RESEARCH ARTICLE

Diversity and Habitat Association of Birds in a Vindhyan Gorge of Kekariya, Rajasthan, India

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Study Area: Vindhyan Gorge of Kekariya, Bhilwara, Rajasthan

Coordinates: N 25° 08' 21.48" E 075° 01' 52.52'

Key words: Avifauna, Threats,

Abstract

Vindhyan gorges are spreaded in the south east part of Rajasthan. Geologically the Vindhyan gorge of Kekariya, Rajasthan is kept in Bhandar group under Vindhyan supergroup having rocks of sandstone, shales and limestone. We studied the diversity of the avifauna of this gorge from 2013 to 2016 using line transect method. Total 82 species of birds were recorded during the present study. Out of these, 64 species were resident and 18 species were migratory. Birds showed their habitat preference for different parts of the gorge. Raptor birds dominated all other birds. Illegal woodcutting, over grazing and people's ignorance towards conservation were some of the threats identified to the gorge biodiversity.

Introduction:

Canyons and gorges are the deep and narrow valleys having wall like steep valley sides. These are formed because of regular down cutting of the valley by the fluvial cycle of erosion and recession of waterfalls (Singh, 2015). The Vindhyan range is located in the south-east part of the Rajasthan state of India in Dholpur, Bharatpur, Karauli, Sawai Madhopur, Bundi, Kota, Bhilwara and Chittorgarh districts. The Vindhyan range gives rise to many rivers as Chambal, Kali Sindh, Parwan, Menali, Berach etc. These river flows from the deep gorges, a characteristic of the Vindhyas. The Chambal River flows in the deep Vindhyan gorge in the Hadoti region of Rajasthan. Several micro-ecosystems are found in the gorges due to the differences in humidity, sunlight and other typical abiotic factors. This diversity of habitat and regional micro-ecosystems make gorges richer in vegetation and the concerned fauna (Grant, 2005; Mowbray & Henry, 1968). The almost undisturbed ecology and riparian vegetation of the gorges also favours the rich biodiversity. The Kresna gorge of Bulgaria was reported to harbour 232 avian species which is indeed 58% of the total Bulgarian avian fauna (Hubenov, 2012). Keeping such figures and facts in mind many of the gorges outside India, have been protected by laws as Protected Areas.

Biodiversity of the birds of the gorges have been studied worldwide (Kopij, 2013; Spence *et al.*, 2011; Patten *et al.*, 2006; Nikolov & Spasov, 2005; Shurulinkov &

Nikolov, 2005; Hornsby, 1997; Taylor, 1989; Parnell & Quay, 1964) but no scientific study has been done in India besides a single checklist of the birds on Vindhyan gorges (Sharma and Singh, 2006). In the present study, we attempted to bring to the fore the diversity of the birds in this wonderful area accompanied with the threats and conservation suggestions for the habitat.

Materials and methods:

Study Area: Bhilwara district is located in the mid-southern part of the Rajasthan state. The Vindhya Range passes from the south-east part of the district through Mandalgarh subdivision. The gorge of Kekariya is situated 15 Km south west from headquarters of Mandalgarh subdivision. It has its name from the neighbouring village Kekariya. This gorge is 1560 meter in length with varying width along its length. During Monsoon, water flows in the gorge in the form of many small rivulets and streams. Although these streams disappear after monsoon but small underground streams confirm availability of water in the gorge round the year. Water accumulates locally in some pits in the gorges and supports the wildlife. The average rain fall in the area is 735 mm which is above the mean annual rainfall of entire Rajasthan as well as is higher than other parts of Bhilwara district. The average temperature is 25.8 °C The vegetation of the gorge is chiefly dry deciduous type dominated by *Anogeissus pendula* (Dhok), *Boswellia serrata* (Salar), *Prosopis cineraria* (Khejri), *Acacia*

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leucophloea (Khejda) *Senegalia catechu* (Khair), *Dalbergia sissoo* (Shisham), *Butea monosperma* (Dhhak) and *Ziziphus mauritiana* (Ber).

The study was accomplished in and around the Kekariya gorge of Vindhyan mountain range, from winter 2013 to summer 2016. Data were collected during early morning hours from 7:00 to 9:00 in winters and 6:00 to 8:00 in summers on three season basis i.e., summer, monsoon and winter. Random visit between the seasons were also made. Line transect method (Bibby *et al.*, 1998) was followed to study the birds. Transects of different lengths were laid in the bottom and terrace of the gorge. The length was 1560 m in the bottom and 1380 m on the terrace of the gorge. Walking on transect with uniform pace, the birds seen on either side of the transect were recorded. The birds were seen and photographed using Celestron binoculars (8x42) and Canon 1200 DSLR camera with 55-250 mm zoom lens. Call notes of birds were also used for locating and identifying birds. Garmin etrex30 GPS was used to record the geographical coordinates of a particular location. The birds were identified and listed using field books (Grimmett *et al.*, 2011). All the birds were categorized on the basis of trophic guild based on Ali and Ripley (2007) and field observations done. Although this gorge does not have a high altitude but an attempt has been made to show the distribution of the birds according to their preference to stay in gorge. Abbreviation "IG" is used for "In gorge" and RG is used for "Roof or Terrace of the gorge". The residential status of the birds was categorized as "summer migratory" "winter migratory", "passage migratory" and "resident". The birds seen regularly in the study area were categorized as "resident"; birds encountered only in summer and winter seasons were kept under "summer migratory" and "winter migratory" and birds encountered only once or twice during the study period were considered as "passage migratory". We calculated the Relative diversity (RD) of the birds of dominating families using the following formula:

$$RD = \frac{\text{Number of species in a family} \times 100}{\text{Total number of species}}$$

Figure 1: Googleearth image of the gorge showing; a) Vindhyan gorge of Kekariya, b) the transect of study

Results

We recorded total 82 species of 36 Families during the study period (Table: 1). In the previous study (Sharma & Singh, 2006) 30 species of the birds were reported in the same Vindhyan gorge. Out of the 82 species, 64 species were resident, 15 were winter migratory and 3 were summer migratory. As per the IUCN red list 2015, three bird species of the gorge, Long-billed vulture, *Gyps indicus* is critically endangered, Egyptian vulture, *Neophron percnopterus* is endangered and Woolly necked stork, *Ciconia episcopus* is vulnerable. From the guild point of view 41.46% (n=34) birds were insectivorous, 23.17% (n=19) birds were Omnivorous, 21.95% (n=18) were Carnivorous, 8.54% (n=7) were Grainivorous, 3.66% (n=3) were Frugivorous and 1.22% (n=1) was Nectarivorous. Cisticolidae is the biggest family of the area (RD-9.76) followed by Accipitridae with (RD-7.32). Ten species of raptors were recorded here in this gorge.

Discussion:

The Gorge of Kekariya supports a variety of life in its ecology and functions like an ecological corridor. Corridors are the linear path of habitat that permits movement of animals through landscapes (Puth & Wilson, 2001). The gorge of Kekariya provides a safe route for movement and other vital activities for animals away from human disturbances. Availability of food and water, breeding sites and diverse habitats make gorge an excellent stay site for the birds. High cliffs, burrows, crevices, trees with thick trunks, dry tree trunks, patches of long grass, exposed rocks, thorny vegetation and high density of plants and accumulated water in the gorge are some varieties of habitats suitable for different bird species. Cormorants, herons, egrets and kingfishers are attracted towards the gorge because of occurrence of small fishes and small invertebrate like crab and molluscs in water. Humidity, availability of grass and flowering plants affect the population of insectivorous birds in any habitat as suggested by Joshi & Bhatnagar (2015). Flowers of trees and grass of the gorge attract insects which in turn invite insectivorous birds to the gorge. This is why insectivorous birds make the highest proportion (41.46%) among the total bird species (Fig.: 2). Thick trunks are suitable for the birds which make hole-nest such as Rose-ringed Parakeet *Psittacula krameri*, Common Myna *Acridotheres tristis*, Brahminy starling *Sturnus pagodarum* and Indian Roller *Coracias benghalensis*.

A significant aspect of Kekariya gorge biodiversity is the breeding of critically endangered Long-billed vultures and endangered Egyptian vultures. High cliffs and ruins are preferred for nesting by the vultures (Rahmani, 2015; Manchiryal & Medicheti, 2016). Availability of high cliffs in the gorge of Kekariya supports these threatened bird species. Vultures scavenge the dead carcasses and

Figure-2: showing proportion of birds of different guild in the study area

remnants of prey of carnivore animals left in the gorge. In summers, water around the gorge almost dries up and then water inside the gorge becomes a life line for the animals. Availability of water in the gorge is like an oasis for these animals. Many birds like Ashy Crowned Sparrow-Lark *Eremopterix griseus*, Eurasian Collared Dove *Streptopelia decaocto*, Laughing Dove *Streptopelia senegalensis*, Spotted Dove *Streptopelia chinensis* and Babblers which usually avoid their stay in the gorge, come to the gorge floor for water in summers. Presence of small birds, rodents and small mammals support the presence of raptor birds. Different owl and eagle species get their food from the gorge. Birds like house sparrow *Passer domesticus* and house crow *Corvus splendens* were not seen in the area as these birds prefer human habitations and are present in the nearby village.

Wood cutting for fuel and fodder purposes, overgrazing leading to denudation of the land and lack of awareness of people for biodiversity conservation were some pressing problems of this gorge. Gorge biodiversity is dependent on rainfall for their water requirement. So sometime it becomes critical factor for the gorge ecosystem as scarcity of water leads to change in vegetation and habitat alteration (Quinn *et al.*, 2005). During the present study in year 2015 the number of birds was negatively affected due to the low rainfall. Fuel wood collection and overgrazing are identified as the principle threats to the biodiversity (Chanie & Tesfaye, 2015). In Samaria gorge one of the many threats identified was overgrazing by the domestic goats which had destroyed the natural regeneration of important plants in the area (Spanos *et al.*, 2008). We found the similar biotic pressure of overgrazing on trees which remained dwarf only due to overgrazing. Many stunted trees of *Anogeissus pendula* can be seen in the gorge which are not attaining their height because of overgrazing by the livestock. Thus the use of forests for livelihood such as firewood and fodder collection, overgrazing is pushing the biodiversity towards a decline. These socio-economic changes have been identified as a threat for the biodiversity (Jalilovaa, 2013). In Kekariya, the communication between the villagers and the authorities seems a neglected aspect that results into lack of cooperation from the public side. NGO's had

prepared check dam in the gorge to prevent soil erosion and for water conservation but no support or initiative was taken by villagers to maintain them at their own. Similar problem was reported from Lazer Canyon of Eastern Serbia where conservation efforts had lost the directions without insufficient co-operation and communication between organizations (Grujic *et al.*, 2008).

The findings of our study suggest that gorge natural forests must be conserved to prevent the genetic biodiversity loss. It is the habitat and breeding site of the birds as well as many mammals. Grazing should be planned in such a way that it could be done in different patches of the habitat alternatively. So that it would divide the pressure and growing plant will get time to regenerate. Reforestation is also strongly recommended. The conservation should be planned and managed in such a way to ensure the willful participation of local people and also fulfill their daily requirement from the forest.

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Some Threatened Birds of Kekariya Gorge

Table-1 Bird species recorded in the gorge of Kekariya (a Vindhyan gorge)

	Common Name	Zoological name	Residential status	Feeding guild	Distribution in the gorge	IUCN status
Phasianidae						
1	Grey Francolin	<i>Francolinus pondicerianus</i>	R	Omnivorous	RG	LC
2	Indian Peafowl	<i>Pavo cristatus</i>	R	Omnivorous	IG, RG	LC
3	Painted Spurfowl	<i>Galloperdix lunulata</i>	R	Omnivorous	IG	LC
Ciconiidae						
4	Woolly-necked Stork	<i>Ciconia episcopus</i>	R	Carnivorous	RG	Vulnerable
Ardeidae						
5	Indian Pond Heron	<i>Ardeola grayii</i>	R	Carnivorous	IG	LC
6	Little Egret	<i>Egretta garzetta</i>	R	Carnivorous	IG	LC
Phalacrocoracidae						
7	Little Cormorant	<i>Phalacrocorax niger</i>	R	Carnivorous	IG	LC
Accipitridae						
8	Egyptian Vulture	<i>Neophron percnopterus</i>	R	Carnivorous	IG	Endangered
9	Indian or Long-billed vulture	<i>Gyps indicus</i>	R	Carnivorous	IG	Critically Endangered
10	Crested Serpent Eagle	<i>Spilornis cheela</i>	R	Carnivorous	IG	LC
11	Shikra	<i>Accipiter badius</i>	R	Carnivorous	IG, RG	LC
12	Eurasian Sparrowhawk	<i>Accipiter nisus</i>	SM	Carnivorous	IG	LC
13	Bonelli's Eagle	<i>Aquila fasciata</i>	R	Carnivorous	IG, RG	LC

Common Name	Zoological name	Residential status	Feeding guild	Distribution in the gorge	IUCN status
Scolopacidae					
14 Common Sandpiper	<i>Actitis hypoleucos</i>	WM	Insectivorous	IG	LC
Columbidae					
15 Common Pigeon	<i>Columba livia</i>	R	Grainivorous	RG	LC
16 Eurasian Collared Dove	<i>Streptopelia decaocto</i>	R	Grainivorous	RG	LC
17 Spotted Dove	<i>Streptopelia chinensis</i>	R	Grainivorous	RG,IG	LC
18 Laughing Dove	<i>Streptopelia senegalensis</i>	R	Grainivorous	RG	LC
19 Yellow footed green pigeon	<i>Treron phoenicopterus</i>	R	Frugivorous	RG	LC
Psittacidae					
20 Rose-ringed Parakeet	<i>Psittacula krameri</i>	R	Frugivorous	IG,RG	LC
21 Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	R	Frugivorous	IG,RG	LC
Cuculidae					
22 Jacobin Cuckoo	<i>Clamator jacobinus</i>	SM	Insectivorous	IG,RG	LC
23 Common Hawk Cuckoo	<i>Hierococyx varius</i>	SM	Insectivorous	RG	LC
24 Asian Koel	<i>Eudynamys scolopaceus</i>	R	Omnivorous	RG	LC
25 Southern Coucal	<i>Centropus sinensis</i>	R	Carnivorous	RG	LC
Strigidae					
26 Indian Eagle-Owl	<i>Bubo (bubo) bengalensis</i>	R	Carnivorous	IG	LC
27 Spotted Owlet	<i>Athene brama</i>	R	Carnivorous	IG,RG	LC
28 Brown Fish-Owl	<i>Ketupa zeylonensis</i>	R	Carnivorous	IG	LC
29 Mottled Wood-Owl	<i>Strix ocellata</i>	R	Carnivorous	IG	LC
Apodidae					
30 Little Swift	<i>Apus affinis</i>	R	Insectivorous	IG	LC
Coraciidae					
31 Indian Roller	<i>Coracias benghalensis</i>	R	Carnivorous	RG	LC
Alcedinidae					
32 White-throated Kingfisher	<i>Halcyon smyrnensis</i>	R	Carnivorous	IG	LC
Meropidae					
33 Green Bee-eater	<i>Merops orientalis</i>	R	Insectivorous	RG	LC
Upupidae					
34 Common Hoopoe	<i>Upupa epops</i>	R	Insectivorous	RG	
Picidae					
35 Brown-capped Pygmy Woodpecker	<i>Dendrocopos nanus</i>	R	Insectivorous	RG	LC
36 Lesser Golden-back Woodpecker	<i>Dinopium benghalense</i>	R	Insectivorous	RG	LC
37 Yellow -Crowned Woodpecker	<i>Dendrocopos mahrattensis</i>	R	Insectivorous	RG	LC
Campephagidae					
38 Large Cuckoo-shrike	<i>Coracina macei</i>	R	Insectivorous	RG	LC
39 Small Minivet	<i>Pericrocotus cinnamomeus</i>	WM	Insectivorous	IG	LC
40 Common Woodshrike	<i>Tephrodornis pondicerianus</i>	R	Insectivorous	IG,RG	LC
41 Long-tailed Shrike	<i>Lanius schach</i>	R	Carnivorous	RG	LC
Oriolidae					
42 Indian Golden Oriole	<i>Oriolus oriolus</i>	WM	Omnivorous	IG	LC
Dicruridae					
43 Black Drongo	<i>Dicrurus macrocercus</i>	R	Insectivorous	IG,RG	LC
44 White-bellied Drongo	<i>Dicrurus caeruleus</i>	R	Insectivorous	IG,RG	LC
Rhipiduridae					
45 White-browed Fantail Flycatcher	<i>Rhipidura aureola</i>	R	Insectivorous	IG,RG	LC
Monarchidae					
46 Asian Paradise-flycatcher	<i>Terpsiphone paradisi</i>	WM	Insectivorous	IG	LC
Corvidae					
47 Rufous Treepie	<i>Dendrocitta vagabunda</i>	R	Omnivorous	IG	LC
Paridae					
48 Great Tit	<i>Parus major</i>	R	Omnivorous	IG,RG	LC
Hirundinidae					
49 Wire-tailed Swallow	<i>Hirundo smithii</i>	R	Insectivorous	IG	LC
50 Dusky Crag Martin	<i>Ptyonoprogne concolor</i>	R	Insectivorous	IG	LC

Common Name	Zoological name	Residential status	Feeding guild	Distribution in the gorge	IUCN status
51 Red-rumped Swallow	<i>Cecropis daurica</i>	R	Insectivorous	IG	LC
Alaudidae					
52 Singing Bushlark	<i>Mirafra cantillans</i>	R	Omnivorous	RG	LC
53 Ashy-crowned Sparrow-Lark	<i>Eremopterix griseus</i>	R	Omnivorous	RG	LC
Cisticolidae					
54 Ashy Prinia	<i>Prinia socialis</i>	R	Insectivorous	RG	LC
55 Plane Prinia	<i>Prinia inornata</i>	R	Insectivorous		LC
56 Rufous-fronted Prinia	<i>Prinia buchanani</i>	R	Insectivorous	RG	LC
57 Common Tailorbird	<i>Orthotomus sutorius</i>	R	Insectivorous	IG	LC
58 Common Lesser Whitethroat	<i>Sylvia curruca</i>	WM	Insectivorous	IG, RG	LC
59 Common Chiffchaff	<i>Phylloscopus collybita</i>	WM	Insectivorous	IG, RG	LC
60 Sulphur-bellied Warbler	<i>Phylloscopus griseolus</i>	R	Insectivorous	IG	LC
61 Green Warbler	<i>Phylloscopus trochiloides</i>	WM	Insectivorous	IG	LC
Pycnonotidae					
62 Red-vented Bulbul	<i>Pycnonotus cafer</i>	R	Omnivorous	IG, RG	LC
Timaliidae					
63 Common Babbler	<i>Turdoides caudate</i>	R	Omnivorous	RG	LC
64 Large Grey Babbler	<i>Turdoides malcolmi</i>	R	Omnivorous	IG, RG	LC
65 Jungle Babbler	<i>Turdoides striata</i>	R	Omnivorous	IG	LC
Sturnidae					
66 Bank Myna	<i>Acridotheres ginginianus</i>	R	Omnivorous	RG	LC
67 Common Myna	<i>Acridotheres tristis</i>	R	Omnivorous	IG, RG	LC
68 Asian Pied Starling	<i>Gracupica contra</i>	R	Omnivorous	RG	LC
69 Brahminy Starling	<i>Sturnus pagodarum</i>	R	Omnivorous	RG	LC
Turdidae					
70 Indian Robin	<i>Saxicoloides fulicatus</i>	R	Insectivorous	RG	LC
71 Brown Rock Chat	<i>Cercomela fusca</i>	R	Insectivorous	RG, IG	LC
Muscicapidae					
72 Grey-headed Canary Flycatcher	<i>Culicicapa ceylonensis</i>	WM	Insectivorous	IG	LC
73 Tickell's Blue flycatcher	<i>Cyornis tickelliae</i>	WM	Insectivorous	IG	LC
74 Red-breasted flycatcher	<i>Ficedula parva</i>	WM	Insectivorous	IG	LC
Nectarinidae					
75 Purple Sunbird	<i>Nectarinia asiaticus</i>	R	Nectivorous	RG, IG	LC
Passeridae					
76 Chestnut-shouldered Petronia	<i>Gymnoris xanthocollis</i>	R	Omnivorous	RG	LC
Estrildidae					
77 White Throated Munia	<i>Lonchura malabarica</i>	R	Omnivorous	RG	LC
Motacillidae					
78 Yellow Wagtail	<i>Motacilla flava</i>	WM	Insectivorous	IG	LC
79 Grey Wagtail	<i>Motacilla cinerea</i>	WM	Insectivorous	IG	LC
Emberizidae					
80 Crested Bunting	<i>Melophus lathami</i>	WM	Grainivorous	IG	LC
81 White-capped Bunting	<i>Emberiza stewarti</i>	WM	Grainivorous	IG	LC
82 Grey necked Bunting	<i>Emberiza buchanani</i>	WM	Grainivorous	IG	LC

Abbreviations- R- Resident, WM-Winter Migratory, SM- Summer Migratory, IG- In gorge, RG- Roof or Terrace of the gorge, LC- Least Concern,