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Inventory of bird species along the trekking route of Barsey Rhododendron Sanctuary in West Sikkim, India

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Abstract
A total of 33 bird species belonging to 31 genera and 20 families were recorded in Barsey Rhododendron Sanctuary along the trekking route in West Sikkim. *Tragopan satyra* was listed in Near Threatened as per the IUCN Red List of Threatened Species. Apart from these, the area is rich diversity of floral species too. A total of 98 plant species were recorded along the trekking route in BRS. Of which 34 herb species followed by 26 tree species, 20 shrub/scrub species, 6 climber, 6 ferns and fern-allies, 4 epiphyte and orchid species and 2 bamboo species were recorded in all along 33 sampling plots. This sanctuary is flourished with *rhododendron* species such as *Rhododendron arboreum, Rhododendron barbatum, Rhododendron falconeri, Rhododendron grande, Rhododendron griffithianum* and *Rhododendron hodgsonii* giving the food and shelter of avi-faunal species. Most of the birds are attractive in *Rhododendron arboreum* flower which is dominant taxa with wide range of distribution pattern along the trekking route. The broadleaf trees species are spread over the sanctuary and offer ample food and shelter for faunal and avi-faunal species. The dense forests of *Lithocarpus pachyphyllus* especially the *Oak* forest provides shelter as well as abundant fruits and as such is good indicators of faunal presence and richness. The present paper revealed the inventory of bird species along the trekking route of Barsey Rhododendron Sanctuary in West Sikkim, India. Forest types play a significant role in the forest for the conservation of biodiversity.

Keywords: Rapid Biodiversity Survey, Barsey Rhododendron Sanctuary, Bird Inventory, Trekking Route

Introduction
The assessment of bird communities has been considered as significant tools for the conservation of biodiversity by (Kremen, 1992) [24]. According to the Worldwatch Institute (2006) [1], many bird populations are currently declining worldwide it would be decline, due to loss of habitat, accidental mortality due to pollution, competition and predation. Indian Himalayan Region harbour over 1295 species, out of these, 568 bird species in *Envis websites* and 574 species are found in Sikkim as mentioned by (Inskipp *et al.*, 1996) [22]. From the 19th century, several works have been done in Sikkim by Bulger (1869), Blandford (1872) [7], Grammie, (1877), Ali (1962), and Brooks (1880). Sikkim is identified as an endemic bird area by Birdlife International (2001). Dr. Salim Ali (1962) documented about 430 bird species, 253 genera and 55 families among 16 bird orders. Many bird species were documented by Ganguli-Lachungpa (1990, 1992, 1993, 1994 &1996). Lucksom (1994) [19] documented 43 bird species in Sidkeong Tulku Bird Park at Rabdentse, West Sikkim. Distribution and ecology of birds of Sikkim are studied by many authors in different areas such as Khangchendzonga Biosphere Reserve (Chettri *et al*., 2001, 2005) [9, 10] in the Teesta Valley & Shingba Rhododendron Sanctuary by (Acharya *et al*., 2010) [2]. The study and documented of bird diversity in Rabdentse Bird Park was done by (Lucksom, 1994) [19] and checklist of bird of Barsey Rhododendron Sanctuary by (Tambe & Lachungpa). Barsey Rhododendron Sanctuary is one of the best birding zones due to variety of *rhododendron* habitat associated with *Oak* species in different elevation gradient of different forest types by (Subba *et al*., 2017) [26]. Barsey Rhododendron Sanctuary is one of the important International Bird Areas code IN-SK-01, in Sikkim with Nepal in its western border in the Singalila Range, stretching from temperate forest to alpine forest.

Study area
Barsey Rhododendron Sanctuary (Fig 6) is officially notifies in 1988, for the conservation of flora, fauna and avi-faunal species. Rapid biodiversity survey was conducted along Hilley-Barsey-Sano dhap-Thulo dhap-Kalijhar-Phoktay Dara-Chitray-Chewabhanjyang-Uttarey trekking route (ca. 40 km) in proximity to the Singalila Range. This protected landscape is located between Lat: 27°11´14.9"N & 27°15´38.5"N and Long: 88°07´11.7"E & 88°01´53.9"E in the west district of Sikkim. Along 2200m to 4000m asl, the BRS covers a spatial area of 104 sq.km. The climate of this Sanctuary is wet and cold favouring the spread of the dominant over dozens of *rhododendron* variety. Barsey Rhododendron Sanctuary is a biologically diverse sanctuary and famous for its *rhododendron* stand which blooms usually between April and May. The vegetation is characterized by moist temperate forest, temperate coniferous forest, sub alpine forest and alpine zone. Chewabhanjang is the end point and there is an international border between India and Nepal. The sanctuary is refuge to many Schedule I animals and numerous avifaunal species.

Methodology
Avian assessment
Rapid Biodiversity Survey was conducted in Barsey Rhododendron Sanctuary along the trekking route during the months of May 2016. The vegetation survey as well as distribution and diversity of birds were observed &

recorded. Effort was made in early morning and afternoon during the survey period. Five different points were randomly identified along these transects for the observation of avifauna. Extensive review of published related work on other parts of Sikkim Himalaya was also made. To get secondary information consult with the local bird expert was made.

Vegetation Assessment

Vegetation assessment was made, the trees and shrubs/scrubs and herbs were inventoried and recorded along 33 sampling plot, covering an area of 0.33 ha. For trees, we laid the plots (10m X 10m) quadrats and Circumference Breast Height was measured. For shrubs & scrubs the sub-quadrat of (5m X 5m) were laid and for herbs (1m X 1m) were laid. Consequently, for this site, we calculated the species richness, species diversity index, abundance, frequency and density of trees, shrubs and herbs.

Findings and Discussion

Avian Diversity

The present study recorded a total of 33 species of birds belonging to 31 genera & 20 families were encountered all along the trekking route. Family-wise species composition revealed that the Phasianidae & Turdidae (4 species each) emerged as the dominant family followed by Fringillidae (3 species) as showed in Fig. 6. The families of Corvidae, Leiothrichidae, Muscicapidae, Nectariniidae and Picidae were represented by 2 species. Rest of the families were represented by single species. *Tragopan satyra* was listed in Near Threatened as per IUCN was recorded along the sampling path in the Barsey Rhododendron Sanctuary in the trekking route of West Sikkim.

Fig 1: Spotted laughingthrush *Garrulax ocellatus* belongs to Turdidae family.

This species is globally distribution in Bhutan, China, India (Sikkim), Myanmar and Nepal. Its natural habitat is tropical to subtropical moist forests and temperate rhododendron forest at Sikkim Himalayas, spotted at an elevation of 2737m asl in Hilley, West Sikkim. They are feeds on insects, fruit and seeds.

Fig 2: Verditer flycatcher

Eumyias thalassinus belongs to Muscicapidae. Distributed in Bangladesh, Bhutan, China, India, Laos, Myanmar, Nepal, Thailand and Vietnam, inhabits under moist temperate forest and rhododendron shrubberies in the Himalayan region. Spotted at Barsey at 2700m asl.

Fig 3: Green-tailed sunbird

Aethopyga nipalensis belongs to Nectariniidae family. Worldwide distributed, in Bangladesh, Bhutan, Northeast India (Sikkim), Loas, Myanmar, Nepal, Thailand, Tibet and Vietnam. Their natural habitats are tropical, sub-tropical to temperate forest under the shrubberies of *Berberis insignis*. They feed the flower nectar & insects. Spotted at Hilley Blood pheasant belongs to the family of pheasants, Phasianidae and is the only species in genus *Ithaginis* of the pheasant family. Females are more uniformly colored with dueller shades of reddish brown. These pheasants originate from the Eastern Himalayas, ranging India (including Sikkim), Nepal, Bhutan, Tibet and China. The habitat of these species is coniferous to mixed temperate forest and scrub area in the Himalayas. The population trend appears to be decreasing and listed in Least Concern by IUCN in 2009. Two subspecies viz., *I.c. affinis* and *I.c. kuseri* are found in India. In India, these pheasant are found in Sikkim, Darjeeling Hills, and Arunachal Pradesh. These are feed by pine seeds, green shoots, berries, butterflies and beetles. Blood Pheasant (*Ithaginis cruentus*) is state bird of Sikkim, which is sighted along the sampling path at 3300m asl with

Rhododendron hodgsonii & *Rhododendron lepidotum* in *Rhododendron* Mixed Forest. As per the (Chettri *et al.*, 2005), in Khangchendzonga Biosphere Reserve of Tshoka, Phitang and Dzongri trekking route is also one of the best habitats of Blood pheasant.

Fig 4: Female Blood pheasant (*Ithaginis cruentus*) at 3300 m asl

Fig 5: Male Blood pheasant (*Ithaginis cruentus*) at 3300 m asl

Floral diversity

The study revealed a total of 98 species were recorded of which 34 herb species followed by 26 tree species, 20 shrub/scrub species, 6 climber, 6 fern and fern-allies, 4 epiphyte and orchid species and 2 bamboo species were recorded all along 33 sampling plots. Along 2700m to 3600m altitudes, representing almost majority of the major forest communities were recorded. The sanctuary is flourished with rhododendron trees species such as *Rhododendron arboreum, R. barbatum, R. falconeri, R. grande, R. griffithianum* and *R. hodgsonii* and some other shrub species such as *R. campanulatum, R.dalhousiae and R.lepidotum* giving the forest a beautiful look at the time of blooming and attraction of avi-fauna species. Around 2700m to 2900m asl, the dominant woody taxa are *Quercus lamellosa, Castanopsis tribuloides* and *Lithocarpus pachyphyllus* etc. The broadleaf trees species are spread over the sanctuary and offer ample food and shelter to diversity of faunal and avi-faunal species. Forest types play a significant role in the forest for the conservation of biodiversity. The dense forests of *Lithocarpus pachyphyllus* especially the *Oak* forest provides shelter as well as abundant fruits and as such is good indicators of faunal presence and richness (Subba *et al*., 2017) [26]. Along the sampling paths the dominant *Oak* species were observed along with associated species, including *Quercus lamellosa*-*Symplocos lucida* as an important ecological centre for wild animals and birds. During the fruiting season of *Symplocos lucida*, that acts as an essential food for most birds along the trekking route (personal observation) has been recorded in temperate forests. Above 3000m asl, with increase in an elevation along the sampling path, *Rhododendron arboreum* (pinkish-rose and rosy-red form) has observed a broad range of distribution ranges up to 3400 m asl at Kalijhar top (Phoktay Dara) along the trekking trail which has rich diversity of birds were observed. Barsey is not only famous for *Rhododendron* but also for nature lovers due to its rich biological diversity, beautiful views of scenery and for birds and butterflies as well.

Conservation recommendation and conclusion

The present study observed the 33 bird's species from Barsey Rhododendron Sanctuary along the trekking route is more as compared to total figure 574 species are found in Sikkim by (Inskipp *et al.*, 1996) [22]. Barsey Rhododendron Sanctuary is the habitat of over 17 *rhododendron* species and associated with pure patches of *Oak* species, provides shelter as well as abundant fruits and as good indicator of bird's presence and richness. This might be habitat of variety of tree species with *Rhododendron* species and for good forest quality, offering ample food resources exhibits the bird diversity in Barsey Rhododendron Sanctuary. As per the (IUCN, 2009) [23] many species of birds are threatened and near-threatened in Sikkim. In the present study, found Near Threatened species is *Tragopan satyra* was encountered along the trekking route. For the point of conservation, the habitat of the Blood pheasant is wet temperate forest to temperate coniferous forest and sometimes this species has broad range of distribution up to alpine forest. The population trend appears to be decreasing and listed in Least Concern by IUCN in 2009. The population of bird species in Sikkim is very low due to habitat loss/destruction, and the expression of wildfire, competition, prey & predator. As the loss and destruction of habitat is the most serious threat to many species of birds. During winter season most of the areas of Sikkim get snowfall, avalanche, small landslip, landslide occur and the birds are migrating from one place to another or it may loss habitat.

Many species of birds were encountered including the two individual of Blood pheasant (*Ithaginis cruentus*) male & female were sighted at 3300m above sea level with *Rhododendron hodgsonii* & *Rhododendron lepidotum* in Rhododendron Mixed Forest. Similarly, in Khangchendzonga Biosphere Reserve (KBR) located in Tshoka, Phitang and Dzongri trekking route is also one of the good habitats of Blood pheasant by (Chettri *et al.*, 2005) [10]. *Verditer flycatcher* is found to have wide range of distribution 3600m amplitude followed by Rose finch was that of 2700m asl were recorded in entire sampling path. Present observation, it appears is very rich in avi-diversity with existing rich biological diversity (Subba *et al.*, 2017) [26]. In Sikkim, the Government has many potential efforts by implementing conservation strategies and lack of anthropogenic pressure. The Sikkim Biodiversity Conservation and Forest Management Project aims to enhance the global, social and economic value of biodiversity and implementation of sound management plans and the dissemination of biodiversity information for promoting public awareness and the significance of biodiversity.

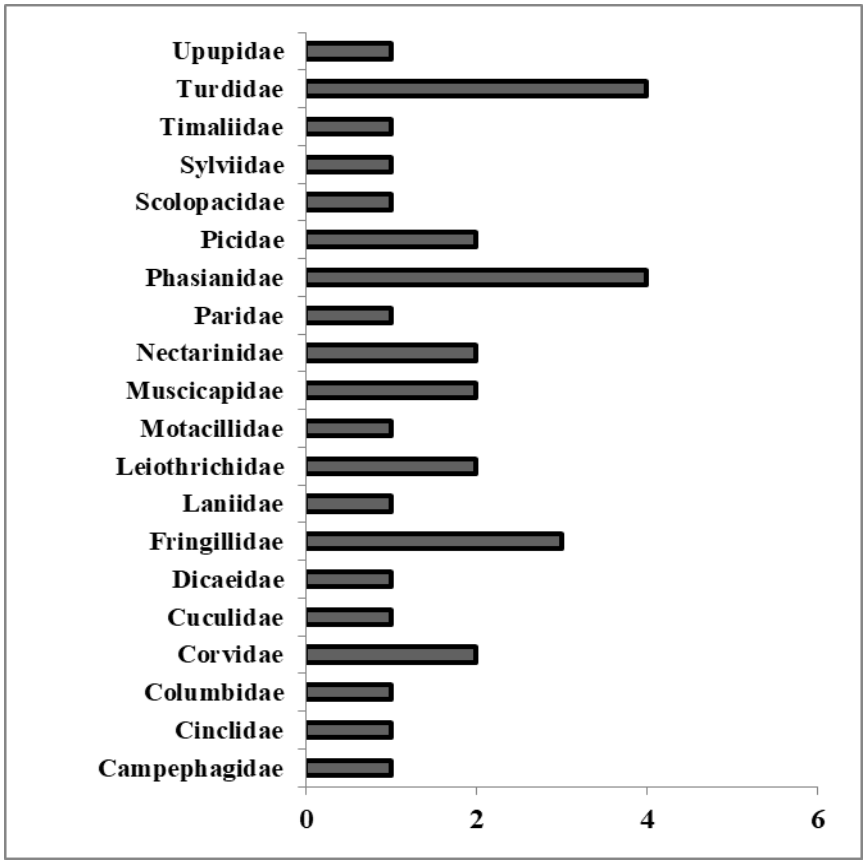

Fig 6: Family-wise distribution of birds in Barsey Rhododendron Sanctuary along the trekking route, West Sikkim

Table 1: Birds were encountered along the trekking route of Barsey Rhododendron Sanctuary in West Sikkim

	Common name	Scientific name	Family	Local name	Elevation (m) asl	IUCN status
1	Bar throated minla	*Minla strigula*	Leiothrichidae		2700	LC
2	Bay wood pecker	*Blythipicus pyrrhotis*	Picidae		1950	NA
3	Black drongo	*Dicrurus macrocercus*	Dicruridae	chibey	1900	LC
4	Blood pheasant	*Ithaginis cruentus*	Phasianidae		4500	LC
5	Blue whistling thrush	*Myophonus caeruleus*	Muscicapidae	Kalchura	2700	NA
6	Common hoope	*Upupa epops*	Upupidae	Fafarey		NA
7	Darjeeling wood pecker	*Dendrocopos darjellensis*	Picidae	Laachey	2300	NA
8	Bullfinch	*Pyrrhula nipalensis*	Fringillidae			LC
9	Fire-tail sunbird	*Aethopyga ignicauda*	Nectariniidae	Balchey	2700	NA
10	Green -backed tit	*Parus monticolus*	Paridae	Fista	2700	LC
11	Green -tailed sunbird	*Aethopyga nipalensis*	Nectariniidae	Kalobalchey	2000	LC
12	Grey-backed shrike	*Lanius tephronotus*	Laniidae			LC
13	Grey-winged blackbird	*Turdus boulboul*	Turdidae		2700	NA
14	Hill partridge	*Arborophila torqueola*	Phasianidae	Peura	2700	LC
15	Kalij pheasant	*Lophura leucomelanos*	Phasianidae	Kaleej	2700	LC
16	Large-billed crow	*Corvus macrorhynchos*	Corvidae	Kag	4500	LC
17	Large hawk-cuckoo	*Hierococcyx sparverioides*	Cuculidae		2300	LC
18	Long- tailed minivet	*Pericrocotus ethologus*	Campephagidae		1820	LC
19	Oriental turtle dove	*Streptopelia orientalis*	Columbidae	Dhukur	4000	LC
20	Plain mountain finch	*Leucosticte nemoricola*	Fringillidae			LC
21	Spot-winged rosefinch	*Carpodacus rodopeplus*	Fringillidae	Tuti	4500	NA
22	Rufous sibia	*Heterophasia capistrata*	Leiothrichidae			LC
23	Satyr tragopan	*Tragopan satyra*	Phasianidae	Mudal	4000	Near Threatened
24	Slender billed scimitar babbler	*Pomatorhinus superciliaris*	Timaliidae		2464	NA
25	Spotted forktail	*Enicurus maculatus*	Muscicapidae		1330	LC
26	Spotted laughingthrush	*Garrulax ocellatus*	Turdidae	Kolkoley	2700	LC
27	Striated laughingthrush	*Garrulax striatus*	Turdidae	Kolkoley	2300	NA
28	Verditer flycatcher	*Eumyias thalassinus*	Muscicapidae	Hariney	4500	LC
29	White-browed fulvetta	*Fulvetta vinipectus*	Sylviidae		2700	NA
30	White-throated dipper	*Cinclus cinclus*	Cinclidae		2300	LC
31	Eurasian Woodcock	*Scolopax rusticola*	Scolopacidae			NA
32	Yellow-billed blue magpie	*Urocissa flavirostris*	Corvidae		2000	LC
33	Yellow wagtail	*Motacilla flava*	Motacillidae			NA

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