Bird Diversity and Abundance in Dachigam National Park, Kashmir, India

Muniza Manzoor[1]*, G. Mustafa Shah[1], Ulfat Jan[1], Naziya Khurshid[1] and Kulsum Ahmad Bhat[1]

[1]Department of Zoology, University of Kashmir, Srinagar-190006, J & K, India
[2]Centre of Research for Development, University of Kashmir, Srinagar -190006, J & K, India
*Corresponding author: munizamanzoor78@gmail.com

Abstract

The present study documents the bird community structure of Dachigam National Park. Since the diversity and richness of birds are good indicators of ecosystem quality, this study focused on providing some baseline information regarding diversity, abundance, seasonal monitoring and management of populations. Field surveys were conducted for a period of 18 months from September 2014 to March 2016, covering all the seasons. Bird study was carried out by Visual sighting method, Line transect method and Point count method. The avifauna of the Dachigam National Park includes a large number of both resident and migratory species. A total of 1,960 individual birds representing 134 species, belonging to 93 genera spread over 38 families and 15 orders were observed during the study. Further, it was interesting to note that the passerine birds dominated the diversity with 79 species as compared to non- passerine (55 species). The bird species diversity (Shannon Weiner's Index and Simpson's index of diversity) was highest during summer (0.854) followed by spring, autumn and winter.
Keywords: Birds, diversity, richness, Dachigam National Park.

Introduction

Birds are conspicuous, ubiquitous, and arguably the best studied group of vertebrates on the planet (Whelan *et al*., 2008). They are highly mobile, occur globally in nearly all habitats and fill many ecological roles (Wenny *et al*., 2011). The activities of birds provide links within and between ecosystems and can have large effects on other species. The birds offer all ecosystem services such as provisioning services refer to natural products that are directly used by humans for food, clothing, medicines, tools, or other uses (Carver, 2009). Cultural services provide recreational opportunities, inspiration for art and music, and spiritual value (Mynott, 2009). Regulating services include pest control and carcass removal (Otvos, 1979; Snow, 1981; Howe and Smallwood, 1982; Herrera, 1984; Stiles, 1985; Clout and Hay, 1989; Whelan *et al*., 2010). Supporting services, such as pollination, seed dispersal, water purification, and nutrient cycling, provide processes essential for ecological communities and agricultural ecosystems (Otvos, 1979; Snow, 1981; Howe and Smallwood, 1982; Clout and Hay, 1989; Nason, 1992; Brenner *et al*., 2010). Dachigam National Park harbors a large number of bird species and is considered an important spot of biodiversity. Hence, the conceptual framework for present study was to document diversity, richness and abundance of the bird species in Dachigam National Park.

Study area

This study was carried out in Dachigam National Park which is one of the most important protected area in Jammu and Kashmir State because it holds the last viable population of Hangul in world (Kurt, 1978, Iqbal *et al*., 2005, Ahmad *et al*., 2005, Ahmad et al., 2009 and Ahmad et al., 2015). The Dachigam National Park is located in Kashmir

Valley, 21 km northeast to Srinagar, capital of Jammu and Kashmir state of India **(Figure 1).** It covers an area of 141 km^2 which extends between $34^°$ 05´- 34º 12´N and 74º 54´E and 75º 09´E in Zanskar mountain range of Northwest Himalayan biogeographic zone (2A) of India (Rodgers *et al*., 2000). It is approximately 24 km in length and 6 km in breadth ranging in altitude from 1700 m to 4250 m (Rodgers and Panwar, 1988; Rodgers *et al.,* 2000; Shah *et al*., 2009; Ahmad *et al*., 2016). The dominant tree species included *Juglans regia. Pinus wallichiana, Salix alba, Quercus robur, Prunus armeniaca, cedrus deodara* etc. The key shrub species include *Indigofera heterantha, Parrotiopsis jacquemontiana, Berberis, Vibernum* and *Rosa.* The major ground vegetation cover was dominated by *Rumex patientia*, *Hedera nepalensis, Primula* sp.
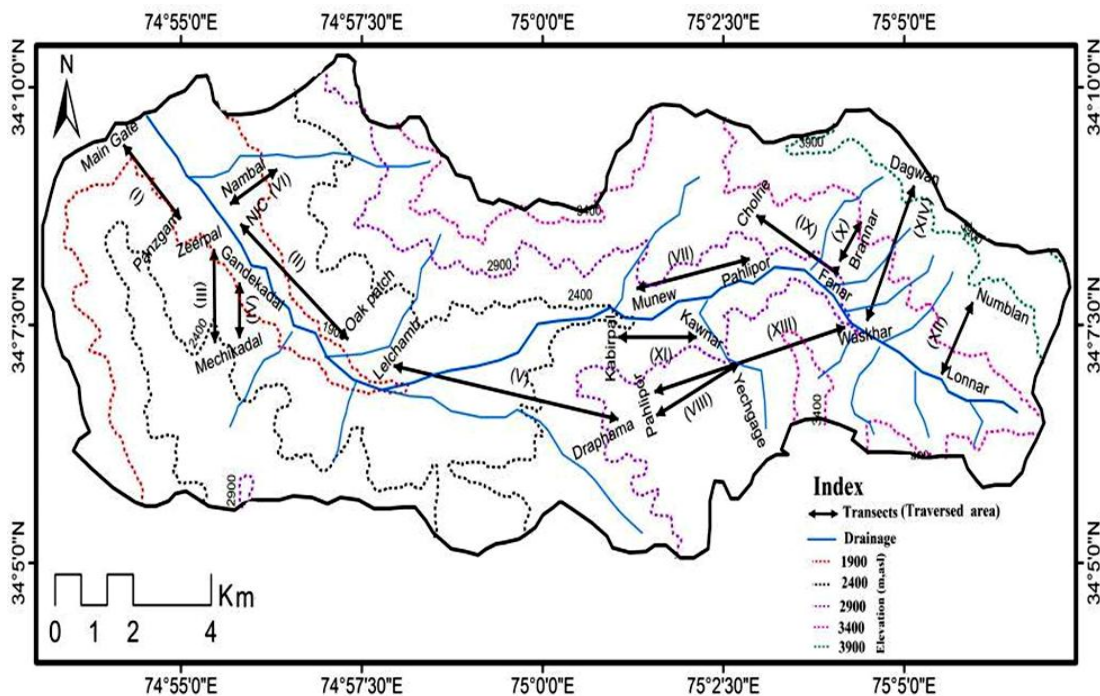

Figure 1: Transects surveyed in Dachigam landscape

Methodology

For conducting the bird study, Dachigam National Park was divided into 14 transects, eight in lower Dachigam and six in upper Dachigam, so that majority of the study area was covered. The transects varied in length from 2 km to 8 km depending on vegetation type and accessibility, and were distributed among two habitat types viz, Riverine and Riparian. Width of the transects varied between 50 m to 100 m. Transects were walked in a straight manner at a fixed speed to record the birds on or near the line. Floral composition and broad vegetation types were noted along all the transects. A Global Positioning System (GPS) receiver was used to record the start and end point of each transects and to record the location of the area where the particular bird was spotted. A pedometer was used to measure the distance walked on trails. Preliminary surveys were conducted prior to data collection to ensure accurate bird identification. Investigations were conducted for a period of one year from September 2014 to August 2015 covering all the seasons. Bird study was carried out by visual sighting method used by Shah (1984), line

transect method (Bhat and Joshi, 2011) and point count method (Reynolds *et al*., 1980; Bibby *et al*., 2000; Rosenstock *et al*., 2002).

Another important aspect kept in consideration was the activity of birds. Since the peak activity in most of the birds lasts 1 or 2 hours after sunrise or before sunset, so monitoring of transects was done either in early morning or late evening hours as used by Thakur *et al*. (2010). The exact timings however varied based on seasonal changes in light conditions and intensity of bird activity. Transects were walked in all four seasons. Each call was treated as a separate sighting and was considered for data analysis at par with actual sightings. Intermittent stops were chosen to listen to the sounds of birds. Unless the number of calling birds was clearly discernible, each call was treated as one bird in terms of numbers. Birds were observed with the aid of 10 x 50 super Zenith field binoculars. Photographs were taken by Nikon still camera (with a zoom lens of 70 mm to 300 mm). The nomenclature (both common and binomial names) and systematic order of bird species and families follows Ali (1979), Grimmett *et al*., (2004) and Kazmierczak (2007).

Diversity index

Species diversity was calculated using

Shannon diversity index (H')

The Shannon diversity index (H') is commonly used to characterize species diversity in a community (Shannon and Weiner, 1949).

$H' = -\sum (P_i \ln P_i)$

Where,

H'= Shannon's diversity index.

$p_i = S / N$

S = number of individuals of one species.

N = total number of all individuals in the sample.

ln = natural logarithm to base e.

Measurement of evenness

For calculating the evenness of species, the Pielou's Evenness Index (e) was used (Pielou, 1966).

$$e = H / \ln S$$

H = Shannon-Weiner diversity index.

S = total number of species in the sample.

Seasonal distribution and residential status of the birds has been worked out and different categories like, resident, local altitudinal migrant, summer visitor and winter visitor have been assigned strictly with reference to the study area on the basis of presence or absence method (Pfister, 2004).

Results and Discussion

Dachigam National Park supports a rich, varied bird life and has proved to be a favorable place for birds to be around. The present study on the bird community structure of national park, revealed the presence of 134 species of birds classified in 93 genera and 38 families belonging to 15 orders. Passerine birds are the most speciose group with 79 species in comparison to non-passerine's with 55 species.

Percentage occurrence of species of various orders of birds revealed that 79% of the species in the study area belong to order Passeriformes whereas order Accipitriformes had 9% of species, Coraciiformes and Piciformes had 5% and

4% of species respectively. Columbiformes, Galliformes, Pelecaniformes and Strigiformes represent 3% each, Charadriiformes and Cuculiformes 2% and Anseriformes, Apodiformes, Psittaciformes, Bucerotiformes and Gruiformes had 1% species each (**Figure 2**). In accordance with our finding Grimmet *et al*. (1998) have also found Passeriformes contributing most to the Indian bird species richness. Other earlier studies have also advocated that Passeriformes is the dominant order in the Himalayan landscape (Bhat and Bhat, 2012; Singh *et al.*, 2013).
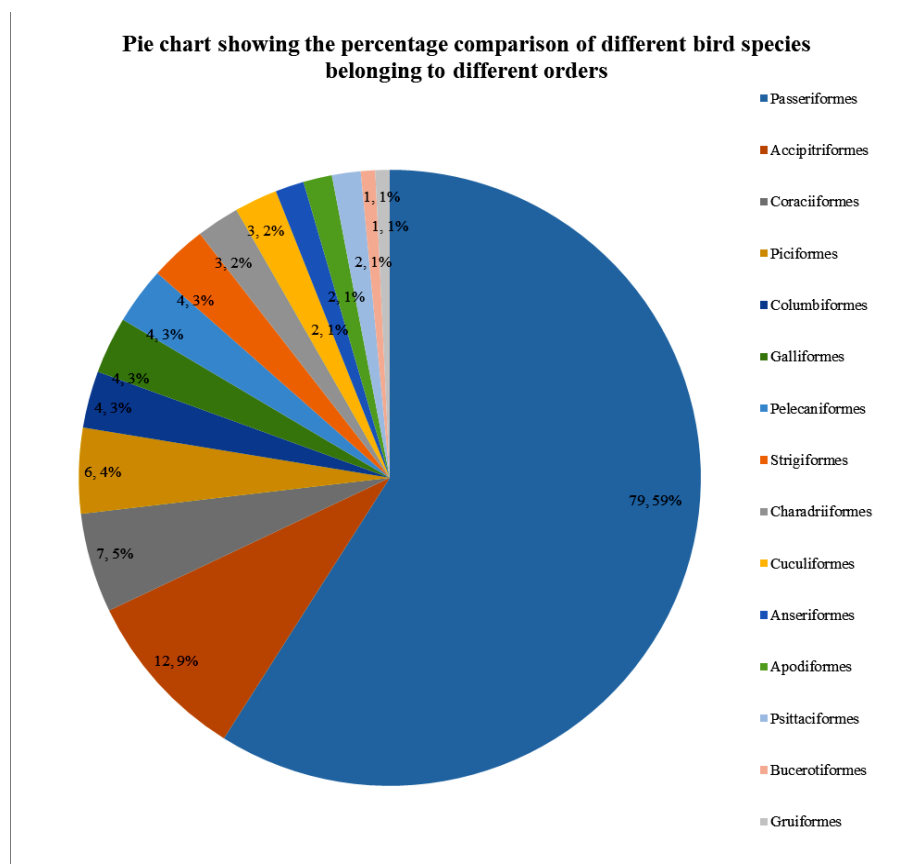

Figure 2: **Comparison of number and percentage of bird species belonging to different avian orders.**

Family wise analysis showed that family Muscicapidae is the most species rich (22 species) followed by Accipitridae (12) and Corvidae (8); Fringillidae (7) and Picidae and Turdidae (6 each); Motacillidae and Paridae (5 each); Ardeidae, Columbidae, Phasianidae, Emberizidae, Alcedinidae and Passeridae (4 each); Cuculidae, Strigidae and Sturnidae (3 each); Psittacidae, Apodidae, Pycnonotidae, Leiothrichidae, Campephagidae, Cincilidae, Certhiidae, Meropidae and Anatidae (2 each) whereas Tytonidae, Upupidae, Coraciidae, Hirundinidae, Laniidae, Zosteropidae, Dicruridae, Oriolidae, Rostratulidae, Rallidae, Ibidorhynchidae and Scolopacidae were poorly represented in the area (**Figure 3**). Muscicapidae is also reported as most species rich family in Himachal Pradesh with 58 species (Thakur *et al*., 2010), which is in conformity to our results.
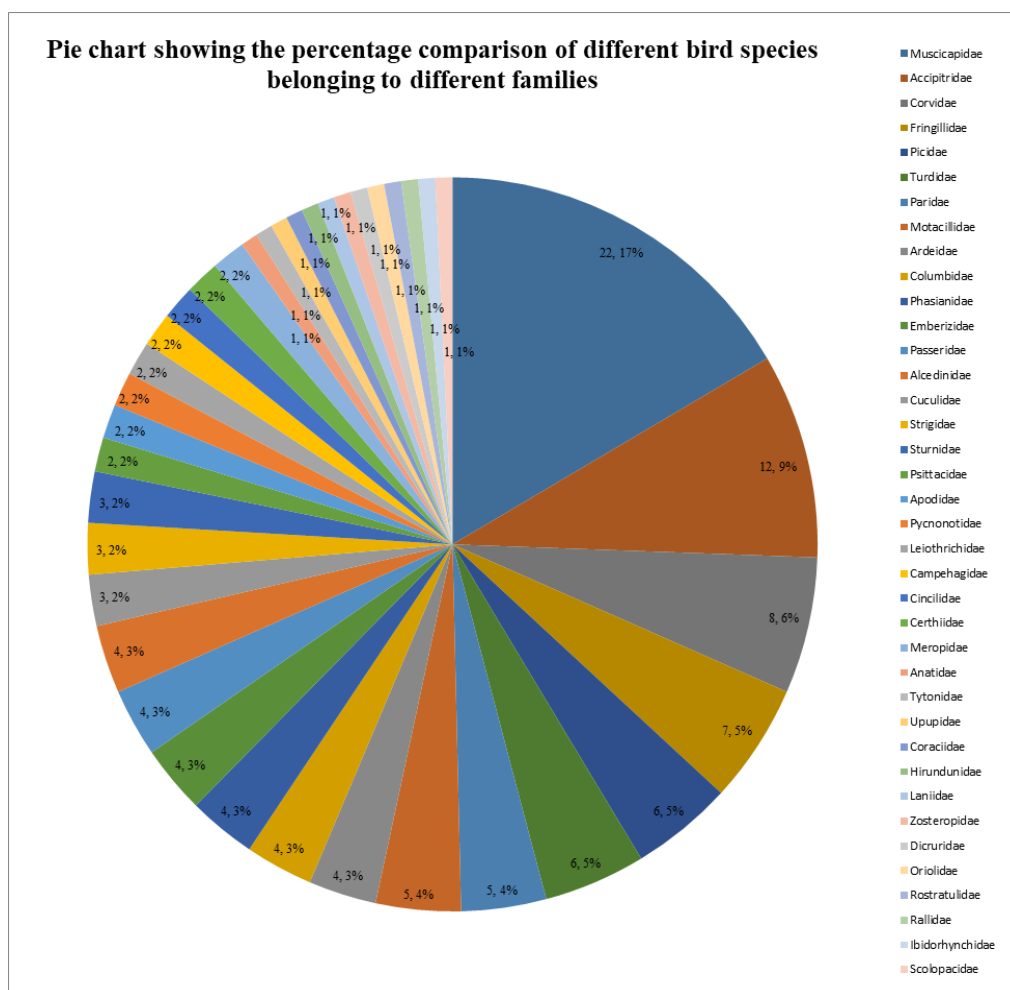
Figure 3: Comparison of number and percentage of bird species belonging to different avian families

Analysis of the data on the residential status revealed that out of 134 species, 61% were resident (82 species), 19% were summer visitors (25 species), 11% were winter visitors (11 species), 11% were altitudinal migrants (15 species) and 1% were passage (spring or autumn) visitors (1 species). **(Figure 4 & 5)**. Overall 61% bird were found to be resident while 39% were found to be migratory in the study area. **(Figure 6)**
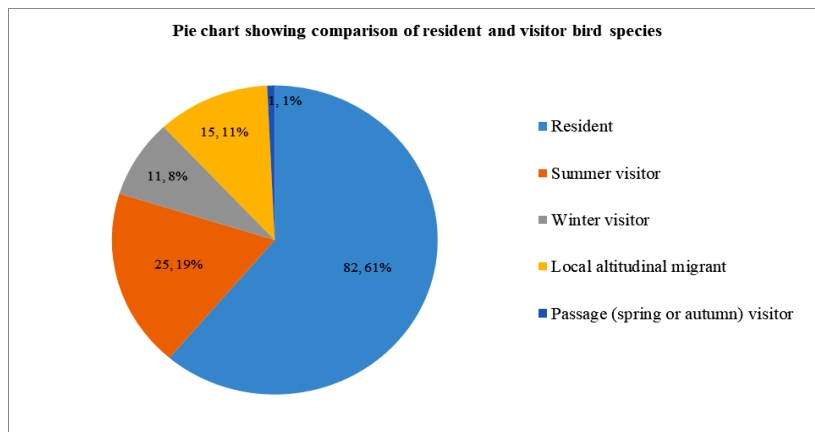
Figure 4: **Comparison of number and percentage of resident and visitor bird species in the study area.**
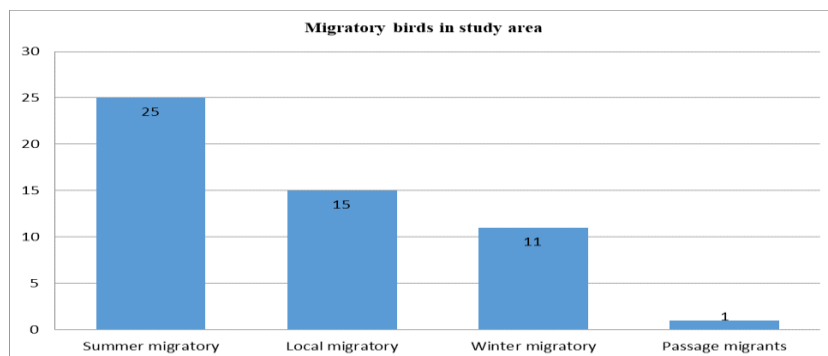

Figure 5: **Bar diagram representing migratory bird species in the study area**
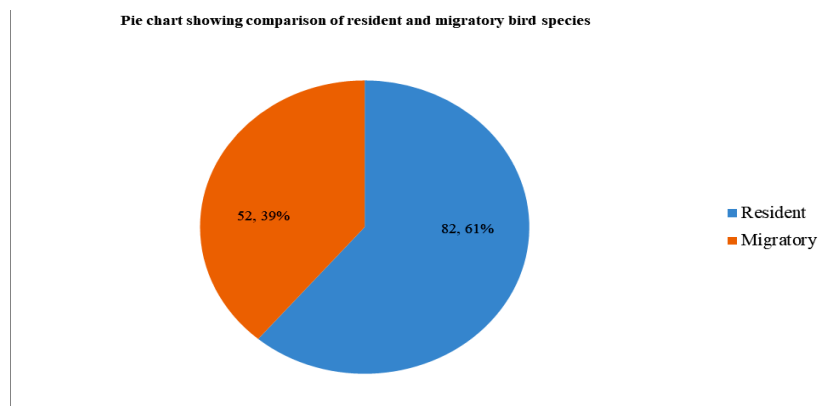

Figure 6: **Comparison of number and percentage of migratory and resident bird species in the study area.**

The studies on relative abundance status of avifauna of Dachigam National Park reveal that the avifauna of the study area can be placed into four abundance categories viz., very common (VC) represented by 51 species, common (C) by 49 species, uncommon (UC) by 28 species and occasional (OC) by 6 species **(Figure 7)**. The diversity of birds in different regions varies with numerous factors like climate of the area, altitude, abundance of food material etc. and is maximum in places with favorable living conditions for birds. Present study area enriched with dense forests and water resources supports a large number of food items for the resident as well as migratory birds.
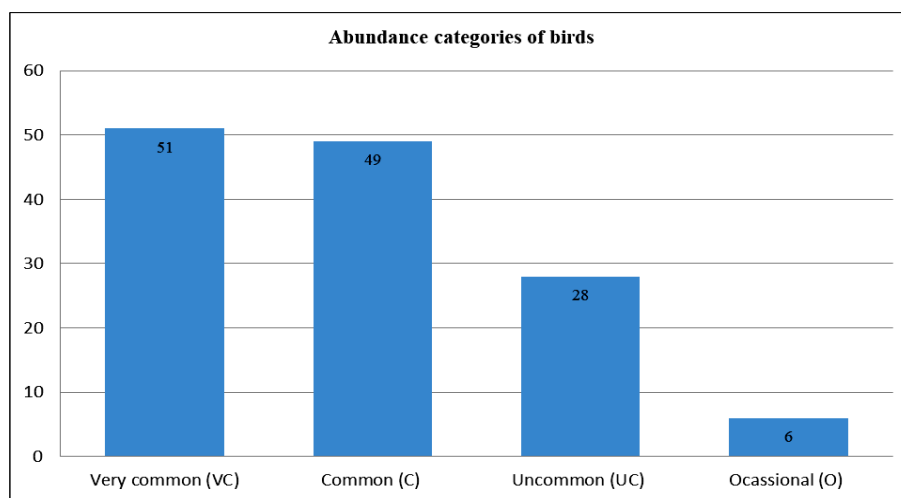

Figure 7: Bar diagram representing abundance category of bird species.

The result of this study shows that bird species diversity (Shannon Weiner's Index and Simpson's index of diversity) was highest during summer followed by spring, autumn and winter **(Table 1 and Figure 8)**. The high diversity during summer can be compared with earlier works of Gaston (1995) and Mahabal (2005) who elucidated that Himalayas receive a flood of breeding birds during summer months from adjacent areas. Among the avifauna, 61% bird were found to be   resident while 39% were found to be migratory in the study area **(Figure 6).** Species evenness followed the same pattern for summer season showing more evenly distributed avifauna followed by spring, autumn and least evenly distribution in winter season.

Table 1: Avian species diversity and Evenness at Dachigam National Park during four   seasons by Shannon Weiner index and Simpson's index of diversity

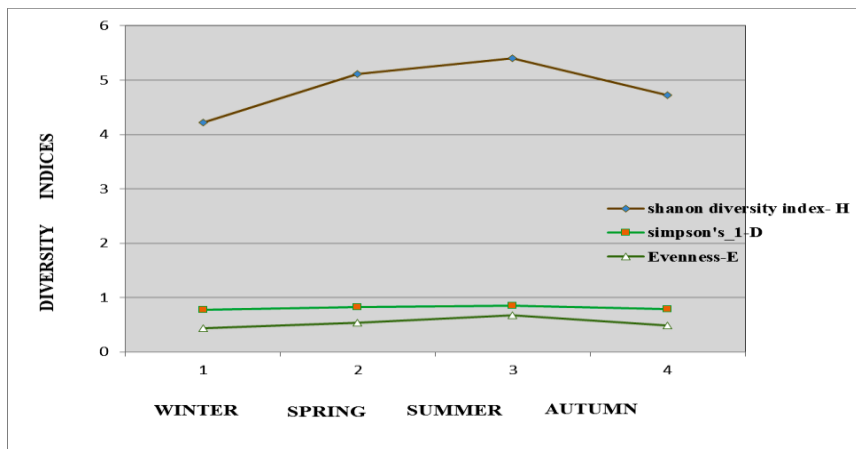| Season	No. of species	No. of individuals	H	E	SID
Winter	48	2256	4.216	0.442	0.776
Spring	76	1841	5.113	0.543	0.823
Summer	66	2187	5.397	0.672	0.854
Autumn	21	573	4.724	0.482	0.793

Figure 8: Species diversity indices during four seasons at Dachigam National Park

Four species of birds struggling for their existence throughout their distributional range were also sighted once or twice in the study area. These birds are placed under different threat categories by IUCN (Red data book, http://www.iucnredlist.org). Of these, Kashmir flycatcher, *Ficedula subrubra* has been placed under Vulnerable Category (VU), Steppe eagle, *Aquila nipalensis* under Threatened category (T), European roller, *Coracias garrulous* and Lesser fish eagle, *Ichthyophaga humilis* under near threatened category (NT) **(Figure 9)**. The Kashmir flycatcher, *Ficedula subrubra* which is one of the globally threatened species was found to inhabit areas between an altitude of 1,800 m to 2,700 m in the Temperate Mixed Broadleaf Forest, Sub Alpine Forest and Montane Grasslands, especially with dense growth of *Parrotiopsis.*
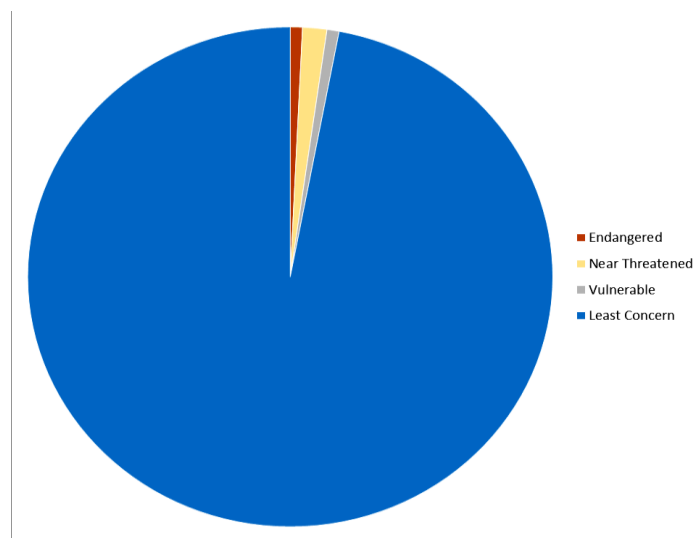

Figure 9: Threatened categories (%) of the bird of the Dachigam National Park.

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