

## Pakistan Journal of Life and Social Sciences

www.pjlss.edu.pk

### RESEARCH ARTICLE

## An Avi-Faunal Inventory of Miangan Tarakai Game Reserve: A Future Destination for Eco-Tourists

Romaan Hayat Khattak<sup>1</sup>, Zheng Xin<sup>2,3\*</sup>, Shakeel Ahmad<sup>4</sup>, Ejaz Ur Rehman<sup>4</sup> and Nathan James Roberts<sup>1</sup>

<sup>1</sup>College of Wildlife and Protected Area, Northeast Forestry University, Harbin 150040, P.R. China

<sup>2</sup>College of Economics Management Northeast Forestry University, Harbin 150040, P.R. China

<sup>3</sup>Library Northeast Forestry University, Harbin 150040, P.R. China

<sup>4</sup>Department of Animal sciences, Faculty of Bio-Sciences, Quaid-i-Azam University 45320, Islamabad, Pakistan

### ARTICLE INFO

Received: Jan 02, 2019

Accepted: May 05, 2019

### Keywords

Avifaunal biodiversity

Eco-tourism

Khyber Pakhtunkhwa

Migratory birds

### ABSTRACT

This study was conducted at Miangan Tarakai Game Reserve from December 01-20, 2017. The main objective of the study was to prepare a checklist of the local birds and to suggest recommendations for conservation of migratory water fowls so as to launch ecotourism programmes. Point count was used for determining number of bird species in a sampling point. A total of 8104 individuals were counted, belonging to 23 families and 30 species. Most of the species represented family Phasianidae (12.90%). The second-most species-rich families included Alaudidae, Accipitridae, Sturnidae, and Corvidae, each of these represented by two species (6.45%). According to the Jackknife species richness estimator, the current study seems to be virtually complete. Shannon-Weiner Diversity Index (H) (2.91), Simpson's Diversity Index (D) (0.92), and Equitability (E) (0.87) were determined for overall families. Post construction of Jallozai Barrani Dam, migratory water fowls were reported for the first time in the area. According to the results, the area seems to be a promising station for the migratory birds, which can ultimately be very useful to launch bird watching and ecotourism programmes. So far, all the migratory birds have been declared as protected at many Game Reserves across Pakistan. Under the circumstances, it is suggested that that the existing law should be extended to Miangan Tarakai Game Reserve, and that hunting practices of local birds should be strictly regulated and controlled according to Khyber Pakhtunkhwa Wildlife and Biodiversity Protection, Preservation, Conservation and Management Act, 2015.

### \*Corresponding Author:

zhengxin@nefu.edu.cn

### INTRODUCTION

Faunal inventories are of great importance in the environmental conservation practices, particularly in areas facing excessive anthropogenic pressures (Ruiz-Esparza et al., 2016). Birds play a key role as bio-indicators of eco-systems (Canterbury et al., 2000). One of the major roles played by birds is serving as a natural biological control agent by consuming agricultural pests, their eggs and larvae, and thus proving themselves to be the true friends of farmers (Mian, 1995; Beg and Qureshi, 1972).

Birds are the primary focus of ecotourism (Buckley, 2004) and bird watching is making huge progress as a vast specialist sector of the ecotourism industry (Jones and Buckley, 2000). Ecotourism can generate stable revenue for local communities (Goodwin 1996; King and Stewart 1996), and especially birdwatchers form the largest ecotourism group, who are often well-educated and having above-average income (Vayanni et al., 2005; Cordell and Herbert, 2002; Ceballos-Lascuráin, 1996). Kerlinger and Brett (1995) estimated the annual revenue from five birding sites in America to be US\$ 2.4 million to US\$4 million. According to Munn (1992), each Macaw (*Ara macao*) in south-

eastern Peru can potentially generate US\$ 750–4700 in one year and US\$ 22500–165000 over whole life based on attracting visitors. This clearly illustrates that bird watching can be a potential tool for economic development and can be a source of income for local communities (Glowinski, 2008; Kerlinger and Brett, 1995).

Pakistan has a vast range of ecosystems which harbour rich bird diversity and is also very appealing for migratory birds to exploit the resources of these rich ecosystems (Khan et al., 1966). More than 668 species of bird are present across Pakistan with their unique occurrence in the three zoogeographical regions, Oriental, Ethiopian and Palaearctic region (Grimmett et al., 2008). Khyber Pakhtunkhwa (KPK), formerly called North West Frontier Province harbours a rich avian biodiversity. Many iconic bird species are found in the province but are not fully explored and documented. Pathan et al. (2014) and Dad et al. (2014) recorded avian diversity of Swat and Buner districts, respectively. In Pakistan birds are hunted and captured on a large scale and the current status of species are stable, but this trend of extensive hunting can cause drastic declines of local species populations (Fuller et al., 2000).

This study was aimed to explore and document the avian fauna of Miangan Tarakai Game Reserve. The study was also focused to educate and increase the knowledge of local people about the local fauna and its worth and to suggest recommendations to initiate ecotourism programs. Findings of this study will serve as a baseline data for future studies necessary for conservation of natural resources.

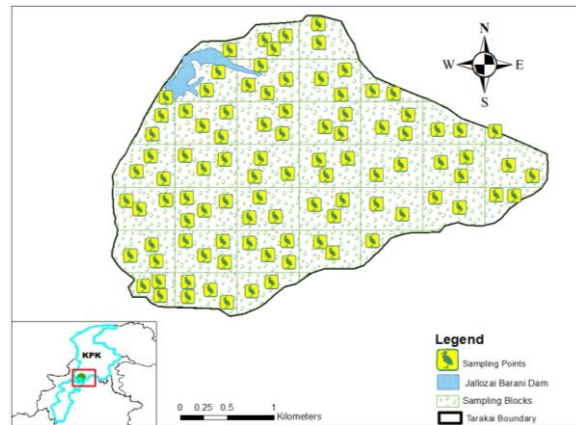
## MATERIALS AND METHODS

### Study area

The study was conducted within Miangan Tarakai Game Reserve and its boundary situated in Dak Ismail Khel (33°51'N, 71°49'E), Nowshera district, KPK (Fig. 1). The reserve encompasses an area of 17.4 km<sup>2</sup> (1740 ha). The forest is sub-tropical broad-leaved evergreen forest (scrub forests). The main plant species are *Acacia modesta* (Phulai), *Acacia nilotica* (Kikar), *Zizyphus mauratiana* (Ber) and *Monothea buxifolia* (Gwargurah). In addition, many shrubs and tall grasses are also abundant in the forest. The area is also used as pasture for livestock. Previously no inventory surveying has been done to record the fauna. As reported by the local community and personal observation during the survey, wild boar (*Sus scrofa*), Asiatic jackal (*Canis aureus*), red fox (*Vulpes vulpes*), wild rabbit (*Lepus nigricollis*), porcupine (*Hystrix indica*), Hedgehog (*Hemiechinus collaris*) and House shrew (*Suncus murinus*) were observed as common animal species. Additionally, livestock depredation records and locals'

responses about wild mammalian fauna revealed common leopard (*Panthera pardus*) as a regular visitor the area, likely because of functional corridors that link the reserve with Cherat Wildlife Park and being adjacent to Manglot Wildlife Park, both occupied by this large felid (Personal Communication with Haleem Khan Marwat, Divisional Forest Officer-Peshawar Division and Farhan Hayat, Range Officer-Cherat wildlife Park). The reserve also harbours a variety of reptiles which are not scientifically assessed and documented yet. Authors observed that *Saara hardwickii*, *Varanus bengalensis*, *Bungarus caeruleus*, and *Platypus rhodorachis* were common.

The reserve was officially declared as community game reserve under the title “Miangan Tarakai Game Reserve” in 2007 by KPK Wildlife Department after an agreement with the local stake holders. In 2014, the construction of a small dam named “Jallozai Barani Dam” was approved by Government of KPK for irrigation purpose, with a storage capacity of approximately 931,000 cubic meters (Anonymous, 2014a).



**Fig. 1: Map of Miangan Tarakai Game Reserve depicting sampling points for bird surveys.**

### Survey methodology

Field surveys were conducted from December 01- 20, 2017. Different direct and indirect methods were used to record the bird species. We used fixed point-count method (Bibby et al., 1992; Hutto et al., 1986). The study area was divided into 0.5 km<sup>2</sup> blocks for the purpose of spatial stratification to avoid clustering of points. In order to carry out exhaustive sampling, a total of 97 fixed points were randomly selected across all the blocks. A buffer of 50-meter radius was chosen for each point. GPS was used to navigate to the location of each point. Binoculars (8 x 40) were used to scan the circular buffer (Haldin and Ulfvens, 1987). In some open areas where the birds usually avoid humans, we used camouflage clothing or cover. Following the methodology of Volpato et al. (2009), the sampling

time for each point was kept 15 minutes. Field surveys were carried out in the morning period, 6.30am- 9.00am and late afternoon period i.e. 3.00pm - 5.00pm.

Species were identified with the help of previously published literature (Grimmett et al., 2008; Mirza and Wasiq, 2007; Roberts, 1991). While moving from one block to another we performed flushing for the game birds, especially in areas with tall grasses and shrubs. We walked roughly with a speed of one step per second (Jiménez et al., 2013). Flushed birds were identified and recorded. In order to decrease the chances in recording false absences, opportunistic observations were also included in data (Devi and Saikia, 2010). Night surveys were also conducted for nocturnal species by using flashlights in the areas marked in daytime, identified as possible nesting areas for such species. In the methodology, we assumed not to carry out field visits on rainy days and with strong wind (Volpato et al., 2009). Throughout the study period the weather was uniform, with exception of being cloudy for few days.

For each independent sighting we also recorded naïve abundance. Common, frequently observed, abundant species however, due to the impracticality and redundancy of precisely counting every individual, were given a standard total value of 1,000 pooled across sampling days and points. Five species were given these abundance values: house sparrow (*Passer domesticus*), common myna (*Acridotheres tristis*), jungle babbler (*Turdoides striata*), common house martin (*Delichon urbicum*) and house crow (*Corvus splendens*). Each of these five species were seen in such high numbers within aggregations, and the totals of each species were far greater than for any other species encountered. It was considered reasonable to assume a standardized value for these species which was at least moderately representative of their relative abundance.

#### **Bird species diversity**

In order to evaluate species diversity, species richness and evenness, Shannon-Weiner (Shannon and Weaver, 1949) and Simpson diversity indices (Simpson, 1949) were calculated for overall bird families.

#### **Shannon-weiner index**

$$H' = - \sum [P_i \ln P_i]$$

Where  $H'$  = Shannon Diversity Index;  $P_i$  = Proportion of each species;  $\ln P_i$  = natural logarithm of this proportion

#### **Simpson index**

$$D = 1 - \left\{ \sum n(n-1) / N(N-1) \right\}$$

$D$  = Simpson diversity index;  $N$  = total count of all species;  $n$  = total count of a particular specie

For estimating the total winter species richness of the area, we used Jackknife 1 calculated in Estimates 9.0 (Colwell et al., 2012). Arc-GIS 10.2.1 was used for map development and the Digital Elevation Model for the area was downloaded from USGS (Glovis, <https://glovis.usgs.gov>).

## **RESULTS AND DISCUSSION**

A total of 8104 birds were observed in the study area belonging to 23 different families and 30 species (Table 1). The majority of species were observed from the family Phasianidae ( $n=4$ , 12.90%). This was followed by Alaudidae, Accipitridae, Sturnidae, and Corvidae. Each of these preceding families was represented by two species (6.45%). The rest of the families were represented by a single species. Family Phasianidae was represented by four species: chukar partridge (*Alectoris chukar*), grey francolin (*Francolinus pondicerianus*), black francolin (*Francolinus francolinus*), and see-see partridge (*Ammoperdix griseogularis*). Newton (1995) described chukar partridge to be the most adaptable game bird within different habitats, including rocky, arid and high elevations. Mann and Chaudhry (2000) also reported black francolin from Cherat which lies next to our study area. In the present study, the total number of black francolin and see-see partridge individuals was less than chukar partridge, and grey francolin.

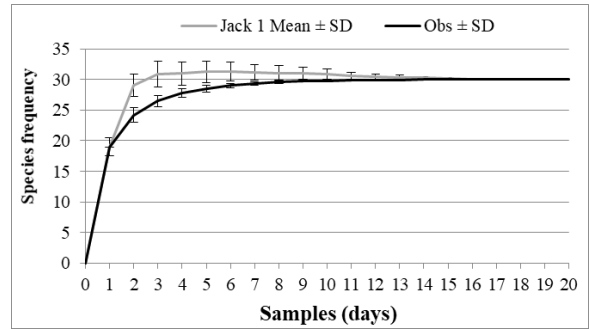
Out of observed bird species, the most abundant were house sparrow, common myna, jungle babbler, house crow and common house martin with more than 1,000 individuals of each specie in the study area. All were capped at a standard value of 1,000 individuals. All of these abundant species belong to the order Passeriformes, an order which includes the songbirds. This supports the worldwide dominance of this order with the exception of Antarctica (Abbas et al., 2014). The following species were next most abundant: Indian bush lark (*Mirafra erythroptera*), rock pigeon (*Columba livia*), and grey francolin. The rare species observed in the area were black kite (*Milvus migrans*), demoiselle crane (*Grus virgo*), Eurasian coot (*Fulica atra*), and rufous treepie (*Dendrocitta vagabunda*). None of the species observed in the area were included in the IUCN Red List of Threatened Species.

Shannon-Wiener Diversity Index (2.91) and equitability (0.87) suggested that all the species were evenly distributed throughout the area (Table 2). The value of Simpson's Index (0.9) indicated that the avifaunal diversity of the area was very low. These values can be used to compare the results with any future studies in the same or surrounding areas. The results therefore discouraged the continuity of hunting practices.

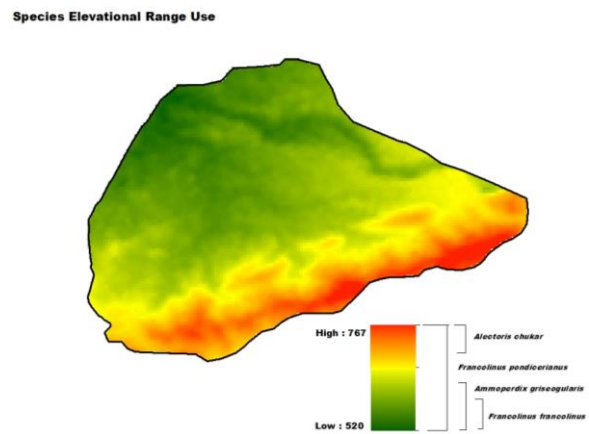
According to the Jackknife 1 species richness estimator within the first few sampling days, there is a potential that the true species richness is 31 species, marginally greater than the 30 as observed here (Fig. 2). The plateau in the species accumulation curve, observed at around 12 sampling days, suggested that the sampling was probably exhaustive; recording virtually all species that likely used the study area during the study period. There was no increase in species observation frequency after the 16<sup>th</sup> sampling day. The Jackknife estimator

further indicated that the precision of the estimate increased with increasing sampling effort and agreed with a diversity estimate of 30 species on the 18<sup>th</sup> day of sampling. Here, we sampled for 20 days and observed 30 species, and we, therefore also considering the standard deviation of zero which indicated that our sampling was 100 % complete. Assuming comparably spatially representative sampling, the species accumulation curve strongly suggested that a strategy of only 16 days sampling is enough to achieve a full species inventory.

In order to avoid harsh and extreme winters, a large number of birds migrate from Europe and Central Asian countries to Pakistan. These birds usually arrive in Pakistan from November to mid-January every year. Among the seven fly-zones in the world, one is the Indus-fly zone in Pakistan. The migratory birds usually include cranes, geese, and ducks (Ali and Akhter, 2005; Ali and Ripley 1987). Being present at the base of Cherat Wildlife Park, the area harbours some endemic as well as migratory species as well. The construction of Jallozai Barani Dam is proving itself to be a new home for the winter migratory birds and a hope for ecotourism in the Nowshera District. In our study, three occasional birds (winter visitors) including little grebe (*Tachybaptus ruficollis*), Demoiselle crane (*Grus virgo*) and Eurasian coot (*Filica atra*) were recorded, which clearly indicated that the newly formed dam can routinely be a future station for these migratory birds. According to Grimmett et al. (1998), most of the birds in Pakistan are normally observed foraging in open cultivated lands inter-mingled with scrub forests and are rarely observed at elevations higher than 1200 m above sea level (ASL). Members of family Phasianidae, the peculiar game birds of the reserve, were showing a remarkable difference in elevational range use (Fig. 3). Chukar partridge was found on the highest rocky cliff between elevations of 700 to 767 m ASL. Robert (1991) also reported that chukar partridge preferred high elevations in rocky cliffs. Dad et al. (2014) reported the presence of chukar partridge at an elevation of 777 m ASL in Totalai Game Reserve, Buner District. Concerning elevational range use, this was followed by see-see partridge, recorded at 590 m in this study. According to Roberts (1991), see-see partridge, usually occurs on the lower elevations at dry rocky foot hills. Black francolin was found at lower elevations up to 540 m ASL in relatively plain areas with grasses and small shrubs. Findings from Dad et al. (2014) reported black francolin to occupy elevation range use of 770m; Grimmett et al. (1998) and Robert (1991) also confirmed the presence of the species at very low elevations. Grey francolin was the only game bird which was spread in the whole area from low to high elevations. According to Roberts (1991) grey francolin is a common resident of scrub forests occurring up to an elevation of 900 m ASL.



**Fig. 2: Species accumulation curve of the observed number of avifaunal species over the sampling period in Tarakai Game Reserve, 01 to 20 December 2017.**



**Fig. 3: Game bird species' principal elevational range use in Miangan Tarakai Game Reserve, District Nowshera.**

The very first step for initiating ecotourism in any area is to establish well-defined and authentic inventories of existing natural resources. Bird watching can play a key role in nature conservation, general human and wildlife well-being. It can also play role in uplifting the economic status of local communities (Anonymous, 2014b). Based on anecdotal reports and pre-construction of Jallozai Barani Dam, these results suggested that the dam attracted several migratory birds. This clearly indicated that the site can proved be a promising station for these migratory birds. In order to promote community-based ecotourism, bird watching can be considered as the main component of an inclusive tourism package (Burkhardt et al., 2005). For sustainable ecotourism, it is of paramount importance to maintain the population of birds using the site, including the migratory birds for which the site evidently provides a valuable resource. Currently, more than 89 game reserves throughout the Pakistan, which share identical classification status as the game reserve of this study and the migratory birds witnessed here have been declared as legally “Protected” by the Pakistan Environmental Protection Act, 1997 (Anonymous, 2008).

**Table 1: Bird species observed in Tarakai Game Reserve along with IUCN Red List Status**

	Species	Common Name	IUCN Status
<b>Passeriformes</b>			
Passeridae	<i>Passer domesticus</i>	House Sparrow	LC
Sturnidae	<i>Acridotheres tristis</i>	Common Myna	LC
	<i>Acridotheres ginginianus</i>	Bank Myna	LC
Alaudidae	<i>Mirafra erythroptera</i>	Indian Bushlark	LC
	<i>Eremopterix griseus</i>	Ashy-crowned Sparrow Lark	LC
Leiothrichidae	<i>Turdoides striata</i>	Jungle Babbler	LC
Corvidae	<i>Corvus splendens</i>	House Crow	LC
	<i>Dendrocitta vagabunda</i>	Rufous Treepie	LC
Dicruridae	<i>Dicrurus macrocercus</i>	Black Drongo	LC
Monarchidae	<i>Terpsiphone paradisi</i>	Indian Paradise Flycatcher	LC
Ardeidae	<i>Bubulcus ibis</i>	Cattle Egret	LC
Pycnonotidae	<i>Pycnonotus leucogenys</i>	Himalayan Bulbul	LC
Hirundinidae	<i>Delichon urbicum</i>	Common House Martin	LC
Motacillidae	<i>Motacilla alba</i>	White Wagtail	LC
<b>Galliformes</b>			
Phasianidae	<i>Francolinus pondicerianus</i>	Grey Francolin	LC
	<i>Ammoperdix griseogularis</i>	See-see Partridge	LC
	<i>Francolinus francolinus</i>	Black Francolin	LC
	<i>Alectoris chukar</i>	Chukar Partridge	LC
<b>Coraciiformes</b>			
Meropidae	<i>Merops orientalis</i>	Green Bee Eater	LC
<b>Bucerotiformes</b>			
Upupidae	<i>Upupa epops</i>	Eurasian Hoopoe	LC
<b>Strigiformes</b>			
Strigidae	<i>Athene noctua</i>	Little Owl	LC
<b>Columbiformes</b>			
Columbidae	<i>Columba livia</i>	Rock Pigeon	LC
<b>Accipitriformes</b>			
Accipitridae	<i>Milvus migrans</i>	Black Kite	LC
	<i>Accipiter badius</i>	Shikra	LC
<b>Anseriformes</b>			
Anatidae	<i>Anas crecca</i>	Common Teal	LC
<b>Caprimulgiformes</b>			
Caprimulgidae	<i>Caprimulgus europaeus</i>	Eurasian Nightjar	LC
<b>Coraciiformes</b>			
Alcedinidae	<i>Alcedo atthis</i>	Common Kingfisher	LC
<b>Podicipediformes</b>			
Podicipedidae	<i>Tachybaptus ruficollis</i>	Little Grebe	LC
<b>Gruiformes</b>			
Gruidae	<i>Grus virgo</i>	Demoiselle crane	LC
Rallidae	<i>Fulica atra</i>	Eurasian Coot	LC

LC: Least Concern

**Table 2: Diversity Indices values for Tarakai Game Reserve, Nowshera District**

Diversity Index	Symbol	Value
Shannon–Wiener Diversity Index	H	2.91
Simpson Index	D	0.92
Equitability	E	0.87

### Conclusions and recommendations

The results obtained from the current study provided the base-line information about the avian fauna of Miangan Tarakai Game Reserve, Nowshera district, indicating the site as a potential habitat for migratory birds. The quick arrival of migratory waterfowls is a clear indication for launching healthy bird watching and eco-tourism programs, which will be very appealing for conservation and boosting up the socio-economic

conditions of the locals. It is suggested that existing level of protection of avian species may be strengthened and applied to Miangan Tarakai Game Reserve, thereby recognizing and mobilizing the already existing law. Native bird species which are known to be hunted in the game reserve must also be subject to investigation by government officials, to ensure that hunting is exclusively and strictly limited to the licenses issued.

### Authors' contribution

RHK conceived the idea, designed project, collected data, analyzed data and wrote manuscript. ZX performed overall project design and write up. SA helped in analysis and write up. ER helped in results collection and review, while NJR helped in results interpretation, write up and review before submission.

### Acknowledgments

We are very thankful to Wildlife Department Khyber Pakhtukhwa and the local community for their cooperation and supporting us throughout the study period. We would like to thank the anonymous reviewers for critically reading the manuscript and suggesting substantial improvements and insightful comments. We are also thankful to Mr. Abdullah Khan for providing us field instruments.

### REFERENCES

- Ali S and SD Ripley, 1987. Bird of India and Pakistan. 2<sup>nd</sup> Edition, Oxford University Press, New Delhi, India. pp: 223-669.
- Ali Z and M Akhtar, 2005. Bird surveys at wetlands in Punjab, Pakistan with special reference to the present status of White-headed Duck *Oxyura leucocephala*. Forktail, 21: 43-50.
- Abbas S, R Tabassum, MZ Khan, B Khan, S Hussain, G Khan and S Awan, 2014. Avian Diversity in Central Karakoram National Park, Gilgit-Baltistan. International Journal of Agriculture and Biology, 16: 377-382.
- Anonymous, 2008. Convention on the Conservation of Migratory Species of Wild Animals. Ministry of Climate Change, Govt. of Pakistan (Available online at: [https://www.cms.int/sites/default/files/document/doc\\_12\\_02\\_nat\\_reporting\\_annex3\\_pakistan\\_0.pdf](https://www.cms.int/sites/default/files/document/doc_12_02_nat_reporting_annex3_pakistan_0.pdf); accessed on 22 October 2018).
- Anonymous, 2014a. Irrigation department: Government of khyber Pakhtunkhwa. (Available online at: [wk.ixueshu.com/file/4c99a2c56aebff3a.html](http://wk.ixueshu.com/file/4c99a2c56aebff3a.html); accessed on June 15, 2018).
- Anonymous, 2014b. National Survey of Fishing, Hunting, and Wildlife associated Recreation. US Fish and Wildlife Service and U.S. Census Bureau, FHW/11-NAT(RV), Washington, DC, USA. (Available online at: <https://www.fws.gov/>; accessed on October 22, 2018).
- Beg MA and JJ Qureshi, 1972. Birds and their habitats in the cultivated areas of Lyallpur district and vicinity. Pakistan Journal of Agricultural Sciences, 9: 161-166.
- Bibby C, ND Burguess and DA Hill, 1992. Bird Census Techniques. Academic Press, London, UK, pp: 257.
- Buckley R, 2004. Environmental impacts of ecotourism. In: R. Buckley (Ed.), Impacts of ecotourism on birds. CABI Publishing, Wallingford, UK.
- Burkhardt R, B Julee and R Pete, 2005. Recommendations for Developing Ecotourism in the Northern Boreal: North Caribou Lake Bird Survey. (Available online at: [https://ontarionature.org/wp-content/uploads/2017/10/FON\\_CaribouLake.pdf](https://ontarionature.org/wp-content/uploads/2017/10/FON_CaribouLake.pdf); accessed on 22 October 2018).
- Canterbury GE, TE Martin, DR Petit, LJ Petit and BD Bradford, 2000. Bird Communities and Habitat as Ecological Indicators of Forest Condition in Regional Monitoring. Conservation Biology, 14: 544-558.
- Ceballos-Lascuráin H, 1996. Tourism, Ecotourism and Protected Areas. Gland, Switzerland: IUCN Publication Services Unit, Switzerland.
- Colwell RK, A Chao, NJ Gotelli, SY Lin, CX Mao, RL Chazdon and JT Longino, 2012. Models and estimators linking individual-based and sample-based rarefaction, extrapolation, and comparison of assemblages. Journal of Plant Ecology, 5: 3-21.
- Cordell HK and NG Herbert, 2002. The popularity of birding is still growing. Birding, 34: 54-59.
- Dad K, S Khan, N Akhtar and K Saeed, 2014. Exploring the wild avian fauna of Totalai game reserve district Buner, Khyber Pakhtunkhwa. Journal of Biodiversity and Environmental Sciences 5: 150-157.
- Devi OS and PK Saikia, 2010. A checklist of avian fauna of Gibbon Wildlife Sactuary, Jorhat District, Assam. NeBIO, 1: 1-7.
- Fuller RA, JP Carroll and JPK McGown, 2000. Partridges, Quails, Francolins, Snowcocks, Guineafowls and Turkeys. Status survey and conservation action plan 2000-2004, IUCN, Gland, Switzerland and Cambridge UK.
- Glowinski SL, 2008. Bird watching, ecotourism and economic development: A review of the evidence. Applied Research in Economic Development, 5: 65-77.
- Goodwin H, 1996. In pursuit of ecotourism. Biodiversity and Conservation 5: 277-291.
- Grimmett R, T Roberts and I Inskip, 2008. Birds of Pakistan. Christopher Helm, London Yale University Press, New Heaven, London UK, pp: 256.
- Grimmett RC, TC Inskipp and T Inskipp, 1998. Birds of the Indian subcontinent. Oxford University Press, New Delhi, India.
- Haldin M and J Ulfvens, 1987. On the efficiency of censusing water birds by boat. Ornis Fennica, 64: 74-75.
- Hutto RL, SM Pletschet and P Hendricks, 1986. A fixed-radius point count method for nonbreeding and breeding season use. The Auk, 103: 593-602.
- Jiménez G, L Meléndez, G Blanco and P Laiolo, 2013. Dampened behavioural responses mediate birds' association with humans. Biological Conservation, 59: 477-483.

- Jones DN and RC Buckley, 2000. Birds watching tourism in Australia. (Wildlife tourism research. Report series No.10). Cooperative Research Centre for sustainable tourism, Gold coast, Australia.
- Kerlinger P and J Brett, 1995. Hawk Mountain Sanctuary: a case study of birder visitation and birding economics. Wildlife and Recreationists: Coexistence through Management and Research. Island Press, Washington DC, California, USA, pp: 271-280.
- Khan AA, R Khan, A Ullah, M Ali, JA Mahmood and KM Sheikh, 1996. Conservation Perspectives of the Imperial Aquila *heliaca* and Steppe Eagle *Aquila nipalensis* in Pakistan. Meyburg. B-U. and R. D. Chancellor eds. Eagle Studies World Walking Group on Birds of Prey (WWGBP) Berlin, London and Paris, pp: 459-461.
- King DA and WP Stewart, 1996. Ecotourism and commodification: protecting people and places. Biodiversity and Conservation, 5: 293-305.
- Mann MA and A Chaudhry, 2000. Francolins in irrigated forest plantations and sub-mountainous tract of the Punjab, Pakistan. Pakistan Veterinary Journal, 20: 118-122.
- Mian A, 1995. Grey partridge demands intensive study. WPA News, UK, 1(2).
- Mirza ZB and H Wasiq, 2007. A field guide to birds of Pakistan. Book Land, Lahore, WWF-Pakistan, pp: 366
- Munn CA, 1992. Macaw biology and ecotourism, or 'When a bird in the bush is worth two in the hand'. In: Beissinger SR and NFR Snyder (Eds.) New World Parrots in Crisis: Solutions from Conservation Biology, Smithsonian Institution Press, Washington, DC, USA, pp: 47-72.
- Newton I, 1995. The contribution of some recent research on birds to ecological understanding. Journal of Animal Ecology, 64: 675-696.
- Pathan AJ, S Khan, N Akhtar and K Saeed, 2014. Diversity and Distribution of Avian Fauna of Swat, Khyber Pakhtunkhwa, Pakistan. Advances in Zoology, 2014: 430297.
- Roberts TJ, 1991. The Birds of Pakistan. Vol. I, (Non-Passeriformes) [M]. Oxford University Press, London, UK, pp: 170-527.
- Ruiz-Esparza J, SM Silvestre, VS Moura, MN de Albuquerque, RF de Carvalho Terra, LM de Castro Mendonça and SF Ferrari, 2016. Inventory of birds in the coastal restinga of a private natural heritage reserve in northeastern Brazil. Neotropical Biology and Conservation, 11: 51-61.
- Shannon CE and W Weaver, 1949. The Mathematical Theory of Communication. University of Illinois Press, Urbana, Illinois, USA, pp: 144.
- Simpson EH, 1949. Measurement of diversity. Nature, 163: 688
- Vayanni H, I Spilanis and I Karagounis, 2005. Framework for the comparative evaluation of tourist products: The case of bird - watching and mass tourism in Ilesvos island - Greece. Recent Development in Tourism Research, Faro-Portugal: Faculty of Economics—University of Algarve, Portugal.
- Volpato GH, EV Lopes, LB Mendonça, R Boçon, MV Bisheimer, PP Serafini and LD Anjos, 2009. The use of the point count method for bird survey in the Atlantic Forest. Zoologia (Curitiba), 26: 74-78.