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A Preliminary Study on the Species Composition of Vertebrates in Rakchham-Chhitkul Wildlife Sanctuary in Trans-Himalayan Baspa (Sangla) Valley, District Kinnaur, Himachal Pradesh, India

Rakesh Kumar Negi[1] and H.S. Banyal[2]
[1.] *Government College, Sunni, Shimla, H.P. India*
[2.] *Abhilashi University, Chailchowk, Mandi, H.P. - 175028, India*

***Abstract**: Biodiversity incorporating all the living forms of life is the essence and manifestation of evolutionary history of life on earth. Vertebrates are the most prominent and an important constituent of the biodiversity. Exploration of Rakchham-Chhitkul Wildlife Sanctuary present in the Baspa (Sangla) valley situated in Trans-Himalayan landscape in a remote tribal district Kinnaur in Himachal Pradesh, India revealed the presence of 104 species of vertebrates, which includes 02 species of fishes, 01 of amphibians, 05 of reptiles, 73 birds, and 23 species of mammals. It was found that the birds were the most dominant vertebrates, followed by mammals, reptiles and fishes, while amphibians were represented least by a single species.*

***Keywords:** Biodiversity, Vertebrates, Trans-himalaya, Species.*

I. Introduction

Himalaya the youngest mountain systems in the world has been designated as a global biodiversity hotspot because it harbours certain unique and endemic taxa (Mittermier *et al.*, 2004). The Trans-Himalaya landscape is a high elevation land lying north of the Greater Himalayan range characterized by extreme cold, low precipitation and rugged terrain of mountains.

The vertebrates with a total of about 62000 described species comprises only 3% of global biodiversity with about 32447 valid species of fishes (www.Fishbase.org), 6515 amphibians, 8734 reptiles, 9990 birds (Chapman, 2009) and 5416 species of mammals (Wilson and Reeder, 2005), occupying all elevations and depths, inhabiting most of the major habitat types, and displaying remarkable variations in body size and life histories; they play vital roles in ecosystems. With only 2.4% of world's land area, India accounts for about 7.52% of recorded animal species of the world. India, considered as one of the mega biodiversity country is home to 2,546 described species of fish belonging to 969 genera, 254 families and 40 orders (Talwar and Jhingram 1991). The amphibian in India are highly diverse with 342 species which includes 306 species of anura, 35 species of gymnophiona and 1 species of salamander (Dinesh et al. 2013). An updated checklist enlists 384 species of amphibians from India (Dinesh et al. 2015). The reptiles in India are represented by 518 species which includes 3 species of crocodiles, 34 species of turtles and tortoises, 202 species of lizards and 279 species of snakes belonging to 28 families ((Aengals *et al*., 2011). The fish, amphibian and reptiles of India make up about 12.23%, 6.59% and 8.8% of respective class of the world. An updated checklist enlists 1263 species of birds from the country representing 12.5% of world avifauna belonging to 498 genera, 107 families and 23 orders (Praveen et al., 2016). The mammalian fauna of the country is also very rich, representing 7.81% of the global mammals with 428 species belonging to 48 families and 14 orders (Sharma *et al.*, 2014). As per IUCN Red List (2015.4), a total of 521 vertebrate species of India are threatened which includes 216 fish species, 75 amphibians, 53 reptiles, 84 birds, and 93 species of mammals.

Himachal Pradesh despite being a smaller state with only 1.7% of total geographical area of the country contributes 6.4% of the total faunal diversity of India. The vertebrate fauna of the state constitutes 17% of the total vertebrate diversity of country (Sharma and Sidhu, 2016). There are 2,542 faunal species as compared to 92,279 species of the country. Invertebrates constitute 88.4% while the vertebrates form 11.6% of the fauna of the state. There are 111 mammalian species forming 25% of the country, 447 species of birds (36%), 55 reptiles (11%), 17 amphibians (5%) and 104 species of fishes (4%), reported from the state (Sharma and Saikia, 2009). The vertebrates of Himachal Pradesh has engaged the attention of many distinguished investigators since long, who have conducted studies on various aspects of vertebrates in different parts of the state (Blanford 1881-91, Annandale 1907, Boulenger 1920, Smith 1935 1943, Acharjee and Kriplani 1951, Wynter-Blyth 1951, Waltner 1974, Dubois 1975, Prater 1980, Tilak and Mehta 1983, Rodgers and Panwar 1988, Negi 1992, Chudawat 1994, Bhatnagar 1997, Manjrekar 1997, Johnsingh *et al.* 1999, Mehta 2000a and 2000 b, Mishra 2000,

Chakraborty *et al.* 2005, Mehta 2005, Mehta and Uniyal 2005, Sharma *et al*. 2008, Sharma and Saikia, 2009, Singh and Banyal 2013, Singh *et al.* 2014; and Thakur and Mattu 2015).

Following the first publication on vertebrates of India (Blanford 1888–1890), a huge wealth of information has been compiled on the vertebrate fauna of various biogeographic zones of the country. However, the present study area of Rakchham-Chhitkul wildlife sanctuary has received very little attention of the field biologists due to severe cold climate, and inaccessible habitat. Only a few studies have been conducted on diversity and ecology of some vertebrate groups of this sanctuary area (Wynter-Blyth 1948, Narang 1989, Negi and Banyal 2015 a&b). The present study is the first of its kind which provides the current status of vertebrate diversity in Rakchham-Chhitkul wildlife sanctuary.

Study Area

Rakchham-Chhitkul Wildlife Sanctuary with geo-coordinates of latitude $31^0$14’22” N - $31^0$28’37”N and longitudes $78^0$17’31”E - 78^0 31’30”E having an area of about 304 Km^2 is situated in Kinnaur district in Himachal Pradesh, India (Fig. 1). The Baspa river originating near the Indo-Tibet border, providing the valley not only water but also giving its name, travels 72 Km through the valley to join the river Sutlej at Karchham. The Baspa (Sangla) valley is characterized by rugged, precipitous peaks covered by perpetual snow cover (Deota et al., 2011). Great Himalayan range and Dhauladhar range, two of world’s greatest mountain ranges represents these peaks on the right and left bank of river Baspa respectively. The altitude of Baspa valley ranges from 2,800 masl to 5,486 masl. The temperature varying from -15°C to 18°C, mean rainfall 463 mm and annual snowfall 1,130 mm. The forest type of this sanctuary includes Lower Western Himalayan Temperate Forest, Upper Western Himalayan Temperate Forest and Sub-Alpine Birch-Fir Forest. The sanctuary area is fed with numerous snow-fed perennial and seasonal streams. The Govind Pashu Vihar a wildlife sanctuary of Uttarakhand state is adjacent to Rakchham-Chhitkul sanctuary and on its eastern boundary lies the Tibetan plateau of China. The valley is famous for many of its passes connecting the valley with Tibet and Shimla District of Himachal Pradesh. There is a great variation in climatic conditions in the valley as ecological characteristics changes very sharply in the mountains due to steep gradient.

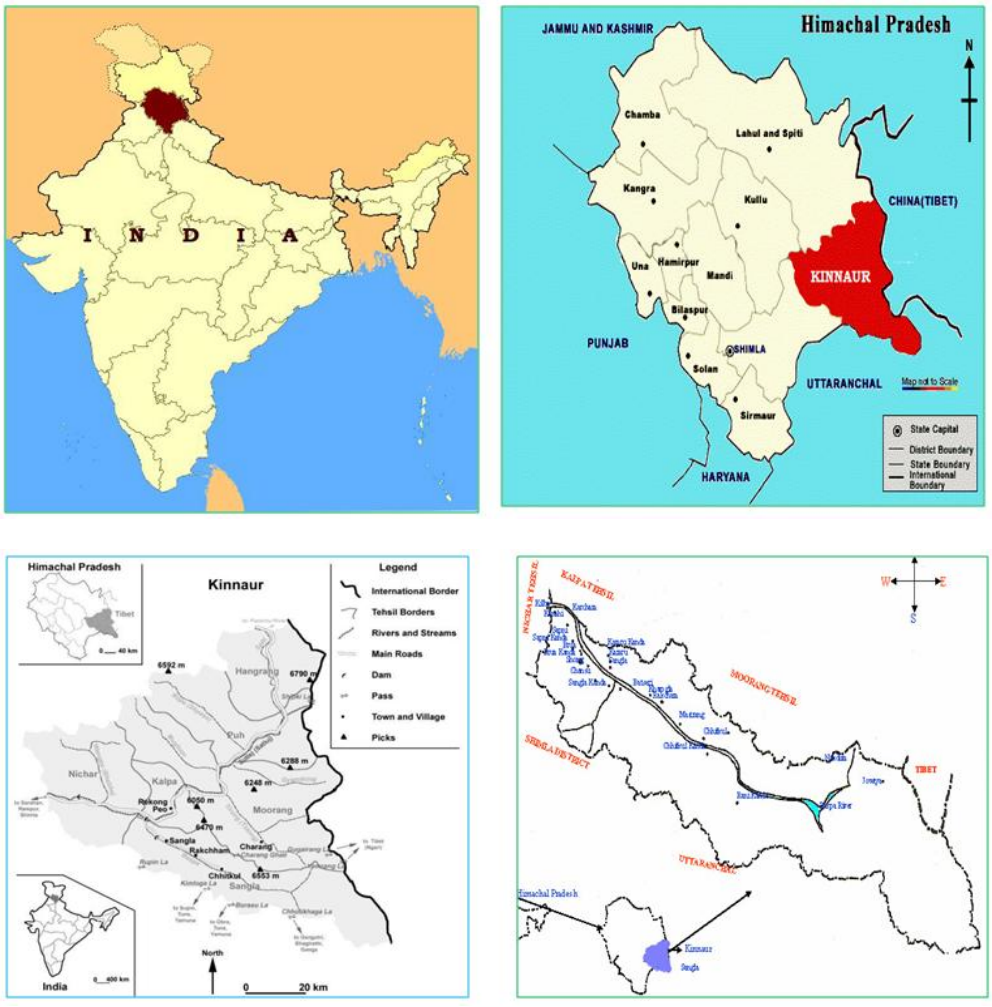

Fig.1: Map of Baspa valley, the study area in District Kinnaur, Himachal Pradesh, India (Source: mapsofindia.com and diagrammatic map of Baspa Valley).

II. Methodology

The present work is an attempt to study the diversity and abundance of vertebrates of the study area. The study area was divided in to three altitudinal zones viz., Zone-I: extending from Sangla to Kharogla (2700 to 3000 m) which is having forests of lower level fir like Tosh, Zone-II: from Rakchham to Mastarang (3050 to 3300 m) with the forests of Deodar and Blue pine and Zone-III: from Chhitkul to Dumti (3450 to 4200 m) having tracts of blue pine, birch & rhododendron forests, and alpine meadows. The survey was conducted during June 2012 to June 2014 at various locations situated at different altitudes. Different methods were adopted for the study of different group vertebrates. Fish fauna of the area were studied by periodically trapping them using drag nets. These specimens were photographed for identification and were then transferred back to the water body. The Amphibians were sampled as per methods by Vasudevan *et al*., (2001). They were sampled using a combination of adaptive cluster sampling, visual encounter surveys, audio surveys and opportunistic records. Considering the topography and altitude of the study area visual encounter survey was used for sampling reptiles. Sampling was restricted largely to day time. This method involved searching for reptiles, examining all possible microhabitats such as boulders, fallen logs, holes in the cliffs etc. They were also sampled using methods described by Ishwar *et al*. (2001). Apart from this some reptiles were observed especially on the large rocks sun basking during the early hours of day. Stratified random sampling technique (Snedecore and Cochran, 1993) has been followed for the study of birds which involved the division of sites into different strata, based on vegetation type and habitat. The other important factor considered was the activity of birds. Since peak activity in most birds lasts for 1 or 2 hours after sunrise or before sunset, the birds were recorded during the most active period of the day i.e., morning (0600 to 1000 hours) and evening (1600 to 1900 hours). The mammals were sampled by using a combination of direct and indirect methods. The direct methods utilized sighting of animals as the main data whereas indirect methods relied on quantification of indirect evidences such as pellet groups, scats, pug marks and hoof marks in a predetermined sampling unit. The direct evidences were made by using line transects method (Burnham *et al.*, 1980). The entire procedure of line transect sampling was performed by walking on local footpaths due to difficult terrain of the study area. The footpaths were monitored in morning and evening hours which generally coincide with maximum activity period of animals. The indirect evidences such as scats, pellet groups were also employed to study the presence of some mammals. All the specimens were photographed with Nikon D-90 for identification No specimens were killed or brought to laboratory during the present study. The data recorded in each survey from different transects has been kept separate and analyzed for relative abundance on the basis of relative frequency scale of occurrence depending upon the number of sightings. Based upon these different categories assigned were: very Common (recorded in more than 45 % of data sheets), Common (between 25% and 44 % of data sheets), Uncommon (between 10% and 24 % of datasheets) and Rare (recorded once or twice). The relative frequency scale was fixed in such a way so as to include the migrant species sighted seasonally in good numbers (which visited the area for a brief period of time) to their respective category. Similarly, residential status was worked into various categories like resident, summer visitors, and resident with local movements etc. on the basis of presence and absence method (Singh *et al.*, 2014). Identification was based on morphological characters. The species were identified by using Smith 1943, Prater 1980, Ali and Ripley 1983, Talwar and Jhingran1991, Jayaram 1999, Grimmett *et al*. 1999, Alferd *et al*. 2002, Daniel 2002, Das and Daniels 2005,

III. Results & Discussion

Present study revealed that the sanctuary located in the salubrious climes of Baspa Valley in Kinnaur district is home to a number of vertebrate species. It harbours a total of 104 species of vertebrates, which includes 02 species of fishes, 01 of amphibians, 05 of reptiles, 73 birds, and 23 species of mammals. It has been recorded that the birds were the most dominant vertebrates, followed by mammals, reptiles and fishes, while amphibian was represented by a single species (Table 2-6). It has been recorded that these 104 species belonged to 17 orders, 41 families and 33 genera. The birds and mammals were represented by 09 and 05 orders respectively, while all other vertebrate classes were represented by 01 order each. The family-wise analysis of data revealed that bird were represented by 24 families, mammals by 11 families, reptiles by 4 families, and amphibian and fishes were restricted to a single family each. Further analysis of data showed that birds were represented by 52 genera, mammals by 20, reptiles by 5, fishes by 2 genera and amphibians by a single genus (Tables 1-5).

Table 1: Fish fauna recorded in Rakchham Chhitkul wildlife sanctuary, Kinnaur

S. No	Zoological Name	Res. St.	Rel. Abd.	Altitudinal zone
Class: Actinopterygii **Order: Salmoniformes** **Family: Salmonidae**				

1	Rainbow Trout *Oncorhynchus mykiss* Walbaum, 1792	R	UC	I, II
2	Brown Trout *Salmo trutta fario* Linnaeus 1758	R	C	I, II

Table 2: Amphibian recorded in Rakchham Chhitkul wildlife sanctuary, Kinnaur

S.No.	Zoological Name	Res. St.	Rel. Abd.	Altitudinal zone
Order: Anura **Family: Bufonidae**				
1.	**Himalayan Toad** *Duttaphrynus himalayanus* (Gunther, 1864)	SV	UC	I

Table 3: Reptilian fauna recorded in Rakchham Chhitkul wildlife sanctuary, Kinnaur

S. No	Zoological Name	Res. St.	Rel. Abd.	Altitudinal zone
Order: Squamata **Family: Agamidae**				
1	Kashmir/Hurdwar Lizard *Laudakia dayana* (Stoliczka, 1871)	R	C	I, II
Family: Scincidae				
2	**Himalayan Ground Skink** *Asymblepharus himalayanus* ***(Gunther, 1864)***	R	VC	I, II, III
Family: Colubridae				
3	Indian Rat Snake *Ptyas mucosus* (Linnaeus, 1758)	R	UC	I, II
Family: Viperidae				
4	Himalayan Pit Viper *Gloydius himalayanus*(Gunther,1864)	R	C	II
5	White-lipped Pit Viper *Trimeresurus albolabris* Gray, 1842	R	Ra	I

Table 4: Bird fauna recorded in Rakchham Chhitkul wildlife sanctuary, Kinnaur

S.No.	Taxon	Res. St.	Rel. Abd.	Altitudinal zone
Order: Falconiformes **Family: Accipitridae**				
1	Black Kite *Milvus migrans* (Boddaert, 1783)	R/SV	C	I, II, III
2	Bearded Vulture * NT *Gypaetus barbatus* (Linnaeus, 1758)	R/LM	C	I, II, III
3	Himalayan Griffon * NT *Gyps himalayensis* Hume, 1869	R/LM	C	I, II, III
4	Long-legged Buzzard *Buteo rufinus* (Cretzschmar, 1827)	R/LM	Ra	I
5	Golden Eagle *Aquila chrysaetos* (Linnaeus, 1758)	R	C	II, III
Family: Falconidae				
6	Common Kestrel *Falco tinnunculus* Linnaeus, 1758	R/SV	VC	I, II, III
Order: Galliformes **Family: Phasianidae**				
7	Himalayan Snowcock *Tetraogallus himalayensis* G.R. Gray, 1843	R	C	III
8	Chukor *Alectoris chukar* (J.E. Gray, 1830)	R	VC	II, III
9	Impeyan Monal *Lophophorus impejanus* (Latham, 1790)	R/LM	C	I, II
Order: Gruiformes **Family: Rallidae**				
10	Common Moorhen *Gallinula chloropus* (Linnaeus, 1758)	SV	UC	II
Order: Charadriiformes **Family: Scolopacidae**				
11	Common Sandpiper *Actitis hypoleucos* Linnaeus, 1758	SV	UC	II

Order: Columbiformes **Family: Columbidae**				
12	Blue Rock Pigeon *Columba livia* Gmelin, 1789	R/SV	C	I, II, III
13	Hill Pigeon *Columba rupestris* Pallas, 1811	R/LM	VC	I, II, III
14	Snow Pigeon *Columba leuconota* Vigors, 1831	R/LM	VC	I, II, III
15	Oriental Turtle-Dove *Streptopelia orientalis* (Latham, 1790)	SV	C	I, II
Order: Cuculiformes **Family : Cuculidae**				
16	Common Cuckoo *Cuculus canorus* Linnaeus, 1758	SV	UC	I, II
Order: Apodiformes **Family: Apodidae**				
17	Himalayan Swiftlet *Collocalia brevirostris* (Horsfield, 1840)	R/SV	C	I, II
18	Common Swift *Apus apus* (Linnaeus, 1758)	SV	C	I, II
Order: Coraciiformes **Family: Upupidae**				
19	Common Hoopoe *Upupa epops* Linnaeus, 1758	SV	VC	I, II, III
Order: Passeriformes **Family: Alaudidae**				
20	Eastern Skylark *Alauda gulgula* Franklin, 1831	SV	VC	I, II
21	Horned Lark *Eremophila alpestris* (Linnaeus, 1758)	R/LM	VC	I, II
Family: Hirundinidae				
22	Plain Martin *Riparia paludicola* (Vieillot, 1817)	R/SV	VC	I, II, III
23	Eurasian Crag-Martin *Hirundo rupestris* Scopoli, 1769	SV	VC	I, III
24	Red-rumped Swallow *Hirundo daurica* Linnaeus, 1771	SV	UC	I
Family: Motacillidae				
25	White Wagtail *Motacilla alba* Linnaeus, 1758	R/SV	VC	I, II, III
26	Citrine Wagtail *Motacilla citreola* Pallas, 1776	SV	C	I, II
27	Grey Wagtail *Motacilla cinerea* Tunstall, 1771	SV	C	I, II
28	Eurasian Tree Pipit *Anthus trivialis* (Linnaeus, 1758)	SV	C	I, II
29	Oriental Tree Pipit *Anthus hodgsoni* Richmond, 1907	SV	VC	I, II, III
Family: Campephagidae				
30	Scarlet Minivet *Pericrocotus flammeus* (Forster, 1781)	R/LM	C	II
Family: Laniidae				
31	Rufous-backed Shrike *Lanius schach* Linnaeus, 1758	SV	C	I, II
32	Grey-backed Shrike *Lanius tephronotus* (Vigors, 1831)	SV	UC	I
Family: Cinclidae				
33	Brown Dipper *Cinclus pallasii* Temminck, 1820	R	C	I, II
Family: Troglodytidae				

34	Winter Wren *Troglodytes troglodytes* (Linnaeus, 1758)	R	C	II
Family: Prundellidae				
35	Rufous-breasted Accentor *Prunella strophiata* (Blyth, 1843)	R/LM	VC	I, II, III
Family: Muscicapidae **Subfamily: Turdinae**				
36	Blue Rock-Thrush *Monticola solitarius* Linnaeus, 1758	SV	UC	II
37	Blue Whistling-Thrush *Myiophonus caeruleus* (Scopoli, 1786)	R/SV	VC	I, II, III
38	Eurasian Blackbird *Turdus merula* (Linnaeus, 1758)	SV	UC	I, II
39	White-collared Blackbird *Turdus albocinctus* Royle, 1840	SV	UC	III
40	Himalayan Rubythroat *Luscinia pectoralis* (Gould, 1837)	R/SV	C	I, II
41	Bluethroat *Luscinia svecica* (Linnaeus, 1758)	R/SV	C	I, II
42	Orange-flanked Bush-Robin *Tarsiger cyanurus* (Pallas, 1773)	SV	UC	I
43	Blue-capped Redstart *Phoenicurus caeruleocephalus* (Vigors, 1831)	SV	C	I, II, III
44	Black Redstart *Phoenicurus ochruros* (Gmelin, 1774)	SV	VC	I, II, III
45	Blue-fronted Redstart *Phoenicurus frontalis* (Vigors, 1832)	SV	C	I, II, III
46	White-capped Redstart *Chaimarrornis leucocephalus*(Vigors, 1831)	R/SV	VC	I, II, III
47	Plumbeous Redstart *Rhyacornis fuliginosus* (Vigors, 1831)	R/SV	C	I, II, III
48	White-bellied Redstart *Hodgsonius phaenicuroides* (Gray, 1846)	R/SV	C	II, III
49	Common Stonechat *Saxicola torquata* (Linnaeus, 1766)	SV	C	I
50	Grey Bushchat *Saxicola ferrea* Gray, 1846	SV	C	I, II
51	Desert Wheatear *Oenanthe deserti* (Temminck, 1825)	SV	Ra	I
Subfamily: Timaliinae				
52	Streaked Laughingthrush *Garrulax lineatus* (Vigors, 1831)	R/LM	C	I
53	Variegated Laughingthrush *Garrulax variegatus* (Vigors, 1831)	SV	UC	I
Subfamily: Sylviinae				
54	Brown-flanked Bush-Warbler *Cettia fortipes* (Horsfield, 1845)	SV	C	I, II, III
Family: Paridae				
55	Simla Crested Tit *Parus rufonuchalis* Blyth, 1849	SV	C	I, II
56	Rufous-bellied Crested Tit *Parus rubidiventris* Blyth, 1847	SV	C	I, III
57	Great Tit *Parus major* Linnaeus, 1758	SV	UC	II
Family: Certhiidae				
58	Eurasian Tree-Creeper *Certhia familiaris* Linnaeus, 1758	SV	C	I, II, III
Family: Emberizidae **Subfamily: Emberizinae**				
59	Rock Bunting *Emberiza cia* Linnaeus, 1766	SV	VC	I, II, III
Family: Fringillidae				
60	Fire-fronted Serin *Serinus pusillus* (Pallas, 1811)	R/SV	VC	I, II, III

61	Yellow-breasted Greenfinch *Carduelis spinoides* Vigors, 1831	R/SV	VC	I, II, III
62	Eurasian Goldfinch *Carduelis carduelis* (Linnaeus, 1758)	SV	C	I, II, III
63	Common Rosefinch *Carpodacus erythrinus* (Pallas, 1770)	SV	C	I, II
64	Red-mantled Rosefinch *Carpodacus rhodochlamys* (Brandt, 1843)	SV	UC	II
65	Common Great Rosefinch *Carpodacus rubicilla* (Guldenstadt, 1775)	R/LM	UC	I, II
66	Red Crossbill *Loxia curvirostra* Linnaeus, 1758	R/LM	UC	II
Family: Passeridae **Subfamily: Passerinae**				
67	House Sparrow *Passer domesticus* (Linnaeus, 1758)	R/LM	VC	I, II, III
68	Cinnamon Tree Sparrow *Passer rutilans* Temminck, 1835	SV	VC	I, II, III
69	Tibetan Snowfinch *Montifringilla adamsi* Adams, 1858	R/LM	C	II, III
Family: Corvidae				
70	Red-billed Chough *Pyrrhocorax pyrrhocorax* (Linnaeus, 1758)	R/LM	VC	I, II, III
71	Yellow-billed Chough *Pyrrhocorax graculus* (Linnaeus, 1766)	R/LM	VC	I, II, III
72	Jungle Crow *Corvus macrorhynchos* Wagler, 1827	R	VC	I, II, III
73	Common Raven *Corvus corax* Linnaeus, 1758	R/LM	C	I, II, III

Table 5: Mammalian fauna recorded in Rakchham Chhitkul wildlife sanctuary

S.No	Taxon	Res. St.	Rel. Abd.	Altitudinal Zone
Order: Primates **Family: Cercopithecidae**				
1.	Rhesus Macaque *Macaca mulatta* Zimmermann, 1780	R/LM	UC	I, II
2.	Himalayan Gray Langur * EN *Semnopithecus ajax* Pocock, 1928	R/LM	UC	II
Order: Carnivora **Family: Canidae**				
3.	Tibetan Wolf *Canis lupus chanco* Gray, 1863	R	Ra	III
4.	Red Fox *Vulpes vulpes* Linnaeus, 1758	R/LM	C	I, II, III
Family: Felidae				
5.	Leopard * NT *Panthera pardus*. Linnaeus,1758	SV	UC	I, II
6.	Snow Leopard * EN *Uncia uncia* Schreber, 1775	R	Ra	III
7.	Desert Cat *Felis libyca* Forster	R/SV	Ra	I
8.	Leopard Cat *Prionailurus bengalensis* Kerr, 1792	R/SV	Ra	II
Family: Mustelidae				
9.	Stone Marten *Martes foina* Erxleben, 1777	R/LM	UC	I, II
10.	Himalayan Yellow-throated Marten *Martes flavigula* Boddaert, 1785	R	C	I, II, III
11.	Himalayan Weasel *Mustela sibirica* Pallas, 1773	R	C	II, III
12.	Ermine *Mustela erminea* Linnaeus, 1758	R	C	I, II
Family: Ursidae				
13.	Brown Bear *Ursus arctos* Linnaeus, 1758	R	UC	III
14.	Asiatic Black Bear * VU *Ursus thibetanus* G.Cuvier,1823	R	C	I, II
Order: Artiodactyla **Family: Moschidae**				
15.	Musk Deer * EN *Moschus chrysogaster* Hodgson, 1839	R	Ra	III

Family: Bovidae				
16.	Himalayan Goral *Naemorhedus goral* Hardwicke, 1825	R/LM	C	I
17.	Bharal *Pseudois nayaur* Hodgson, 1833	R/LM	C	II, III
18.	Yak *Bos grunniens* Linnaeus, 1766	R	C	I, II, III
Order: Rodentia **Family: Cricetidae**				
19.	Royle High Mountain Vole * NT *Alticola roylei* Gray,1842	R	C	III
Family: Muridae				
20.	House Rat *Rattus rattus* (Linnaeus, 1758)	R	VC	I, II
21.	House Mouse *Mus musculus* (Linnaeus, 1758)	R	C	I, II
Family: Sciuridae				
22.	Himalayan Marmot *Marmota himalayana* Hodgson, 1841	R	UC	III
Order: Logomorpha **Family: Ochotonidae**				
23.	Pika *Ochotona roylei* (Ogilby, 1839)	R	C	II, III

Res. St. = Residential status: R= Resident, SV= Summer Visitor, R/LM= Resident with local movement, R/SV= Resident with Summer Influx.
Rel. Abd. = Relative abundance: VC= Very common, C= Common, UC= Uncommon, Ra=Rare
* EN=Endangered, NT=Near Threatened, VU=Vulnerable

The percent composition of different vertebrate groups showed that birds constituted 70% of the total vertebrate fauna, followed by mammals (22%), reptiles (5%), fish (2%) and amphibian (1%). Two species of fish namely Rainbow Trout (*Oncorhynchus mykiss*) and Brown Trout (*Salmo trutta fario*) have been recorded in waters of the Rakchham Chhitkul Wildlife Sanctuary in zone I & II as a resident common species while only one amphibian species has been recorded in zone I as a common species and summer visitor(Table 1,2). Present explorations revealed the presence of 5 species of reptiles from four different families, all belonging to order Squamata. The Kashmir/Hurdwar Lizard and Himalayan Ground Skink were recorded in good populations from the study area. They were recorded from all the three altitudinal zones in sanctuary area (Table 3). The exploration of Rakchham- Chhitkul Wildlife Sanctuary area revealed the presence of a diverse population of birds consisting of 73 species, belonging to 52 genera, spread over 24 families and 9 orders. The diversity was dominated by the Passerines constituting the majority with 54 species while non-passerines were represented by only 19 species (Table 4). The family Muscicapidae, the largest bird family in India as well as in Himachal Pradesh holds its status as the largest family in this sanctuary too with 19 species. The second largest family in the sanctuary was Fringillidae with 7 species, closely followed by families Accipitridae and Motacillidae with 5 species each. The family Columbidae and Corvidae were represented by 4 species each, while family Phasianidae, Hirundinidae, Paridae and Passeridae by 3 species each. The family Apodidae, Alaudidae and Laniidae were represented by 2 species each. However, quite a large number of families 11 in total viz. Falconidae, Rallidae, Scolopacidae, Cuculidae, Upupidae, Campephagidae, Cinclidae, Troglodytidae, Prundellidae, Certhiidae and Emberizidae were least represented in the area with single species each. Analyses of the data on residential status of the avifauna of the sanctuary revealed that 6 species (8%) were purely resident and the remaining 67 species (92%) showed seasonal local or long range migrations. Analysis of data on relative abundance showed that of the 73 species recorded, 23 species (31%) were very common, 34 species (47%) common, 14 species (19%) uncommon and 2 species (3%) rare to the sanctuary (Table 4). Present study revealed the presence of 23 species of mammals, belonging to 20 genera, 11 families and 5 orders. It was recorded that Carnivora was the most diverse order with 12 species followed by order Artiodactyla and Rodentia with 04 species each. The order Primate has 02 species followed by order Logomorpha with only 01 species representation. The family wise analysis of the data revealed that families Felidae and Mustelidae were represented by 04 species each followed by family Bovidae with 03 species. The families Cercopithecidae, Canidae, Ursidae and Muridae were represented by 02 species each whereas families Moschidae, Cricetidae, Sciuridae and Ochotonidae were represented by 01 species each (Table 5).

Both the species of fish recorded in the sanctuary area were present in Zones-I & II. The single species of amphibian, Himalayan Toad, is confined only to the Zone-I. The reptiles, recorded during the present study, have wide distribution and were present in all the three zones. Of the 5 species of reptile, 4 species namely Hurdwar Lizard, Himalayan Ground Skink, Indian Rat Snake and White-lipped Pit Viper were recorded in Zone-I. Similarly, these 4 species were also recorded in the Zone-II whereas, only one species of reptile i.e. Himalayan Ground Skink was recorded in Zone-III. Analyses of data on change in bird composition with corresponding increase in altitude showed that 59 species were recorded in Zone-I, 61 in Zone-II and 38 species. It has been reported that comparatively equal bird species diversity in Zones-I & II, drastically decreases in the Zone-III. There were 17 such species of birds whose habitat/altitude requirements were narrow due to which these were recorded from a single zone and rest 56 were recorded from 2 or more than 2 altitudinal zones. The mammals have almost uniform distribution in all the three zones. They were represented by 12 species in Zone-I, 15 species in Zone-II and 12 in Zone-III.

Present study area is bestowed with some of the unique and characteristic vertebrates like Kashmir/Hurdwar Lizard (*Laudakia dayana)*, Himalayan Ground Skink **(***Asymblepharus himalayanus*), Himalayan Pit Viper (*Gloydius himalayanus***),** Golden Eagle (*Aquila chrysaetos*), Chukor (*Alectoris chukar*), Himalayan Snowcock (*Tetraogallus himalayensis*), Snow Pigeon (*Columba leuconota*), Horned Lark (*Eremophila alpestris*), Oriental Tree Pipit (*Anthus hodgsoni*), Rufous-breasted Accentor (*Prunella strophiata*), Red-billed Chough (*Pyrrhocorax pyrrhocorax*), Yellow-billed Chough (*Pyrrhocorax graculus*), Red Fox (*Vulpes vulpes*), Snow Leopard (*Uncia uncial*), Asiatic Black Bear (*Ursus thibetanus*), Musk Deer (*Moschus chrysogaster*), Bharal (*Pseudois nayaur*), Yak (*Bos grunniens*), Royle High Mountain Vole (*Alticola roylei*) and Pika (*Ochotona roylei*). Many of these are threatened species.

The study area has of late witnessed various development activities. It has developed as a popular tourist destination leading to the arrival of large number of tourists every year. Further there are countless hydroelectric projects that are being constructed in the entire Kinnaur district. The Baspa valley too has been exploited by the construction of numerous hydroelectric power projects. These will have a synergistic effect on many extinction drivers, such as habitat fragmentation and degradation, diseases and climate change. A region specific study summarises and documents the current status of vertebrate diversity providing benchmark data for documentation and appreciation of biodiversity at regional level. The research in such protected areas can not only add to the body of human knowledge but also generate information useful for the efficient management of wildlife sanctuaries and forests that has been made in the present paper.

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