

Diversity and Conservation status of Avifauna in Ramnagar Forest division, Corbett Landscape, Uttarakhand, India



Black Stork (Juvenile) spotted in the Dabka River of Ramnagar Forest Division

Introduction

Birds are key indicators for assessing the status of ecosystem quality (Taper et al., 1995; Gregory et al., 2003) and their assemblage structure is affected by changes in habitat either due to natural or anthropogenic disturbances (Duguay et al., 2000; Weakland et al., 2002; Rahayuninagsih et al., 2007). The change in vegetation composition has an impact on birds in terms of their food, water and cover and its extent which consequently affect the diversity, abundance and distribution of birds (Gregory et al., 2003; Clawges et al., 2008; Rajpar & Zakaria, 2011). Avian species shows a direct response to different vegetation structure (MacArthur & MacArthur 1961), and their diversity increases with quality of vegetation composition (Wiens 1995). Moreover, avian community structure also affects the vegetation structure as large numbers of tree species are dependent on the seed dispersal services provided by frugivores (Strauss & Irwin 2004; Chatterjee &

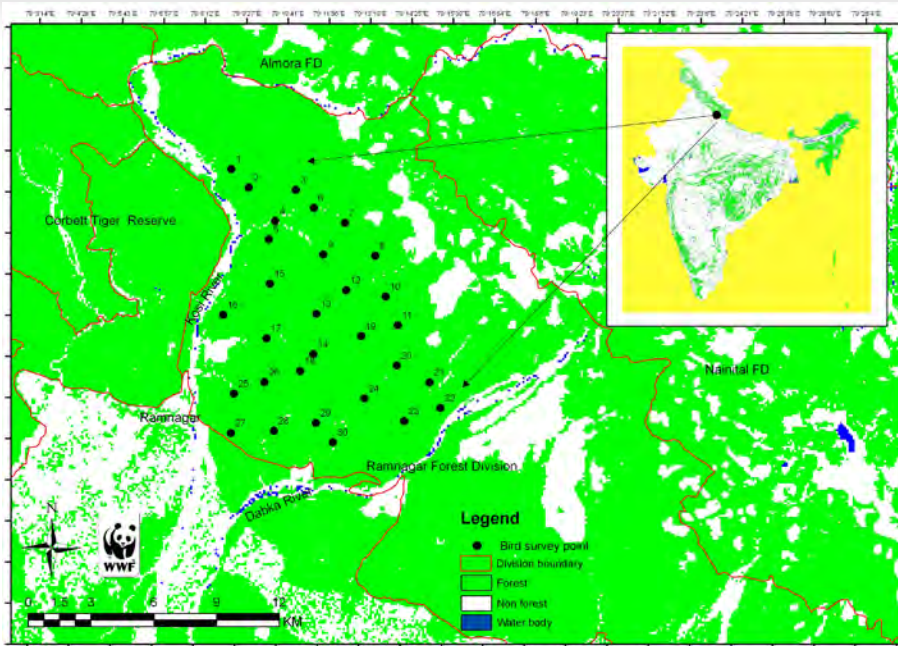
Basu 2015). The Corbett Tiger Reserve including the adjoining landscape provides unique habitat for various endangered species including tiger and elephant as keystone species. The population of these large mammals depends on the habitat quality, sufficient food and water availability as well as the protection cover. These habitat parameters also ensure survival of other mammalian, avian and insect species. As a result of this, approximately 40% of avian species found in India, are observed in the landscape (Dhakate et al., 2008). However, change in habitat composition as a consequence of anthropogenic and natural disturbances, such as habitat fragmentation, illicit felling, grazing, forest fire and other developmental activities have been observed in the region. These factors influence the existing habitat quality, and have a direct impact on species abundance and diversity as well. A long check list of birds was published from the Corbett TR (Dhakate et al., 2008) but in the adjoining territorial forests, priority of the forest officials are mainly forestry oriented while management and conservation of wild animals and birds remains a secondary responsibility unlike it is in protected areas. Therefore, present study was conducted in the Ramnagar Forest Division, to understand avian community structure with the help of data collected while visiting the forests primarily for the monitoring of tiger and its prey species. Present study was carried out in a short duration and aimed to encourage scientific community to come up with a detailed study on avifauna of the territorial forests of the Corbett landscape, where different kinds of habitat support a large number of avifauna in addition to charismatic tigers.

Materials and Methods

2.1 Study area

Ramnagar Forest Division is situated in the Terai Arc Landscape (TAL) of Uttarakhand state of India. The forest division is located between 29°25'46" N & 79°08'58" E, with an elevational range from 385m asl to 1550m asl. The division is spread over five forest ranges with a total area of about 12000 ha. The territorial forest division is adjoining to the Corbett Tiger Reserve at the western side, Terai West forest division in the South-western side and Terai Central Forest division in the southern part. It also shares territorial boundaries with Almora and Nainital forest division in the northern side. The Ramnagar forest division serve as a transition zone between the Terai and mountain forest ecosystem, and thus important for wildlife movement in between of these two habitat. The area receive an average annual rainfall of 2100mm and temperature varies from 15°C to 42°C.

The forest division is dominated with plant species such as *Shorea robusta*, *Terminalia alata*, *Syzygium cumini*, *Dalbergia sissoo*, *Madhuca* spp., *Bauhinia variegata*,



Map depicting the study area and sampling sites

Mallotus philippensis, *Melia* spp., *Acacia* spp., *Zizyphus* spp., *Butea monosperma*, *Ficus* spp. and plantations of *Tectona grandis*, *Eucalyptus* spp., and some indigenous spp. such as *Broussonetia papyrifera* and *Trewia nudiflora* (Anwar et al., 2014). Some of the common weeds

present in the division are

Pogostemon spp., *Justicia adhatoda*, *Senna tora*, *Parthenium* spp., *Lantana camara* and *Ipomoea* spp. The forest division and its surrounding forms a mosaic of various habitat types including woodland, riverine forest, grassland, agricultural field, water bodies as ponds and ditches including seasonal streams. River Kosi and Dabka including their tributaries are major habitats for riverine birds and waterfowls, both the resident and migratory species. Intensive study area lies between these two Rivers (Kosi & Dabka) passing through the forests of Ramnagar division and are perennial source of water to the mammals and Avifauna of the division.

2.2 Methodology

The survey for avifauna was conducted in winter season (November 2013-January 2014), during the regular monitoring of camera traps, deployed for photo-capturing tigers. Points for data collection were located in the woodland, grassland, seasonal streams (Riverine habitat) and plantations. The streams act as work transition zone between two forest stands and open grasslands act as a corridor between two woodlands for the wildlife movement. A grid size of 4 sq.km. was considered, to accommodate a point in each grid for data collection. These locations were spaced 1.5 to 2 km apart from each other. All these locations were considered as vantage for the present bird survey in the Ramnagar forest division. Birds were recorded through point count (fixed) distance sampling method (Bibby et al., 2000). An observation time of 10 minutes at each point was invested to record sightings of the birds. The species were recorded only which

Birds species recorded in Ramnagar forest division, Uttarakhand during November 2010 to January 2011

Family	Scientific Name	Common Name	Status	Status (IUCN)	IWPA Schedule	Guild
Accipitridae	<i>Milvus migrans</i>	Black Kite	R	LC	IV	Carnivorous
	<i>Sarcogyps calvus</i>	Red-headed Vulture	R	CR	IV	Carnivorous
	<i>Spilornis cheela</i>	Crested Serpent Eagle	R	LC	IV	Carnivorous
	<i>Spizaetus cirrhatu</i>	Changeable Hawk Eagle	R	LC	IV	Carnivorous
Anatidae	<i>Tadorna ferruginea</i>	Ruddy Shelduck	WV	LC	IV	Omnivorous
Anhingidae	<i>Anhinga melanogaster</i>	Darter	R	LC	IV	Carnivorous
Ardeidae	<i>Casmerodius albus</i>	Great Egret	R	LC	IV	Carnivorous
	<i>Ardeola grayii</i>	Indian Pond Heron	R	LC	IV	Carnivorous
	<i>Egretta garzetta</i>	Little Egret	R	LC	IV	Carnivorous
Bucerotidae	<i>Ocyrocus birostris</i>	Indian Grey Hornbill	R	LC	IV	Frugivorous
	<i>Anthracoeros albirostris</i>	Oriental Pied Hornbill	R	LC	IV	Frugivorous
	<i>Buceros bicornis</i>	Great Hornbill	R	NT	IV	Frugivorous
Campephagidae	<i>Pericrocotus flammeus</i>	Scarlet Minivet	R	LC	IV	Insectivorous
	<i>Pericrocotus cinnamomeus</i>	Small Minivet	R	LC	IV	Insectivorous
	<i>Tephrodornis pondicerianus</i>	Common Woodshrike	R	LC	IV	Insectivorous
	<i>Corcina macei</i>	Large Cuckooshrike	R	LC	IV	Insectivorous
Certhiidae	<i>Certhia himalayana</i>	Bar-tailed Tree-creeper	WV	LC	IV	Insectivorous
Cerylidae	<i>Megaceryle lugubris</i>	Crested Kingfisher	R	LC	IV	Carnivorous
	<i>Ceryle rudis</i>	Pied Kingfisher	R	LC	IV	Carnivorous
Cettiidae	<i>Tesia castaneocoronata</i>	Chestnut-headed Tesia	R	LC	IV	Insectivorous
Charadriidae	<i>Vanellus indicus</i>	Red-wattled Lapwing	R	LC	IV	Insectivorous
Cisticolidae	<i>Prinia socialis</i>	Ashy Prinia	R	LC	IV	Insectivorous
	<i>Cisticola juncidis</i>	Zitting Cisticola	R	LC	IV	Insectivorous
	<i>Prinia criniger</i>	Striated Prinia	R	LC	IV	Insectivorous
Columbidae	<i>Columba livia</i>	Rock Pigeon	R	LC	IV	Granivorous
	<i>Streptopelia chinensis</i>	Spotted Dove	R	LC	IV	Granivorous
	<i>Chalcophaps indica</i>	Emerald Dove	R	LC	IV	Granivorous
Coraciidae	<i>Coracias benghalensis</i>	Indian Roller	R	LC	IV	Carnivorous
Corvidae	<i>Dendrocitta vagabunda</i>	Rufous Treepie	R	LC	IV	Frugivorous
	<i>Cissa chinensis</i>	Common Green Magpie	R	LC	IV	Carnivorous
	<i>Urocissa erythrorhyncha</i>	Red-billed Blue Magpie	R	LC	IV	Carnivorous
	<i>Corvus macrorhynchos</i>	Large-billed Crow	R	LC	IV	Carnivorous
	<i>Dendrocitta formosae</i>	Grey Treepie	R	LC	IV	Frugivorous
Cuculidae	<i>Centropus sinensis</i>	Greater Coucal	R	LC	IV	Omnivorous

Family	Scientific Name	Common Name	Status	Status (IUCN)	IWPA Schedule	Guild
Dicruridae	<i>Dicrurus macrocercus</i>	Black Drongo	R	LC	IV	Insectivorous
	<i>Dicrurus remifer</i>	Lesser Racket-tailed Drongo	R	LC	IV	Insectivorous
	<i>Dicrurus hottentottus</i>	Spangled Drongo	R	LC	IV	Insectivorous
	<i>Dicrurus leucophaeus</i>	Ashy Drongo	WV	LC	IV	Insectivorous
	<i>Dicrurus carrulescens</i>	White-bellied Drongo	R	LC	IV	Insectivorous
Emberizidae	<i>Melophus lathamii</i>	Crested Bunting	W/S	LC	IV	Insectivorous
Estrildidae	<i>Lonchura punctulata</i>	Scaly-breasted Munia	R	LC	IV	Granivorous
Falconidae	<i>Microhierax caerulescens</i>	Collared Falconet	WV	LC	IV	Carnivorous
Halcyonidae	<i>Halcyon smyrnensis</i>	White-throated Kingfisher	R	LC	IV	Carnivorous
	<i>Halcyon capensis</i>	Stork-billed Kingfisher	R	LC	IV	Carnivorous
Hirundinidae	<i>Hirundo rustica</i>	Barn Swallow	WV	LC	IV	Insectivorous
Ibidorhynchidae	<i>Ibidorhyncha struthersii</i>	Ibis Bill	R	LC	IV	Carnivorous
Laniidae	<i>Lanius Schach</i>	Long-tailed Shrike	R	LC	IV	Omnivorous
Leiothrichidae	<i>Garrulax leucolophus</i>	White-crested Laughing Thrush	R	LC	IV	Insectivorous
	<i>Turdoides striatus</i>	Jungle Babbler	R	LC	IV	Insectivorous
Megalaimidae	<i>Megalaima haemacephala</i>	Coppersmith Barbet	R	LC	IV	Frugivorous
	<i>Megalaima zeylanica</i>	Brown-headed Barbet	R	LC	IV	Frugivorous
	<i>Megalaima asiatica</i>	Blue-throated Barbet	R	LC	IV	Frugivorous
Meropidae	<i>Merops orientalis</i>	Green Bee-eater	R	LC	IV	Insectivorous
	<i>Nyctyornis athertoni</i>	Blue-bearded Bee-eater	R	LC	IV	Insectivorous
Motacillidae	<i>Motacilla maderaspatensis</i>	White-browed Wagtail	R	LC	IV	Insectivorous
	<i>Motacilla flava</i>	Yellow Wagtail	WV	LC	IV	Insectivorous
	<i>Motacilla cinerea</i>	Grey Wagtail	WV	LC	IV	Insectivorous
	<i>Motacilla alba</i>	White Wagtail	WV	LC	IV	Insectivorous
Muscicapidae	<i>Myophonus caeruleus</i>	Blue Whistling Thrush	R	LC	IV	Insectivorous
	<i>Copsychus malabaricus</i>	White-rumped Shama	R	LC	IV	Insectivorous
	<i>Saxicoloides fulicata</i>	Indian Robin	R	LC	IV	Insectivorous
	<i>Chaimarrornis leucocephalus</i>	White-capped Water Redstart	R	LC	IV	Insectivorous
	<i>Rhyacornis fuliginosus</i>	Plumbeous Water Redstart	R	LC	IV	Insectivorous
	<i>Phoenicurus frontalis</i>	Blue-fronted Redstart	WV	LC	IV	Insectivorous
	<i>Saxicol ferrer</i>	Grey Bushchat	R	LC	IV	Insectivorous
	<i>Saxicola caprata</i>	Pied Bushchat	R	LC	IV	Insectivorous
	<i>Luscinia pectoralis</i>	White-tailed Rubythroat	WV	LC	IV	Insectivorous
	<i>Niltava sundara</i>	Rufous-bellied Niltava	R	LC	IV	Insectivorous
	<i>Ficedula strophiatea</i>	Rufous-gorgeted Flycatcher	R	LC	IV	Insectivorous
	<i>Niltava macgrigoriae</i>	Small Niltava	WV	LC	IV	Insectivorous
	<i>Ficedula tricolor</i>	Slaty-blue Flycatcher	W/S	LC	IV	Insectivorous
Nectariniidae	<i>Nectarinia asiatica</i>	Purple Sunbird	R	LC	IV	Nectarivorous

Family	Scientific Name	Common Name	Status	Status (IUCN)	IWPA Schedule	Guild
Oriolini	<i>Oriolus traillii</i>	Maroon Oriole	R	LC	IV	Omnivorous
	<i>Oriolus xanthornus</i>	Black-hooded Oriole	R	LC	IV	Omnivorous
Paridae	<i>Parus major</i>	Great tit	R	LC	IV	Insectivorous
Pellorneidae	<i>Pellorneum ruficeps</i>	Puff-throated Babbler	R	LC	IV	Insectivorous
Phalacrocoracidae	<i>Phalacrocorax niger</i>	Little Cormorant	R	LC	IV	Carnivorous
	<i>Phalacrocorax carbo</i>	Great Cormorant	R	LC	IV	Carnivorous
Phasianidae	<i>Francolinus pondicerianus</i>	Gray Francolin	R	LC	IV	Omnivorous
	<i>Gallus gallus</i>	Red Jungle Fowl	R	LC	IV	Omnivorous
	<i>Lophura leucomelanos</i>	Kalij Pheasant	R	LC	IV	Omnivorous
	<i>Pavo cristatus</i>	Indian Peafowl	R	LC	IV	Omnivorous
Phylloscopidae	<i>Seicercus xanthoschistos</i>	Grey-hooded Warbler	R	LC	IV	Insectivorous
	<i>Phylloscopus humei</i>	Hume's Warbler	WV	LC	IV	Insectivorous
	<i>Seicercus burkii</i>	Golden-spectacled Warbler	R	LC	IV	Insectivorous
Picidae	<i>Picus canus</i>	Grey-headed Woodpecker	R	LC	IV	Insectivorous
	<i>Chrysocolaptes lucidus</i>	Greater Flameback	R	LC	IV	Insectivorous
	<i>Picus flavinucha</i>	Greater Yellownape	R	LC	IV	Insectivorous
	<i>Dinopium benghalense</i>	Black-rumped Flameback	R	LC	IV	Insectivorous
	<i>Dendrocopos canicapillus</i>	Grey-capped Pygmy Woodpecker	R	LC	IV	Insectivorous
	<i>Picus xanthopygaeus</i>	Streak-throated Woodpecker	R	LC	IV	Insectivorous
Psittaculidae	<i>Psittacula krameri</i>	Rose-ringed Parakeet	R	LC	IV	Granivorous
	<i>Psittacula cyanocephala</i>	Plum-headed Parakeet	R	LC	IV	Granivorous
	<i>Psittacula eupatria</i>	Alexandrine Parakeet	R	NT	IV	Granivorous
Pycnonotidae	<i>Hemixos flava</i>	Ashy Bulbul	R	LC	IV	Frugivorous
	<i>Pycnonotus leucogenys</i>	Himalayan Bulbul	R	LC	IV	Frugivorous
	<i>Pycnonotus cafer</i>	Red-vented Bulbul	R	LC	IV	Frugivorous
	<i>Pycnonotus melanicterus</i>	Black-crested Bulbul	R	LC	IV	Frugivorous
Rallidae	<i>Amaurornis phoenicurus</i>	White-breasted Waterhen	R	LC	IV	Omnivorous
Rhipiduridae	<i>Rhipidura aureola</i>	White-browed Fantail	R	LC	IV	Insectivorous
Saxicolinae	<i>Cercomela fusca</i>	Brown Rockchat	R	LC	IV	Insectivorous
	<i>Saxicola torquata</i>	Common Stonechat	WV	LC	IV	Insectivorous
Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper	WV	LC	IV	Insectivorous
Sittidae	<i>Sitta castanea</i>	Chestnut-bellied Nuthatch	R	LC	IV	Insectivorous
	<i>Sitta frontalis</i>	Velvet-fronted Nuthatch	R	LC	IV	Insectivorous
	<i>Sitta leucopsis</i>	White-tailed Nuthatch	R	LC	IV	Insectivorous
Stenostiridae	<i>Culicicapa ceylonensis</i>	Grey-headed Canary Flycatcher	WV	LC	IV	Insectivorous
	<i>Rhipidura hypoxantha</i>	Yellow-bellied Fantail	WV	LC	IV	Insectivorous

Family	Scientific Name	Common Name	Status	Status (IUCN)	IWPA Schedule	Guild
Strigidae	<i>Ketupa zeylonensis</i>	Brown Fish Owl	R	LC	IV	Carnivorous
	<i>Athene brama</i>	Spotted Owlet	R	LC	IV	Carnivorous
	<i>Glaucidium radiatum</i>	Jungle Owlet	R	LC	IV	Carnivorous
Sturnidae	<i>Acridotheres tristis</i>	Common Myna	R	LC	IV	Granivorous
	<i>Sturnus vulgaris</i>	Asian Pied Starling	R	LC	IV	Granivorous
Tephrodornithidae	<i>Hemipus picatus</i>	Bar-winged Flycatcher-shrike	R	LC	IV	Insectivorous
Tichodromadidae	<i>Tichodroma muraria</i>	Wall Creeper	WV	LC	IV	Insectivorous
Timaliidae	<i>Stachyris pyrrhops</i>	Black-chinned Babbler	R	LC	IV	Insectivorous
Turdidae	<i>Copsychus saularis</i>	Oriental Magpie Robin	R	LC	IV	Insectivorous
	<i>Monticola Solitarius</i>	Blue Rock Thrush	WV	LC	IV	Insectivorous
Upupidae	<i>Upupa epops</i>	Common Hoopoe	R	LC	IV	Insectivorous
Zosteropidae	<i>Zosterops palpebrosus</i>	Oriental White-eye	R	LC	IV	Insectivorous
	<i>Orthotomus sutorius</i>	Common Tailorbird	R	LC	IV	Insectivorous

R - Resident, WV - Winter Visitor, S/W - Partial visitor in both Summer and Winter, LC - Least Concern, NT - Near Threatened, CR - Critically Endangered

were observed in a radius of up to 150 m from the center point. The birds were identified through Grimm et al., 2011 and the species were assigned to a feeding guild following Wells, 1999 and Wells, 2007. The survey was conducted during time period of 08:00 to 16:30 hrs and species presence was further analyzed as per the survey hour. The time periods during which no birds were encountered or point counts were not undertaken, have been excluded for the survey analysis and results.

3. Results and Discussion

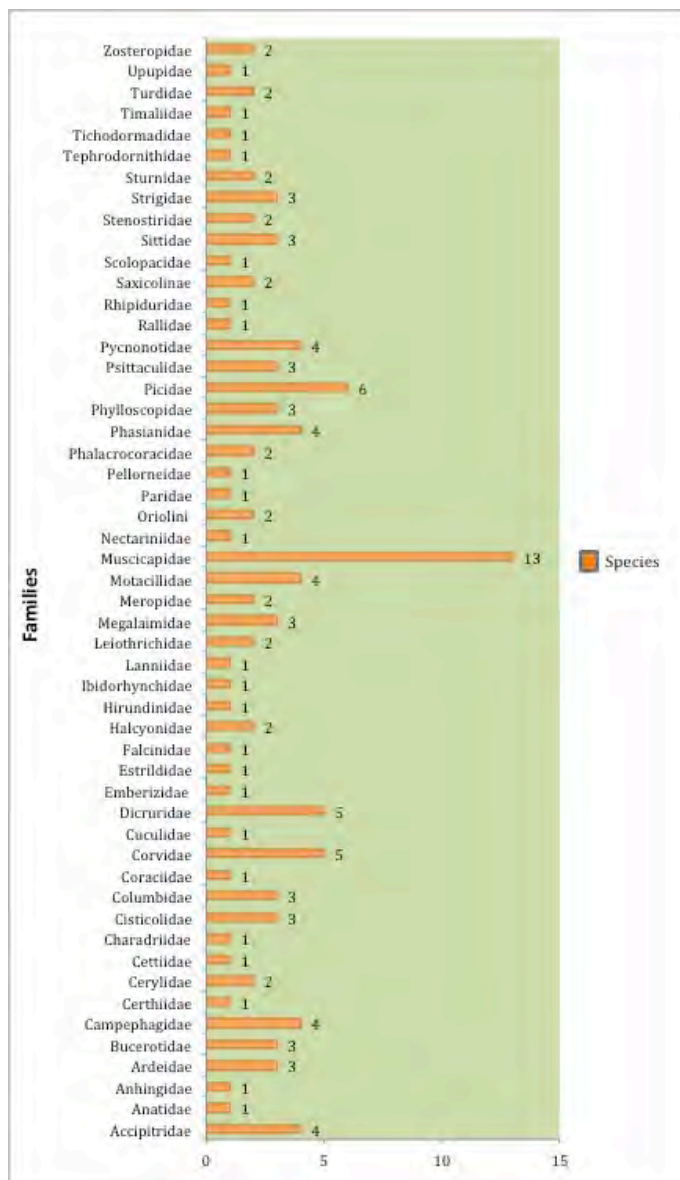
3.1 Avian diversity

A total of 121 bird species belonging to 52 families were recorded during the survey. Out of these species 101 were identified as Resident (R), 18 species as Winter Visitor (WV) and 2 species as partial visitor during both the Summer and Winter season (S/W) in the area. Some of these winter migrants breed in Central Europe such as Black Stork and migrate with their juveniles. Maximum members were represented by family Muscipadidae (13 species) followed by Picidae (6 species) and Corvidae and Dicruridae (5 species each). Among the other recorded families, five families were represented with 4 species each, nine families with 3 species each and ten families with 2 species each. The remaining 25 families were represented with only one species in each. The record of 121 species during a single season indicates habitat quality and diversity in the forest division. It is evident that variation in vegetation structure influence species distribution (MacArthur et al., 1962; Karr

& Roth, 1971; Pearman 2002) within a habitat. The landscape with more than one habitat types provides additional opportunities to diverse avian assemblages (Karr & Roth 1971). These habitat characteristics are important to support diverse avifauna and to reduce the habitat restriction of a particular bird species.

3.2 Avian community structure as per feeding guild

Among the recorded 121 species, 55% (66 species) were insectivorous, 19% (23) were carnivorous, 10% were frugivorous, 8% were omnivorous, 7% were granivorous and 1% nectarivorous according to their feeding habit. The presence of large number of insectivore bird community indicates that the area consists rich insect diversity as well as less human disturbances such as forest fire consequences (Gregory et al., 2001).



Number of species recorded in each family

The study finding is comparable with earlier studies that have found a positive relationship between the abundance of insectivores and relatively undisturbed or less disturbed habitat, and the abundance of carnivores and granivores significantly higher in relatively disturbed or modified environments (Fujioka & Yoshida 2001; Lombardini et al., 2001; Chettri et al., 2005; Zakaria et al., 2005; Azman et al., 2011). However, the presence of carnivorous species in the study area which is primarily influenced with the availability of food sources, indicates the abundance of their prey. Prey base such as small birds, lizards, snakes, rats, snails, leeches, are among the food sources for carnivores in the area. Furthermore, control on forest fire or a very few forest fire incidents have taken place in the area over the years. As a result it provide conditions to proliferate insect diversity which further supports bird species preying on them (Tim 2014).

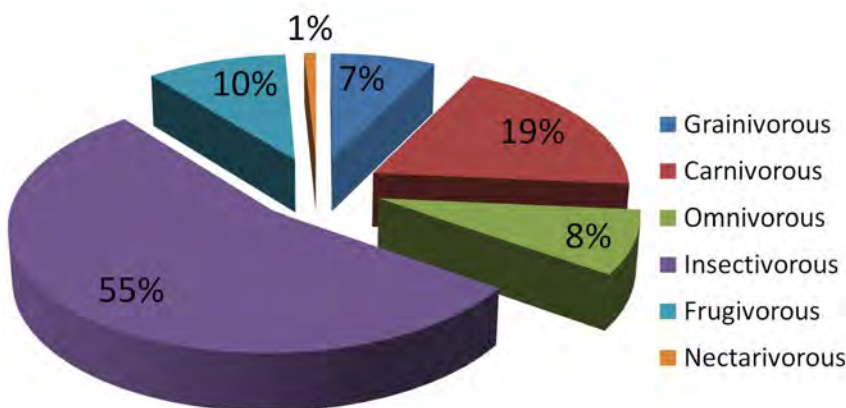
The presence of water birds especially the ducks was recorded in the upstream of Kosi River and its tributaries, indicates suitable foraging grounds in the forest division, addition to the Kosi barrage.

3.3 Conservation status

Among the recorded species a total of 118 species are listed as Least Concern (LC) while one species (Red-headed Vulture) as Critically Endangered (CR) and two species (Great Hornbill and Alexandrine Parakeet) as Near Threatened (NT) in the IUCN Red List 2015. In terms of Indian Wildlife Protection Act (IWPA, 1972), all species are listed under Schedule IV.

Two prominent Protected Areas (PAs) of the Uttarakhand in the Terai-bhabar of Himalayan foothills, namely Corbett Tiger Reserve (CTR) and Rajaji Tiger Reserve (RTR) are declared Important Bird Areas (Rahmani & Islam, 2004). In both the PAs avifaunal checklists have been prepared and 549 species in CTR (Sharma et al., 2003) and 312

species of birds in RTR (Pandey et al., 1994) were recorded. Influence of adjoining diverse ecosystem can be seen on similar habitats especially in terms of bird community structure (Matlock & Edwards 2006). Moreover, adequate habitat protection measures influence the species diversity and



Percentage of bird species as per their feeding guild

abundance. The recorded species in present study are about 22% of the birds recorded in CTR by Sharma et al., 2003. The presence of Red-headed Vulture in the forest division is also significant for the survival of globally threatened species and its conservation planning. However, no records of two more globally threatened resident raptor species (White-rumped Vulture and Slender-billed Vulture) was a serious issues of concern and indicates the poor recovery of the species after mass extinction during 1990s and early 2000s. For the recovery of these two species of vultures in the Ramnagar division, an action plan needs to be incorporated in the working plans of the division. Furthermore, a detailed investigation including all the season is necessary to enhance the understanding on avian diversity including habitat preference by various specialized bird species in the

Ramnagar forest division.

Conclusion

Ramnagar forest division has received adequate protection after monitoring studies proved occurrence of viable population of the tigers in the division. In addition to this, large number of migratory birds especially in winters arrived in the landscape for foraging due to its unique habitats characteristics. Riverine and wetland habitat such as perennial rivers, seasonal water streams, ponds and an irrigation barrage on the Kosi river, are among the suitable habitats for water and riverine birds. The Ramnagar forest division has received adequate protection under tiger conservation programme within the Corbett Landscape, however, increasing anthropogenic pressure such as non-regulated tourism, malpractices of fishing (use of dynamite, chemicals, live wire, etc.) and increasing tourism infrastructure chain are being the issues of concern. These issues have severe consequences on biological diversity of area including the avifaunal abundance. Moreover, drying of natural water resources due to variability in climatic condition over the years increases the species vulnerability. Appropriate measures such as control on fishing, promoting responsible tourism, regulation on mining and regular monitoring on practices damaging the ecosystem are needs to be undertaken to restore the habitat quality. Education and outreach activities such as bird watching events to aware the school children and people on importance of bird communities, would be crucial for conserving the habitat and avian diversity in the landscape.

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