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Distribution and Threats of Rufous-necked Hornbill (*Aceros nipalensis*) in Bhutan

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Abstract

Hornbills (*Bucerolidae*) have a huge bill with a casque on upper mandible in some species. The casque is smaller in female in some species. Rufous-necked Hornbill (*Aceros nipalensis*), which belongs to *Bucerolidae* family, is a big bird measuring 90-100 cm long, with around 150 cm wingspan and weighing somewhat between a and 4 kg (4.4 to 8.8 lb). They are found in the Indian Subcontinent, East Asia and Southeast Asia. It is listed as Vulnerable in IUCN Red List, Appendix II of CITES and Schedule I (totally protected wild animals) species in Forest and Nature Conservation Act of Bhutan, 1995. It has high forest dependency and is mostly found between the altitude of 150 and 2,200 meters. Rufous-necked Hornbill mostly feeds on berries, drupes, fruits of *Lauraceae spp.*, *Moraceae spp.*, *Annonaceae spp.* and *Meliaceae spp.* In Bhutan, Rufous-necked Hornbill is reported from Samtse, Chhukha, Trashigang, Zhemgang, Monggar, Samdrup Jongkhar, Sarpang Districts, along Punatshang Chhu, and mostly from Wildlife Sanctuaries and National Parks. Though being vulnerable in nature and ecologically important species, it is poorly studied and documented in Bhutan. Therefore, this paper aimed to review published secondary sources related to Rufous-necked Hornbill in Bhutan. The result showed that there were no illegal killings of species in Bhutan. Habitats are threatened because of timber extraction, road construction, clearing of forest for power transmission lines and dying of nest trees.

Keywords: Bucerotidae; Habitat loss; Vulnerable; Hotspot, Hornbill, fragmentation, fruits

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Introduction

Bhutan, with an area of 38,394 km² (DoFPS, 2018), a country rich in biological diversity is sandwiched between two super powers, China in North and India in South, East and West (NBSAP, 2014). Bhutan lies to the East of Himalaya with a total of 11,248 species within all biodiversity taxa (NBC, 2019). Bhutan is a part of 8 ecoregions, 23 important bird areas, important plant areas and wetlands with 3 Ramsar sites (Banerjee & Bandopadhyay, 2016). Bird diversity of Bhutan is the reflection of country's unique geographical position, altitudinal variation and climatic differences. Till date, 752 species (26 globally threatened) of birds have been recorded for Bhutan (NBC, 2019), of which southern and central part of the country embodies the highest avian diversity. Of the 54 species of Hornbills (Jinamoy 2013; Sadadev, Dhimi, Thapa, Bista, Rawat, Neupane and Gautam 2020), Asia harbors 33 species of hornbill (Poonswad, Kemp, & Strange, 2013). Oriental Pied hornbill (*Anthracoceros albirostris*), Rufous-necked Hornbill (*Aceros nipalensis*), Wreathed Hornbill (*Rhyticeros undulates*) and Great Hornbill (*Buceros bicornis*) are the 4 species of Asian hornbills found in Bhutan (Grimmett, Inskipp, Inskipp, & Sherub, 2019). Oriental Pied Hornbill is listed as Least Concern globally, while the other three are Vulnerable (Sherub & Singh, 2020). Globally, Rufous-necked Hornbill (*Aceros nipalensis*) is listed as Vulnerable by International Union for Conservation of Nature (Shukla, Naniwadekar, & Datta, 2016), listed as protected species under

Schedule I of the Forest and Nature Conservation Act 1995 of Bhutan (RGoB, 1995) and listed in Appendix II by Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Sadadev, et al., 2020). Similarly, Forest and Nature Conservation Rules and Regulations, 2017 kept them under Schedule-I (protected) species with heavy fines and penalties for defaulters (UWICER, 2017). Its population is declining across much of its global range (Shukla et al, 2016). Rufous-necked Hornbill is reported from evergreen forest in Bhutan, Northern Myanmar, Western and Northern Thailand, part of North Eastern India, Southern China, Northern Laos and North-western Vietnam (Sherub & Singh, 2020). It is close to extinction in Vietnam and reportedly extinct from Nepal (Poonswad et al, 2013). Globally, its population is estimated to be around more than 2,500 but less than 10,000 birds (Poonswad et al, 2013).

Rufous-necked Hornbill feed on the fruits of 33 plants (Appendix 1), invertebrate species including bee larvae, freshwater crabs, young of birds, caterpillars, and beetles (Appendix 2) (Sherub & Singh, 2020). Breeding season begins from the last week of April and last till August, approximately about 4 months (Shukla, Naniwadekar, & Datta, 2016). Rufous-necked Hornbills are recognized to range over large space (Datta & Rawat, 2003). Their presence indicates the good health of the forest as they require large tracts of primary forest with large trees for nesting (Poonswad & Kemp, 1993) and plays an important functional role as seed dispensers

(Kannan & James, 1999). Despite having significant role in the ecosystem, this species is threatened by habitat loss and fragmentation, grazing, extraction of timber, and cutting of fruiting trees (Mudappa & Raman, 2009). Though they are not at risk of extinction in Bhutan, but they are facing the impact of economic development and globalization (Sherub & Tshering, 2019).

The study aimed to study the distribution evidences and threats of Rufous-necked Hornbill from the published papers in and out of Bhutan. There were not many published paper of Rufous-necked Hornbill based on Bhutan, but some paper published by non-Bhutanese had mentioned about the threats and distribution of Rufous-necked Hornbill in Bhutan.

Methods and Materials

This paper was set up by checking the relevant published papers globally and nationally on Rufous-necked Hornbill (*Aceros nipalensis*) from late 1990s till 2020. The distribution of the species was also extracted from eBird (www.ebird.org), iNaturalist (www.inaturalist.org) and Bhutan Biodiversity Portal (www.biodiversity.bt), an online citizen science project. The literature mostly focused on ecology, status and threats of Rufous-necked Hornbill. There was more study conducted on this species from 2010. I found only few papers with threat assessment and population density estimates. Therefore, numerous papers published were used to extract information and mold the information into consumable one. Gathered information was

utilized well and the authors are cited accordingly.

Results and Discussions

Status and Distribution

In Bhutan, Rufous-necked Hornbill is distributed at the altitude of 150-2,200 m in mature broadleaf forests (Inskipp, Inskipp, & Grimmett, 1999). The Rufous-necked Hornbill is sighted at Samdrup Jongkhar, Trashigang, Monggar, Pema Gatshel, Zhemgang, Gelephu, Trongsa, Wangdue Phodrang, Punakha, Samtse and Chhukha (eBird, 2020; BBP, 2020; iNaturalist, 2020). Jigme Dorji National Park, Phibsoo Wildlife Sanctuary, Jigme Singye Wangchuck National Park, Royal Manas National Park and Jomotsangkha Wildlife Sanctuary reported the sightings of the Rufous-necked Hornbill (BBP, 2020; eBird, 2020; iNaturalist, 2020). Rufous-necked Hornbill is occasionally sighted from other places as well but they are not documented well (UWICER, 2017).

Major Threats

The anthropogenic activities pose threats to the habitat and survival to the world's most distinct bird species (Pandit & Grumbine, 2012). The Rufous-necked Hornbill is mainly threatened by deforestation, mortality due to natural calamities and food resource competition.

Deforestation

Hornbills are greatly affected when the fruiting trees are felled down for extension of roads, power transmission

towers, construction of farm roads and illegal logging (Thongsikem, Poonswad, & Kemp, 2014). Moreover, the collection of non-wood forest product (NWFP), fodder for cattle and handicrafts development poses greater threats to Hornbills in Bhutan (UWICER, 2017). The subsidized timber resources provided by the National Policy encourage people to use more trees for firewood and construction proposes (Datta, 2009).

Mortality due to natural calamities

There are many other factors threatening the habitat and survival of Rufous-necked Hornbill, apart from anthropogenic pressure (Datta, 1998). Landslides during the summer, disease out breaks, accidental forest fires, famines and conditions of the nesting trees are some of the evident catastrophes threatening the life of Hornbills in Bhutan (Dorji, 2013).

Food resource competition

Though their role as seed dispersers are ecologically important, all the seeds dispersed will not generate 100 percent as it depends on various factors such as seed viability, ground substrata, and climatic elements (UWICER, 2017). The age old practice of cattle herding by communities poses threats to Hornbills and reduces food sources as they collect cattle fodder, wild foods for home consumption and commercial purposes, trees felled for handicraft making, NWFP as traditional medicines is considered as better than scientific medicine in Bhutan (Pandit, Manish, & Koh, 2014).

Bhutan has not documented or reported poaching and hunting against Rufous-necked Hornbill although their beaks kept as trophies are found in rural households (UWICER, 2017). Creating employment opportunities from ecotourism through Hornbill conservation, sustainable forest management, alleviation of poverty (Banerjee & Duflo, 2011), and conservation for education and recreational purposes are some of the benefits of presence of Hornbill in residential community (Poonswad P. , 1998).

Conservation Measures

The Constitution of the Royal Kingdom of Bhutan mandates to keep 60 percent forest cover for all times to come (Tobgay, 2015). The national developmental philosophy of Gross National Happiness (GNH) places Conservation of Environment as one of the four pillars (Tella & MacCulloch, 2008). The National Assembly of Bhutan passed the Forest and Nature Conservation Act of Bhutan 1995, where Rufous-necked Hornbill was classified as Schedule I species (totally protected), along with other critically important species (RGoB, 1995). The Forest and Nature Conservation Rules and Regulations, 2017 further made their conservation strong by introducing heavy fines and penalties for defaulters (UWICER, 2017). The forest cover of 71 percent (DoFPS, 2018) is great home for Rufous-necked Hornbill, but will their conservation be as strong as now in near future.

Conclusion

While collecting and the reviewing the scholarly works on Rufous-necked Hornbill thoroughly, I found out that there was not a single paper writing about the poaching and hunting of the species in context of Bhutan. Human-induced interventions such as deforestation, habitat loss and fragmentation, and developmental activities are effecting the population and habitat of Rufous-necked Hornbill. Forest and Nature Conservation Act of Bhutan 1995 and Forest and Nature Conservation Rules and Regulations 2017 kept them under Schedule-I (totally protected) species, but detailed research on its documentation of status, distribution, threats and behavioral ecology of this species is needed. Insufficient data poses major drawback to the management and conservation efforts. Hence, detailed ground level collective evidences on population density, breeding biology, threats, distribution, behavioral ecology and diet composition should be studied to aid in the conserving and maintaining the viable population of Rufous-necked Hornbill.

Way Forward

Separate Hornbill Protection and Management Plan must be incorporated for specific action to conserve and manage the population of Rufous-necked Hornbill and its habitat. Detailed ground level collective evidences on population density, breeding biology, threats, distribution, behavioral ecology and diet composition should be studied to aid in the conserving and maintaining the healthy population of

Rufous-necked Hornbill. Conservation awareness programs for the public and inclusion of importance of Hornbills (and other birds) in syllabus in schools' and colleges' education are vital in making people aware about its vulnerable state. People should also be made aware of the law protecting the ecologically important species and to keep people away from practicing illegal killing. The effect of climate change on Hornbill's habitat and food habit should be studied to aid in conservation of the species. Carrying timely research on Hornbill population is important to determine the impact of economic development and to check their resilient capacity to adapt to the changing climate.

Competing Interests

The author declared that no conflict of interest exists in this work.

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Appendix 1: List of species of fruits on the diet of Rufous-necked Hornbill in Bhutan (all the common languages are from Bhutan)

| Sl.No. | Family | Species | Common Name | Habit | Fruit Type | IUCN Status |
|--------|----------------|------------------------------------|--|--|------------|-------------|
| 1 | Alangiaceae | <i>Alangium alpinum</i> | Domseng (Kheng), Galasune (Nepali) | Small tree | Drupe | LC |
| 2 | Anacardiaceae | <i>Spondias pinnata</i> | Amaroo (Nepali), Amber shing (Sha) | Deciduous tree | Drupe | LC |
| 3 | | <i>Drimycarpus racemosus</i> | Kadarmey (Kheng), Khak Balaiyo (Nepali) | Evergreen tree | Drupe | LC |
| 4 | | <i>Mangifera sylvatica</i> | Chuche Anp (Nepali), Shutale (Kheng) | Evergreen tree | Drupe | LC |
| 5 | | <i>Choerospondias axillaris</i> | Thrungchung shing (Sha), Lapsi (Nepali), Klunmachi (Kheng) | Evergreen tree | Drupe | LC |
| 6 | | Boraginaceae | <i>Ehretia sp.</i> | Jagpaseng (Kheng) | Tree | Berry |
| 7 | Burseraceae | <i>Canarium strictum</i> | Poikar (Dzongkha), Poikarshing (Sha), Gokuldhup (Nepali) | Evergreen tree | Drupe | LC |
| 8 | Elaeocarpaceae | <i>Elaeocarpus lanceifolius</i> | Khasha kokpa (Kheng/ Kurtoed), Khashatarka (Tsamang), Gasha Thung shing (Sha), Bhadrasesy (Nepali) | Evergreen tree | Drupe | LC |
| 9 | Lauraceae | <i>Persea odoratissima</i> | Shjaguli (Kurtoed) | Small tree | Drupe | LC |
| 10 | | <i>Alseodaphne sp.</i> | Bragshing (Saling) | Evergreen tree | Drupe | LC |
| 11 | | <i>Persea sp.</i> | Serkala (Kheng), Guliser (Saling) | Evergreen tree | Drupe | LC |
| 12 | | <i>Phoebe sp.</i> | Chogsengma (Kheng) | Evergreen tree | Drupe | LC |
| 13 | | <i>Parasassafras confertiflora</i> | Shingmar/ Singsii (Sha), Kalo bori (Nepali) | Small tree | Drupe | LC |
| 14 | | <i>Cinnamomum bejolghota</i> | Throkthrokla/ Zapale (Kheng) | Evergreen tree | Drupe | LC |
| 15 | | <i>Cinnamomum glaucescens</i> | Kipchushing (Dzongkha), Kawla/Malagiri (Nepali), Wamchagpa (Kheng) | Shrub | Drupe | DD |
| 16 | | <i>Beilschmiedia villosa</i> | Krupti (Kheng Broksar) | Tree | Drupe | DD |
| 17 | | <i>Beilschmiedia roxburghiana</i> | Thrulo Tarsing (Nepali), Praguli/ Brangkhala (Kheng) | Evergreen | Drupe | DD |
| 18 | | <i>Beilschmiedia clarkei</i> | Sanu Tarsing (Nepali) Brangkhala (Kheng) | Evergreen tree | Drupe | DD |
| 19 | | Flacourtiaceae | <i>Casearia glomerata</i> | Phangla seng (kheng), Barkaunle (Nepali) | Shrub | Capsule |
| 20 | Meliaceae | <i>Aglaia edulis</i> | Yamphai sey (Sha) | Deciduous | Capsule | LC |

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| | | | | tree | e | |
|----|-----------------|-----------------------------------|---|----------------------|---------|----|
| 21 | | <i>Aglaia cucullata</i> | Khwelaiseng (Kheng) | Evergreen tree | capsule | LC |
| 22 | Moraceae | <i>Maclura cochinchinensis</i> | Maidal Kanra (Nepali) | Climbing Shrub | Berry | NE |
| 23 | | <i>Ficus auriculata</i> | Chongma (Sha), Nebaro (Nepali), Khomdhang (Kheng) | Tree | Syconia | NE |
| 24 | Proteaceae | <i>Helicia nilgirica</i> | Potorshing (Sha), Bandre (Nepali) | Small tree | Drupe | LC |
| 25 | Santalaceae | <i>Pyrularia edulis</i> | Amphi (Nepali), Tan li (Chinese) | Small tree | Drupe | LC |
| 26 | Vitaceae | <i>Cyphostemma auriculatum</i> | Zezeymai ruu (Kheng) | Climbing shrub | Berry | - |
| 27 | | <i>Tetrastigma leucostaphylum</i> | Crenpashui (Kheng), Bherseri (Nepali) | Large climbing shrub | Berry | LC |
| 28 | Solanaceae | <i>Cyphomandra betacea</i> | Shing Lambendha (Kurtoed/Kheng) | Small tree | Berry | NE |
| 29 | Rosaceae | <i>Docynia indica</i> | Tong (Dzongkha), Thungkakpa (Sha), Mel (Nepali) | Deciduous tree | Pome | LC |
| 30 | | <i>Fragaria nubicola</i> | Strawberry, Marib (Kheng) | Stoloniferous herb | Berry | LC |
| 31 | Phyllanthaceae | <i>Emblica officinalis</i> | Churu (Dzongkha) Kudth (Kheng), Amala (Nepali) | Deciduous shrub | Capsule | LC |
| 32 | Fagaceae | <i>Castanopsis or Lithocarpus</i> | Shakhoi (Kheng) | - | Acorn | - |
| 33 | Magnoliaceae | <i>Michelia sp.</i> | Kharshing (Kheng) | Evergreen tree | - | LC |
| 34 | Unknown species | <i>Unknown sp.</i> | Nyecloth (Kheng) | Tree | Drupe | - |

Appendix 2: List of species of animals on the diet of Rufous-necked Hornbill in Bhutan (all the common languages are from Bhutan)

| Vertebrate | Invertebrate |
|-------------------|----------------------|
| Animal | Animal |
| Lizards | Caterpillar |
| Rats | Crab |
| Squirrels | Snails |
| Frog | Bettles |
| Snake | Cikada |
| Bird Chick | Wild bees |
| | Chirpine Caterpillar |