated with primary productivity and habitat suitability (Acharya, Sanders, Vijayan and Chettri, 2011). In Western Himalayas of Uttarakhand showed hump-shaped elevational richness and was significantly correlated with species richness and vegetation structure (Joshi and Bhatt, 2015). Climatic variables are also considered the main driver of bird diversity (McCain, 2009) and temperature shows a distinct pattern which gets decreases with increasing altitude, which directly affects the physiological tolerance of birds (Currie et al., 2004; Pan et al., 2016).

Out of 886 species of birds recorded from Nepal, Shivapuri Nagarjun National Park (SNNP) consists of 318 species of birds (BCN and DNPWC, 2018), which indicate SNNP as an Important Birds and Biodiversity Area (IBA) (Baral and Inskipp, 2005). Diversity and distribution of birds have been immensely studied in national parks, including SNNP. Though, SNNP is rich in avian diversity, but research based on elevational gradient has not been explored yet, therefore this study aimed to (i) explore avian diversity along the elevational gradient (ii) assess the elevational pattern of birds and bird response to different environmental variables affecting the richness pattern.

Materials and Methods

Study area
The study was conducted in SNNP from an initial point carried out at Sundarijal (27° 45’ N and 85° 25’ E) along with elevation gradient ranging from 1350 m to 2732 m (Peak). The SNNP was established in 2002 and is located in the country's mid-hills on the northern fringe of the Kathmandu valley and named after Shivapuri Peak of 2,732 m altitude. It covers an area of 159 km² (144 km² designated as Shivapuri forest and 15 km² as Nagarjun forest). The floral composition of the park has been categorized into four types viz. i) lower mixed hardwood forests ii) chirpine forests, iii) oak forests and iv) upper mixed hardwood forests. The major plant species found are Schima wallichii, Castanopsis indica, Pinus roxburghii, Myrica esculenta, Pyrus pasia, Rhododendron arboreum, Juglans regia and Quercus sp. (SNNP, 2010).
Bird survey

Bird survey was carried out using point count method (Bibby, Burgess, Hill and Mustoe, 2000) which has been widely used for bird surveys. Observer records all birds detected (seen or heard) within a fixed point in a center (Petit, Petit, Saab and Martin, 1995; Ralph, Sauer and Droge, 1995). Bird count was conducted in the monsoon season from 15 June to 10 July 2019. A total of 15-point count locations were made in every 100 m altitudinal differences by using Garmin Etrex 10 GPS. The birds were observed for 10-20 min in each point count by using binoculars (10×50 wide angle) and photographs were taken using Nikon P1000 camera. Birds observed and heard within a 50 m radius were recorded from a fixed point. Incorporating a longer count period is advantageous in subtropical forests where many birds are cryptic and the vegetation structure birds may be hard to locate (Riley, 2003). Bird count was done from 6:30 a.m. to 11 a.m. in morning and 4 p.m. to 7 p.m. in evening under favorable condition. This time was the most efficient time for birders because most birds start foraging early in the morning after long sleep at night and in the evening before returning to their nests. For identification, nomenclature and systematic order of birds, field book Birds of Nepal (Grimmett, Inskipp, Inskipp and Baral, 2016) was used. Environmental variable like Distance to settlement (DTS) and Distance to the nearest water surface (DTW) was measured by using Google earth. The climate data of resolution 1km×1km on mean monthly precipitation and mean monthly temperature based on the coordinates of bird-count points were extracted from the World Clim database (https://www.worldclim.org/bioclim).
Data analysis

The data collected after the bird survey was interpreted and classified into four feeding guilds based on diet described in (Dangaura, Pandey, Chand and Bhusal, 2020; Katuwal et al., 2018) as insectivores (feeding predominantly on insects, larvae, worms, spiders), omnivores (feeding on both plants and animals), frugivores (feeding on fruits, berries, figs, drupes and nectars), and carnivores (feeding on fishes, amphibians, reptiles, birds and mammals). Birds were classified as residents, summer visitors, winter visitors and passage migrants based on (Grimmett et al., 2016). Shannon-Weiner (H) diversity index, Simpson diversity index and evenness index for the diversity of the birds were calculated by using PAST (V.3.04). Species response to elevation and environmental variations was established by Generalized Linear Model (GLM).

Results

Bird diversity

A total of 841 individuals of 130 bird species belonging to 40 families and 12 orders were recorded by point count method in the SNNP including Steppe Eagle (endangered species) and the only endemic bird of Nepal, Spiny Babbler (Annex I). Out of the 12 orders, order Passeriformes had the highest species richness (96) which alone occupied (73.84%) of total bird species, followed by Piciformes (7), Cuculiformes (7), whereas Pelicaniformes, Falconiformes and Galliformes had least bird species (1). Similarly, the highest number of bird species belong to family Muscicapidae (23) followed by Cuculidae (7), and Corvidae (7) (Figure 2). Guild structure analysis revealed that insectivore was the abundant guild (71) followed by omnivore (34), frugivore (16) and carnivore (9) (Figure 3). Resident species (106 species) had highest species richness followed by summer visitors (19 species), winter visitors (3 species) and passage migrants (2 species).
### Table 1. Bird species richness along elevational gradients

<table>
<thead>
<tr>
<th>Site (Elevation)</th>
<th>Species richness</th>
<th>Shannon Wiener index (H’)</th>
<th>Simpson Diversity Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sundarijal (Total)</td>
<td>130</td>
<td>2.65</td>
<td>0.92</td>
</tr>
<tr>
<td>S1 (1300m asl)</td>
<td>20</td>
<td>2.996</td>
<td>0.95</td>
</tr>
<tr>
<td>S2 (1400m asl)</td>
<td>25</td>
<td>3.219</td>
<td>0.96</td>
</tr>
<tr>
<td>S3 (1500m asl)</td>
<td>18</td>
<td>2.89</td>
<td>0.94</td>
</tr>
<tr>
<td>S4 (1600m asl)</td>
<td>16</td>
<td>2.773</td>
<td>0.94</td>
</tr>
<tr>
<td>S5 (1700m asl)</td>
<td>22</td>
<td>3.091</td>
<td>0.95</td>
</tr>
<tr>
<td>S6 (1800m asl)</td>
<td>12</td>
<td>2.485</td>
<td>0.92</td>
</tr>
<tr>
<td>S7 (1900m asl)</td>
<td>18</td>
<td>2.89</td>
<td>0.94</td>
</tr>
<tr>
<td>S8 (2000m asl)</td>
<td>12</td>
<td>2.485</td>
<td>0.92</td>
</tr>
<tr>
<td>S9 (2100m asl)</td>
<td>18</td>
<td>2.89</td>
<td>0.94</td>
</tr>
<tr>
<td>S10 (2200m asl)</td>
<td>19</td>
<td>2.944</td>
<td>0.95</td>
</tr>
<tr>
<td>S11 (2300m asl)</td>
<td>12</td>
<td>2.485</td>
<td>0.92</td>
</tr>
<tr>
<td>S12 (2400m asl)</td>
<td>10</td>
<td>2.303</td>
<td>0.90</td>
</tr>
<tr>
<td>S13 (2500m asl)</td>
<td>11</td>
<td>2.398</td>
<td>0.90</td>
</tr>
<tr>
<td>S14 (2600m asl)</td>
<td>9</td>
<td>2.197</td>
<td>0.89</td>
</tr>
<tr>
<td>S15 (2700m asl)</td>
<td>7</td>
<td>1.946</td>
<td>0.86</td>
</tr>
</tbody>
</table>

In case of distribution pattern, monotonically decrease in species richness with increasing elevation was observed (Figure 4). Bird species richness was significantly higher at 1400m asl and lower at 2700m asl. Various diversity indices were calculated and found Shannon-Weiner diversity index (H’=2.65) was observed in Sundarijal. Similarly, Simpson diversity index was (0.92) and evenness index was (E=0.94) indicating diverse bird assemblage. Site-wise diversity indices revealed that highest diversity was found in point count site 2 at 1400m asl.

![Figure 4. Distribution pattern of bird species richness along elevational gradient in SNNP.](image-url)
Environmental factors affecting diversity
From the Generalized Linear Model (GLM), avian richness differed significantly with altitude, DTS, DTW, temperature and precipitation. For instance, insectivorous species richness showed significant relationship with altitude, DTS, temperature and precipitation. Similarly, omnivorous species richness showed significant relationship with altitude and temperature. Frugivorous species richness showed significant relationship with altitude, DTS, temperature and precipitation. In case of carnivorous species altitude, DTW, temperature and precipitation showed significant relationship.

Table 2. Generalized linear model (GLM) with normal distribution and identity link function test showing the effects of different environmental factors on avian richness pattern. Values marked in italics are statistically significant at P < 0.05.

<table>
<thead>
<tr>
<th>Species</th>
<th>Variables</th>
<th>Slope</th>
<th>Intercept</th>
<th>P-value</th>
<th>Age</th>
<th>Age</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total species</td>
<td>Altitude</td>
<td>-0.00928</td>
<td>33.705</td>
<td>0.005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DTS</td>
<td>-129.33</td>
<td>2832.7</td>
<td>&gt;0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DTW</td>
<td>-123.06</td>
<td>2325.7</td>
<td>&gt;0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>0.239</td>
<td>11.597</td>
<td>&gt;0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Precipitation</td>
<td>1.6176</td>
<td>173.05</td>
<td>&gt;0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Altitude</td>
<td>-0.00225</td>
<td>11.3</td>
<td>&gt;0.041</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insectivores</td>
<td>DTS</td>
<td>-309.2</td>
<td>2978.2</td>
<td>0.005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DTW</td>
<td>47.123</td>
<td>647.23</td>
<td>0.688</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>0.380</td>
<td>12.635</td>
<td>&gt;0.035</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Precipitation</td>
<td>3.474</td>
<td>173.91</td>
<td>&gt;0.011</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Altitude</td>
<td>-0.002214</td>
<td>9.2952</td>
<td>&gt;0.006</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Omnivores</td>
<td>DTS</td>
<td>-245.64</td>
<td>2071</td>
<td>0.127</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DTW</td>
<td>-107.3</td>
<td>1489.3</td>
<td>0.457</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>0.509</td>
<td>12.745</td>
<td>&gt;0.020</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Precipitation</td>
<td>3.1714</td>
<td>182.1</td>
<td>0.092</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Altitude</td>
<td>-0.003571</td>
<td>9.8762</td>
<td>&gt;0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frugivores</td>
<td>DTS</td>
<td>-259.22</td>
<td>1584.1</td>
<td>&gt;0.023</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DTW</td>
<td>-177.18</td>
<td>1452</td>
<td>0.085</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>0.5312</td>
<td>13.772</td>
<td>&gt;0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Precipitation</td>
<td>3.2579</td>
<td>188.63</td>
<td>&gt;0.014</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Altitude</td>
<td>-0.00125</td>
<td>3.2333</td>
<td>&gt;0.004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carnivores</td>
<td>DTS</td>
<td>-438.54</td>
<td>1197.2</td>
<td>0.194</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DTW</td>
<td>-506.9</td>
<td>1339.4</td>
<td>&gt;0.048</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td>1.482</td>
<td>14.137</td>
<td>&gt;0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Precipitation</td>
<td>7.482</td>
<td>14.137</td>
<td>&gt;0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discussion
A diverse bird community was observed in SNNP during this study period. However, the number of bird species recorded in this study seemed low compared to the record of 318 species found in SNNP (BirdLife Nepal, 2018) which is the official checklist of birds that covers all sites of SNNP in all four seasons over a long period of time but our study was only limited in one trekking trail i.e., Sundarijal and only covers monsoon season. Insectivores were the most abundant species feeding guild in SNNP which is supported by many other studies on birds (Katuwal et al., 2016; Neupane, Khanal, Gyawali and Chalise, 2020; Pandey, Khanal, and Chalise, 2020). Bird Species belonging to Order Passeriformes were numerically most abundant in SNNP which is similar to study done by (Husein and Sultan, 2009) in mountainous landscape in Nansebo Forest of Southern Ethiopia as well as (Jha, 2020) in Nagarjun forest of SNNP revealed same result. Diversity indices were calculated and found that lower elevations have
dive bird community compared to higher elevation. Diversity indices of whole study area showed diverse bird assemblage with decrease in species richness with increasing elevation in SNNP. A similar pattern was also observed in other studies (McCain, 2009; Neupane et al., 2020; Rahbek, 1995; Santhakumar, Arun, Sony, Murugesan and Ramesh, 2018). This is due to significant decrease in plant species richness with increase in elevation along sub-tropical gradient in the Himalayas which had provided different habitats for various avian species (Bhattarai, Vetas and Grytnes, 2004). Decline in species richness was found to have been associated with decline in forest area at higher elevations due to declines in abundance and distribution of invertebrates, competition for life essence and changes in environmental conditions (Janes, 1994). Pan et al., (2016) revealed that the species richness of overall birds are positively correlated with forest habitat, productivity and habitat heterogeneity. According to the study done by (Fleishman, Austin and Weiss, 1998) in butterfly and (Fisher, 1996) in ant species also revealed monotonic decline in species richness as elevation increases, which directly (food) or indirectly (pollination) justifies the monotonic decline in avian species richness as elevation increases.

But a few studies revealed higher species richness at mid elevational range in compared to lower and higher elevations (Ding et al., 2019; Hu et al., 2018; Pandey et al., 2020). Similarly, the present study also recorded higher species richness at 1700m, 1900m and 2200m. This is due to the human settlement with agricultural field which provides very relevant source of food to many birds in the form of fruits, grains, insects, rodents, etc. that helps in increasing bird richness (Chettri, Deb, Sharma and Jackson, 2005). Agricultural land and human settlement area have played an important role as habitat, shelter and resources to species (Ferger, Schleunig, Hemp, Howell and Böhning-Gaese, 2014; Schaub et al., 2010). Due to less productive environment at higher altitudes cause a decline in abundance and distribution of invertebrate resources leads to lack of food items for birds and favors a very low number of species (Blake and Loiselle, 2000; Hu et al., 2018).

In case of environmental variables and their relationship with avian diversity, total species of birds showed significant relationship ($P < 0.05$) with all the environmental variables such as altitude, DTS, DTW, Temperature and Precipitation. It was found that most of the environmental variables of subtropical region along the elevation gradient show positive significant relationship with avian diversity (Chettri et al., 2005; Pandey et al., 2020). Specifically, (McCain, 2009) revealed the positive relationship between temperature and bird diversity, in shaping bird diversity along elevational gradients. Previous study showed that temperature is not the only climatic factor affecting bird diversity patterns (McCain, 2009; McCain and Grytnes, 2010) but precipitation also plays important role in shaping biodiversity in tropical ecosystems (Hawkins and Porter, 2001). Similarly, (Fraga, 1989) revealed that habitat having disturbed area like agricultural field may have the higher number of flowering plants, different fruiting plants under open conditions which attract frugivore bird. As well (Elphick, Taft and Lourenço, 2010; Laiolo, 2004) also revealed agricultural field, cultivation of rice, wheat and corn greatly attract granivore birds so they mostly prefer farm land consisting agricultural field due to easy access to food. But in case of feeding guilds (different feeding habitat), such as insectivore, omnivore, frugivore and carnivore shows variable relationships with their surrounding environment. For instance, insectivorous and frugivore birds had shown a significant relationship ($P < 0.05$) with most of the environmental variables except DTW. This is due to the fact that, during the study period, there was an adequate rainfall (monsoon period) which have made water availability more prominent around themselves then to depend upon major nearby water sources (Studds and Marra, 2011). In case of frugivore, they fed on fruits such as berries (blueberries, raspberries, mulberries, etc.) which are usually rich in water content (Pesotskaya, Chaplygina, Kratenko and Shupova, 2020).

Similarly, carnivorous bird species richness had also shown a significant relationship with most of the environmental variables except DTS which did not showed significant relationship with bird species. This might be due to lack of food availability around or near settlements as human either bury or throw the dead carcasses (domestic animals) far away from their settlements. According to (MacGregor-Fors, Morales-Pérez and Schondube, 2011) bird species richness values were approximately 30% lower in human settlements.
than in shrub lands. As well (Samia, Nakagawa, Nomura, Rangel and Blumstein, 2015) revealed that human alters the prey distribution of carnivore bird species which reduced foraging efficiency of carnivore birds as well as they are less tolerant to human. But in case of omnivorous bird species, they had showed a positive relationship ($P < 0.05$) with only few of the environmental variables such as altitude, precipitation and Temperature. This is because omnivores have diverse kind of feeding habit like insects, crops, ripen fruits, nuts or grains according to available limited resources and conditions which allows them to have a broad range of choices and take advantage of more food sources for better survival (Abbas et al., 2019). The wide dietary range of omnivorous birds allows them to adapt easily to other food source, if their preferred food sources become scarce (Azman et al., 2011) and showed significant relationship in avian richness and diversity patterns. However, during our study period, the study area was highly disturbed due to heavy construction (dam), settlements and frequent trekking activities which might affect the bird diversity. Thus, proper habitat conservation and integrated management should be implemented along the trekking trails and human settlement which plays vital role in sustaining avian diversity and their natural habitats for future generations.

Conclusion
This study highlights the avian diversity along elevational gradients in SNNP which act as a IBAs. The assemblage of avian species richness in SNNP displayed decrease in species richness pattern with increasing elevational gradients. Elevational gradients not only supports species richness due to heterogenic habitats but also different species belonging to different feeding guild. Similarly, environmental variables like altitude, temperature, precipitation, DTS and DTW play an important role of the Kerian River Basin, Perak, Malaysia. Tropical Life Sciences Research, 22(2): 45.


doi:10.1371/journal.pone.0158362


McCain, C. M. and J.A. Grynnes 2010. Elevational gradients in species richness. eLS.


Riley, J. 2003. Population sizes and the conservation status of endemic and restricted-range bird species on Karakelang, Talauld


Appendix 1. Check-list of bird with common name, scientific name, family, order, residential status and feeding guild.

<table>
<thead>
<tr>
<th>Bird species</th>
<th>Scientific name</th>
<th>Family</th>
<th>Order</th>
<th>Sp account</th>
<th>Feeding guild</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian koel</td>
<td>Eudynamys scolopaceus</td>
<td>Cuculidae</td>
<td>Cuculiformes</td>
<td>Resident</td>
<td>Omnivore</td>
</tr>
<tr>
<td>Ashy wood pigeon</td>
<td>Columba pulchricollis</td>
<td>Columbidae</td>
<td>Columbiformes</td>
<td>Resident</td>
<td>Frugivore</td>
</tr>
<tr>
<td>Asian barred owlet</td>
<td>Glaucidium cuculoides</td>
<td>Strigidae</td>
<td>Strigiformes</td>
<td>Resident</td>
<td>Carnivore</td>
</tr>
<tr>
<td>Ashy throated warbler</td>
<td>Phylloscopus maculipennis</td>
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<td>Resident</td>
<td>Frugivore</td>
</tr>
<tr>
<td>Red rumped swallow</td>
<td><em>Cecropis daurica</em></td>
<td>Hirundinidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Insectivore</td>
</tr>
<tr>
<td>Steppe eagle</td>
<td><em>Aquila nipalensis</em></td>
<td>Accipitridae</td>
<td>Accipitriformes</td>
<td>Winter visitor</td>
<td>Carnivore</td>
</tr>
<tr>
<td>Striated laughing thrush</td>
<td><em>Garrulax striatus</em></td>
<td>Leiothrichidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Insectivore</td>
</tr>
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<td>streaked laughing thrush</td>
<td><em>Garrulax squamatus</em></td>
<td>Leiothrichidae</td>
<td>Passeriformes</td>
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<td>Insectivore</td>
</tr>
<tr>
<td>Stripe throated yuhina</td>
<td><em>Yuhina gularis</em></td>
<td>Zosteropidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Insectivore</td>
</tr>
<tr>
<td>Spotted dove</td>
<td><em>Streptopelia chinensis</em></td>
<td>Columbidae</td>
<td>Columbiformes</td>
<td>Resident</td>
<td>Frugivore</td>
</tr>
<tr>
<td>Common Name</td>
<td>Scientific Name</td>
<td>Family</td>
<td>Order</td>
<td>Habitation</td>
<td>Diet</td>
</tr>
<tr>
<td>-------------------------------------</td>
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<tr>
<td>Streak breasted scimitar babbler</td>
<td><em>Pamotorhinus ruficollis</em></td>
<td>Timaliidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Omnivore</td>
</tr>
<tr>
<td>Slaty headed parakeet</td>
<td><em>Psittacula himalayana</em></td>
<td>Psittacidae</td>
<td>Psittaciformes</td>
<td>Resident</td>
<td>Frugivore</td>
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<tr>
<td>Slaty backed forktail</td>
<td><em>Enicurus schistatus</em></td>
<td>Muscicapidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Insectivore</td>
</tr>
<tr>
<td>Small niltava</td>
<td><em>Niltava macgrigoriae</em></td>
<td>Muscicapidae</td>
<td>Passeriformes</td>
<td>Summer visitor</td>
<td>Insectivore</td>
</tr>
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<td>Striated bulbul</td>
<td><em>Pycnonotus striatus</em></td>
<td>Pycnonotidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Omnivore</td>
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<tr>
<td>Spaty babbler</td>
<td><em>Turdoides nipalensis</em></td>
<td>Leiothrichiidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Insectivore</td>
</tr>
<tr>
<td>Scarlet minivet</td>
<td><em>Perricrocotus flammeus</em></td>
<td>Campephagidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Insectivore</td>
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<td>Spotted owlet</td>
<td><em>Athene brama</em></td>
<td>Strigidae</td>
<td>Strigiformes</td>
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<td>Carnivore</td>
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<td>Snowy browed flycatcher</td>
<td><em>Ficedula hyperythra</em></td>
<td>Muscicapidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Insectivore</td>
</tr>
<tr>
<td>Spotted forktail</td>
<td><em>Enicurus maculatus</em></td>
<td>Muscicapidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Insectivore</td>
</tr>
<tr>
<td>Tickells thrush</td>
<td><em>Turdus unicolor</em></td>
<td>Turdidae</td>
<td>Passeriformes</td>
<td>Summer visitor</td>
<td>Insectivore</td>
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<tr>
<td>Tickells leaf warbler</td>
<td><em>Phylloscopus affinis</em></td>
<td>Phylloscopidae</td>
<td>Passeriformes</td>
<td>Passage migrants</td>
<td>Insectivore</td>
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<tr>
<td>Verditer flycatcher</td>
<td><em>Eumyias thalassinus</em></td>
<td>Muscicapidae</td>
<td>Passeriformes</td>
<td>Summer visitor</td>
<td>Insectivore</td>
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<tr>
<td>Wedge tailed green pigeon</td>
<td><em>Treron sphenura</em></td>
<td>Columbidae</td>
<td>Columbiformes</td>
<td>Resident</td>
<td>Frugivore</td>
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<tr>
<td>White throated fantail</td>
<td><em>Rhipidura albicollis</em></td>
<td>Rhipiduridae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Insectivore</td>
</tr>
<tr>
<td>White throated laughing thrush</td>
<td><em>Garrulax albogularis</em></td>
<td>Leiothrichiidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Insectivore</td>
</tr>
<tr>
<td>Whiskered yuhina</td>
<td><em>Yuhina flavicollis</em></td>
<td>Zosteropidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Insectivore</td>
</tr>
<tr>
<td>White tailed robin</td>
<td><em>Myiornis leucura</em></td>
<td>Muscicapidae</td>
<td>Passeriformes</td>
<td>Summer visitor</td>
<td>Insectivore</td>
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<tr>
<td>White tailed nuthatch</td>
<td><em>Sitta himalayensis</em></td>
<td>Sittidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Insectivore</td>
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<tr>
<td>Nepal fulvrtta</td>
<td><em>Alicipe nipalensis</em></td>
<td>Sylvidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Insectivore</td>
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<td>White capped redstart</td>
<td><em>Chaimarrornis leucocephalus</em></td>
<td>Muscicapidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Insectivore</td>
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<td>White collared blackbird</td>
<td><em>Turdus albocinclus</em></td>
<td>Turdidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Omnivore</td>
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<tr>
<td>White browed fulvetta</td>
<td><em>Fulvetta vinipectus</em></td>
<td>Timaliidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Insectivore</td>
</tr>
<tr>
<td>White crested laughing thrush</td>
<td><em>Garrulax leucolophus</em></td>
<td>Leiothrichiidae</td>
<td>Passeriformes</td>
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<td>Insectivore</td>
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<td>White throated kingfisher</td>
<td><em>Halcyon smyrnensis</em></td>
<td>Alcedinidae</td>
<td>Coraciiformes</td>
<td>Resident</td>
<td>Carnivore</td>
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<td>Yellow breasted green finch</td>
<td><em>Carduelis spinoides</em></td>
<td>Fringillidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Frugivore</td>
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<td>Yellow billed blue magpie</td>
<td><em>Urocissa flavirostris</em></td>
<td>Corvidae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Omnivore</td>
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<tr>
<td>Yellow browed tit</td>
<td><em>Sylviparus modestus</em></td>
<td>Paridae</td>
<td>Passeriformes</td>
<td>Resident</td>
<td>Omnivore</td>
</tr>
<tr>
<td>Yellow bellied fantail</td>
<td><em>Chelidorhynx hypoxantha</em></td>
<td>Corvidae</td>
<td>Passeriformes</td>
<td>Summer visitor</td>
<td>Insectivore</td>
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