Nep J Environ Sci (2021), 9(2), 25-33
https://doi.org/10.3126/njes.v9i2.37378

ISSN 2350-8647 (Print) 2542-2901 (Online)

Research Article

A baseline study on diversity of birds in Sani Bheri River Valley, Nepal

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(Received: 12 May 2021; Revised: 30 September 2021; Accepted: 14 December 2021)

Abstract

Rivers and lakes are important habitats for both resident and migratory wetland-dependent birds. This paper presents the study of bird diversity in Sani Bheri River Valley located outside the protected areas of Nepal. The study was carried out from 8-17 March 2019 (Spring) and 12-21 October (Autumn) 2019 covering a 52 km river stretch from Naighat (upstream area where Pelma River and Uttarganga River mix and flow as Sani Bheri river) to Remnaghat (downstream towards the confluence with Thuli Bheri) using the Mackinnon Listing method. The present study recorded 851 occurrences belonging to 11 Orders, 33 Families, and 71 bird species. Order Passeriformes (52 species) and family Muscicapidae (13 species) were dominant. Plumbeous Water-redstart (*Phoenicurus fuliginosus*) had the highest relative abundance (7.64%). Shannon-Weiner diversity index (H'= 3.61) and Evenness index (e= 0.85) indicate the diverse assemblage of avian fauna in the study area. The study recorded one globally threatened, four nationally threatened, and eight species listed in Appendix-II of CITES in the study area. The results provide the baseline information on avian species, which can provide a good database and can be incorporated in conservation implications.

Keywords: Diversity indices, Mackinnon listing, Rukum East and Rukum West

Introduction

Birds are considered an ecological bioindicator species of climate change and water quality (Edwards, 1996). It serves the ecosystem in various ways like regulating the population of certain species (e.g., pest control) in an ecosystem (Karp et al., 2013), seed dispersal by carrying large distance and/or by droppings (Paradis et al., 1998). They are also the center of attraction for birdwatchers and in the field of ecotourism (Edwards, 1996).

Habitat types and climatic factors are major responsible factors for avian diversity and its abundance due to available food sources and nesting opportunities (Girma et al., 2017; Mamo et al., 2016; Wu et al., 2013). Freshwater wetlands like riparian habitat comprises high local and regional biodiversity (Palmer & Bennett, 2006) and also support about 40% of the world's bird species (Paracuellos, 2006).

Nepal is exceptionally rich in avian fauna with 886 species of birds (DNPWC & BCN, 2018) which is about 9% of the world's known bird species (Inskipp et al., 2016). The government of Nepal has also set aside 20% of its total land area into protected areas of national parks, wildlife reserves, and hunting reserves (Baral et al., 2012) which are considered to be a supporting system for maintaining and promoting different bird habitats. However, areas outside the protected zones are also equally important to maintain the biodiversity which can provide potential habitats to those birds as these species are boundary less and fly from one place to another place. Therefore, documentation of birds in such places is very necessary and evaluation of habitat types and conditions can be carried out in the future. Sani Bheri River Valley, a riparian habitat, has been chosen as the study area where assemblages of shorebirds, wetland-dependent birds, and waterfowls can be encountered. Therefore, the main aim of the study was to assess the diversity, abundance, and conservation status of birds in Sani Bheri River Valley, Lumbini and Karnali provinces, Nepal.

Materials and Methods

Study area

The study was conducted in the Sani Bheri River Valley, located in the Rukum east of Lumbini province and Rukum west of Karnali province (Fig. 1). This river is one among the tributaries of Karnali river that confluence through Bheri river. This study was carried out from Remnaghat (82º16'49.91" E and 28º41'34.93" N) to Naighat (82º44'56.22" E and 28º37'59.82" N) having 52 km in the distance from an elevation range of 720 m to 1415 m.

Dominant plant species like *Shorea robusta, Woodifordia frutocosa, Ficus sps, Acacia catechu, Dalbergia sissoo, Eupatorium adenophora, Diploknema butyraceae* and *Imperica cylindrica* were observed along the rivers stretch.

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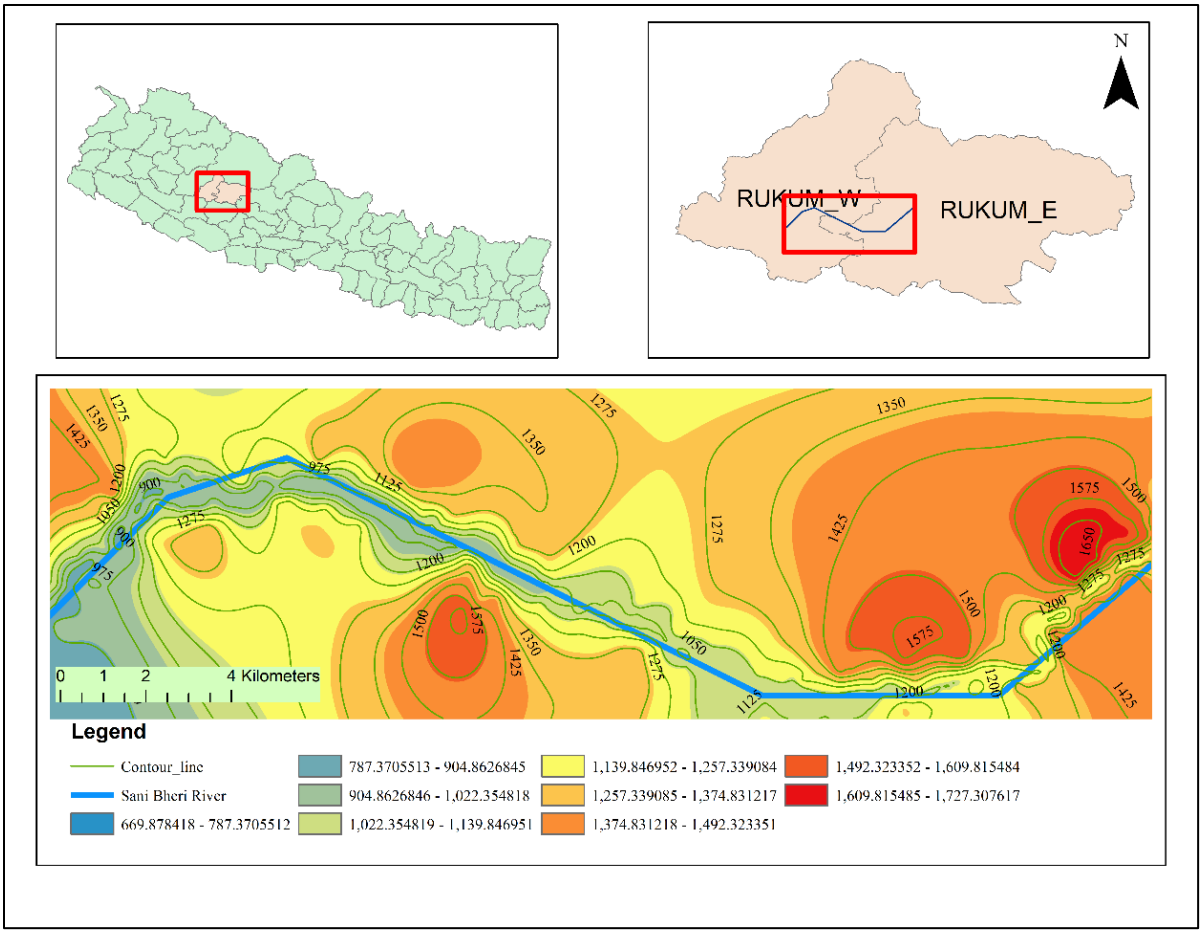

Figure 1 Location of the study districts (Rukum West and Rukum East) in the Nepal map (upper left); The study area with location of the river valley flowing through two districts (upper right); and elevational gradients of the river valley (lower).

Methods

Bird survey

Mackinnon's listing method, a quantitative approach was used to count the number of birds in the study area (Mackinnon & Philips, 1993). The detection rate of more species either endemic or threatened species in point count method or any other time-lapse method will be very minimal whereas, in Mackinnon's listing method, it is dependent moreover on the number of species observed rather than time, area/or walking speed of the researcher (Herzog et al., 2002). Listing methods have a very low bias (Poulsen et al., 1997) which makes it to be better than any other surveying birds (Ribon, 2010) and has been promoted in the manual of bird census chapters (Bibby et al., 2000). Depending upon the richness of the study area, number of species in lists are selected usually 5 or 10 unique species are observed at first with later frequent repetition (Herzog et al., 2002; Macleod et al., 2011).

In this study, observations were classified into consecutive lists of 10 species as recommended by Herzog et al. (2002). The study was carried from 8-17 March 2019 (Spring) and 12-21 October 2019 (Autumn) for 10 days each. The birds observed 200 m from the riverside were recorded. Binocular having magnification of 10*42 mm with depth angle of 5^{0} for bird watching and digital Camera for photographs was used. The bird survey started from 7:30 am to 5:00 pm every day. For the identification of birds, Helm Field Guide- Birds of Nepal was used (Grimmett et al., 2016). The scientific nomenclature and systematic order of birds follow Bird Conservation Nepal Checklist (DNPWC & BCN, 2018).

The data collected from the field were arranged, organized, and entered into MS-Excel for further analysis. Shannon-Weiner Index (H') (Shannon & Wiener, 1949), Evenness index (e), and Relative abundance were calculated from the bird data.

Results and Discussion

Bird species richness and diversity indices

Using the Mackinnon-listing method, 54 bird species in March and 51 bird species in October with 32 common species were recorded. The dissimilarity in species diversity is due to the result of the season as it plays important role in species richness and composition (Shoo et al., 2005). The species richness curve in both surveyed times was shown in Fig. 2 and Fig. 3. These figures in both times of survey show the curve has not reached to asymptote type, this type of curve in Mackinnon's listing method estimates total species richness in the particular areas don't stabilize and may encounter new species in continual sampling.

A total of 851 individuals of 71 bird species belonging to 11 orders and 33 families were recorded from the Sani Bheri River Valley (Annex 1). A similar study by Neupane et al. (2020) observed 1036 individuals of 120 species from 8 Orders and 33 Families in the Kaligandaki River basin. In another study in and around the Barandabhar corridor forest, Chitwan recorded 3664 individuals of water birds belonging to 54 species, 11 Orders, and 13 Families (Adhikari et al., 2016). Similarly, Rapti and Narayani rivers harbor 46 species (Khadka et al., 2017) whereas Chhetri (2006) recorded 98 species. Hence, Sani Bheri River Valley supported a comparatively more or less good number of species richness and population.

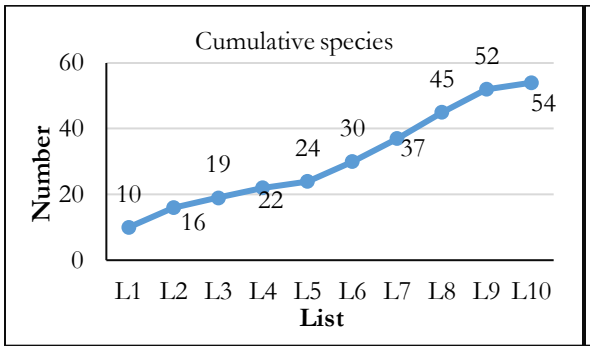

Figure 2. Species richness curve (March)

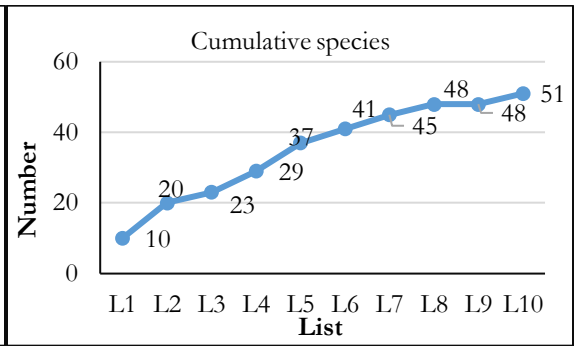

Figure 3. Species richness curve (October)

Among 11 Orders, Passeriformes was the dominant Order having 22 Families and 52 species. Family Muscicapidae of Order Passeriformes has the highest species richness (13 species) (Fig 4). As mentioned by Hoyo et al. (2014) that Passeriformes reproduce quickly in a forested area, the high species richness in the present study (dominated by forests) could be one of the reasons. Number of Plumbeous Water-redstart (n = 65) was found maximum (7.64%) among others as shown in Annex-1, probably due to its preferable habitat near the flowing rivers and streams (Tyler & Omerod, 1993).

The Shannon-Weiner diversity index (H') was 3.61 indicated the diverse assemblage of avian fauna in the study area as its value ranges from 0 to 4; with 0 being less diverse and 4 being more diverse (Shannon & Wiener, 1949). Also, the value of the Evenness index (e) was 0. 85 which means species are evenly distributed. Although it is difficult to find the study in similar settings, a study carried out in the Kaligandaki River basin had a value of H' as 3.93 and 4.006 in winter (January and February) and summer (May and June), respectively (Neupane et al., 2020). Such a high H' index in the present study also supports that Sani Bheri River Valley harbors a good habitat and supports high avian biodiversity.

Conservation status

Out of 71 bird species, 8 species (Black Kite, Himalayan Vulture, Egyptian Vulture, Crested Serpent-eagle, Common Kestrel, Slaty-headed Parakeet, Brown Fish-owl, and Asian Barred-owl) are listed in Appendix-II of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Only one species (Egyptian Vulture) is globally threatened species as Endangered (EN) and Asian Woollyneck and Himalayan Vulture are globally Near-Threatened (NT). Sharma (2004) enlisted twelve nationally threatened species in the Barandabar corridor forest. Later, Adhikari et al. (2016) recorded three globally vulnerable species and three globally near-threatened species in Barandabhar corridor forest, Chitwan, lowlands of Nepal.

In our study, Himalayan Vulture, Egyptian Vulture, Dark-sided Thrush, and Brown Fish-owl are nationally threatened (VU), whereas River Lapwing and Asian Woollyneck are Near-Threatened species (NT). DNPWC & BCN (2018) described 167 nationally threatened species, 42 globally threatened, and 35 globally near-threatened species. The checklist of bird species recorded with their detailed information is given in Annex-1. The findings from the present study show the importance of bird habitats outside the protected areas for conservation.

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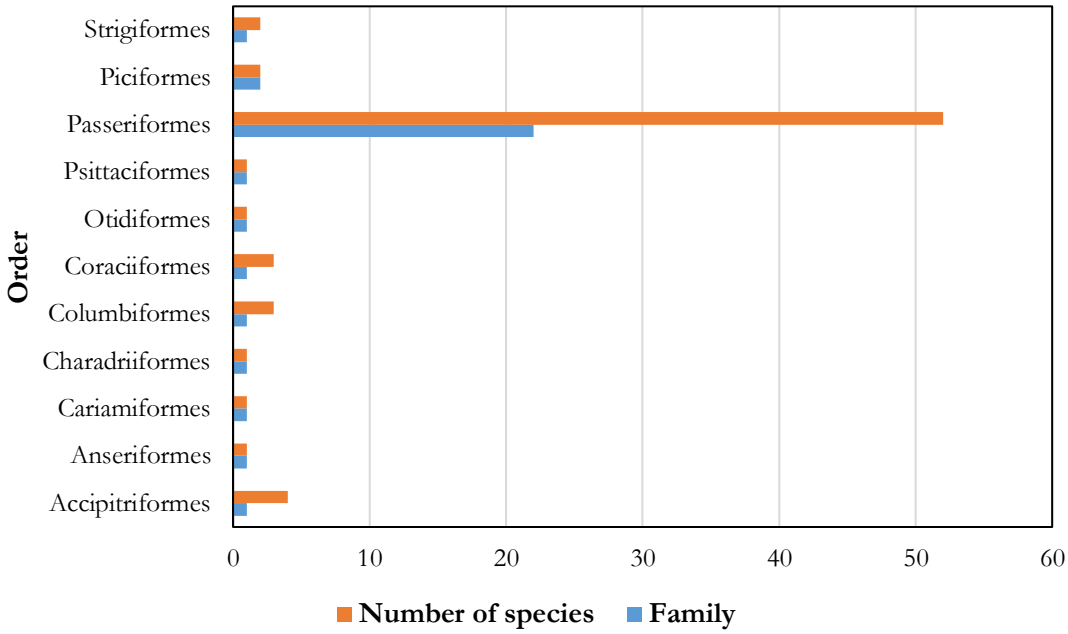

Figure 4 Species richness of birds in the Sani Bheri River Valley.

Conclusion

Sani Bheri River Valley is one of the pristine riparian habitats for wetlands-dependent birds and for other biodiversity outside the protected areas, located in Rukum east (Lumbini province) and Rukum west (Karnali province) of Nepal. Seventy-one avian species were recorded in which Order Passeriformes and Muscicapidae family were the dominant taxa. One globally threatened species, two globally near-threatened species, four nationally threatened species, and two nationally near-threatened species were recorded during this study. Additionally, eight species listed in Appendix-II of CITES were recorded. The study area had a high Shannon-Weiner's diversity index (3.61) and Evenness index (0.85) indicating the highly diverse composition of avian fauna in the study area. Therefore, habitats beyond the protected areas should also be prioritized and continuous monitoring is very necessary for planning and implementing conservation implications.

Acknowledgements: The authors would like to thank the Central Department of Environmental Science, Kirtipur, Kathmandu, for providing a platform to conduct this research and be grateful to the local people of Rukum for their assistance.

Author Contributions: GS: Overall research design and field study, data analysis, manuscript write-up, and revisions; MBS: methodology guidance, resource management, bird identification, checklist preparation, writing, reviewing, and editing; RMB: research study supervision; SR and SO: fieldwork for data collection.

Conflict of Interest: The authors declare no conflict of interest.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author, upon reasonable request.

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Annex 1 Checklist of birds recorded in Sani Bheri River Valley with their classifications scientific names, count and its conservation status.

S.N	Order/Family/ Common Name	*Scientific name*	Count	Conservation status		CITES
				National	Global	
	ACCIPITRIFORMES					
	Accipitridae					
1	Black Kite	*Milvus migrans*	5	LC	LC	II
2	Himalayan Vulture	*Gyps himalayensis*	5	VU	NT	II
3	Egyptian Vulture	*Neophron percnopterus*	3	VU	EN	II
4	Crested Serpent-eagle	*Spilornis cheela*	1	LC	LC	II
	ANSERIFORMES					
	Anatidae					
5	Goosander	*Mergus merganser*	2	LC	LC	
	CARIAMIFORMES					
	Falconidae					
6	Common Kestrel	*Falco tinnunculus*	8	LC	LC	II
	CHARADRIIFORMES					
	Charadriidae					
7	River Lapwing	*Vanellus duvaucelii*	5	NT	LC	
	COLUMBIFORMES					
	Columbidae					
8	Rock Pigeon	*Columba livia*	47	LC	LC	
9	Grey-capped Emerald Dove	*Chalcophaps indica*	2	LC	LC	
10	Western Spotted Dove	*Spilopelia suratensis*	1	LC	LC	
	CORACIIFORMES					
	Alcedinidae					
11	Common Kingfisher	*Alcedo atthis*	3	LC	LC	
12	Crested Kingfisher	*Megaceryle lugubris*	17	LC	LC	
13	White-throated kingfisher	*Halcyon gularis*	9	LC	LC	
	OTIDIFORMS					
	Ciciidae					
14	Asian Woollyneck	*Ciconia episcopus*	8	NT	NT	
	PSITTACIFORMES					
	Psittacidae					

15	Slaty-headed Parakeet	*Psittacula himalayana*	5	LC	LC	II
	PASSERIFORMES					
	Vireonidae					
16	White-browed Shrike-babbler	*Pteruthius aeralatus*	1	LC	LC	
	Hirundinidae					
17	Barn Swallow	*Hirundo rustica*	4	LC	LC	
18	Red-rumped Swallow	*Cecropis daurica*	5	LC	LC	
	Paridae					
19	Cinereous Tit (Great tit)	*Parus major*	28	LC	LC	
20	Black lored tit	*Machlolophus xanthogenys*	18	LC	LC	
21	Red-headed Bushtit	*Aegithalos concinnus*	9	LC	LC	
	Dicruridae					
22	Ashy Drongo	*Dicrurus leucophaeus*	2	LC	LC	
	Muscicapidae					
23	Oriental Magpie-robin	*Copsychus saularis*	11	LC	LC	
24	White-capped Water-redstart	*Phoenicurus leucocephalus*	52	LC	LC	
25	Spotted Forktail	*Enicurus maculatus*	13	LC	LC	
26	Grey Bushchat	*Saxicola ferreus*	4	LC	LC	
27	Pied Bushchat	*Saxicola caprata*	8	LC	LC	
28	Hodgson's Redstart	*Phoenicurus hodgsoni*	4	LC	LC	
29	Himalayan Bush-robin	*Tarsiger rufilatus*	2	LC	LC	
30	Chestnut-bellied Rock-thrush	*Monticola rufiventris*	1	LC	LC	
31	Plumbeous Water-redstart	*Phoenicurus fuliginosus*	65	LC	LC	
32	Little Forktail	*Enicurus scouleri*	16	LC	LC	
33	Common Stonechat	*Saxicola torquatus*	7	LC	LC	
34	Blue-fronted Redstart	*Phoenicurus frontalis*	7	LC	LC	
35	Blue Whistling-thrush	*Myophonus caeruleus*	23	LC	LC	
	Cinclidae					

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36	Brown Dipper	*Cinclus pallasii*	2	LC	LC
	Sturnidae				
37	Common Myna	*Acridotheres tristis*	18	LC	LC
	Cisticolidae				
38	Common Tailorbird	*Orthotomus sutorius*	6	LC	LC
	Turdidae				
39	Dark sided Thrush	*Zoothera marginata*	2	VU	LC
	Phylloscopidae				
40	Grey hooded Warbler	*Phylloscopus xanthoschistos*	11	LC	LC
	Corvidae				
41	Grey Treepie	*Dendrocitta formosae*	7	LC	LC
42	Large-billed Crow	*Corvus macrorhynchos*	5	LC	LC
43	Yellow billed Blue magpie	*Urocissa flavirostris*	10	LC	LC
44	Red-billed Blue magpie	*Urocissa erythrorynchа*	7	LC	LC
45	Rufous Treepie	*Dendrocitta vagabunda*	13	LC	LC
	Motacillidae				
46	White-browed wagtail	*Motacilla maderaspatensis*	55	LC	LC
47	White Wagtail	*Motacilla alba*	8	LC	LC
48	Paddyfield Pipit	*Anthus rufulus*	1	LC	LC
49	Grey Wagtail	*Motacilla cinerea*	17	LC	LC
	Pycnonotidae				
50	Red-vented Bulbul	*Pycnonotus cafer*	33	LC	LC
51	Mountain Bulbul	*Ixos mcclellandii*	5	LC	LC
52	Himalayan Bulbul	*Pycnonotus leucogenys*	24	LC	LC
	Stenostiridae				
53	Yellow-bellied Fairy-fantail	*Chelidorhynx hypoxanthus*	4	LC	LC
54	Grey-headed Canary-flycatcher	*Culicicapa ceylonensis*	3	LC	LC

	Nectariniidae					
55	Purple Sunbird	*Cinnyris asiaticus*	2	LC	LC	
56	Crimson Sunbird	*Aethopyga siparaja*	2	LC	LC	
	Passeridae					
57	Tree Sparrow	*Passer montanus*	68	LC	LC	
58	Russet Sparrow	*Passer cinnamomeus*	12	LC	LC	
59	House Sparrow	*Passer domesticus*	85	LC	LC	
	Campephagidae					
60	Long-tailed Minivet	*Pericrocotus ethologus*	6	LC	LC	
	Laniidae					
61	Long-tailed Shrike	*Lanius schach*	6	LC	LC	
	Zoseropidae					
62	Indian White-eye	*Zosterops palpebrosus*	5	LC	LC	
63	Whiskeres Yuhina	*Yuhina flavicollis*	3	LC	LC	
	Estrilididae					
64	Scaly breasted Munia	*Lonchura punctulata*	6	LC	LC	
65	White-rumped Munia	*Lonchura striata*	5	LC	LC	
	Dicruride					
66	Hair-crested Drongo	*Dicrurus hottentottus*	2	LC	LC	
	Sittidae					
67	Wallcreeper	*Tichodroma muraria*	8	LC	LC	
	PICIFORMES					
	Megalaimidae					
68	Great Barbet	*Psilopogon virens*	2	LC	LC	
	Picidae					
69	Rufous Woodpecker	*Micropternus brachyurus*	4	LC	LC	
	STRIGIFORMES					
	Strigidae					
70	Brown Fish-owl	*Ketupa zeylonensis*	2	VU	LC	II
71	Asian Barred Owl	*Glaucidium cuculoides*	1	LC	LC	II

LC= Least Concern, NT= Near Threatened, VU= Vulnerable, EN= Endangered