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Cover photo Lesser Mouse-tailed Bat (*Rhinopoma hardwickii*) by Aditya Srinivasulu.

‘The devil is in the detail’: Peer-review of the Wildlife Conservation Plan by the Wildlife Institute of India for the Etalin Hydropower Project, Dibang Valley

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ABSTRACT

A group of Indian scientists including botanists, entomologists, ornithologists, mammalogists, herpetologists, aquatic fauna specialists, hydrologists, geographers, and social scientists, many with research experience in northeastern India, including the Dibang Valley in Arunachal Pradesh, have conducted a peer-review of the Technical Report prepared by the Wildlife Institute of India’s (WII) titled ‘Wildlife Conservation Plan for the impact zone of Etalin HEP, Dibang Valley District, Arunachal Pradesh’ (the ‘Report’). The Report was prepared in response to the Forest Advisory Committee’s (FAC) recommendation to conduct “*a multiple seasonal replicate study on biodiversity assessment*” of the 3097 MW Etalin Hydro Electric Project (HEP) in Dibang Valley, Arunachal Pradesh. The review has found that the study was conducted in under five five months from February to June 2018 and cannot be considered as a ‘multiple seasonal replicate’ study as it does not represent three seasons in Arunachal Pradesh. This survey period excludes seasonal migrants and/or crucial breeding times for certain species. Further, fieldwork was conducted in a very small area (‘Zone of Influence’, ZoI) compared with the area that will be directly and indirectly affected by the impacts of

the HEP, with uneven sampling within the limited ZoI. While several groups of taxa were not surveyed, the Report outlines poor detectability for better studied taxa such as birds, without statistically accounting for low detections. Approaches and methods used to analyse field data, and produce results are inadequate, not clearly explained and, often, not scientifically recognised. Commonly-used methods (e.g., species accumulation curves) to analyse and report data on species richness and diversity were not applied to most taxa (except fish). Because of methodological and analytical deficiencies and exclusion of highly diverse taxa such as insects and other arthropods, comparisons with published research from Dibang Valley shows that the Report under-reports hundreds of species of butterflies and other insect groups and birds, and tens of species of orchids, mammals, and herpetofauna. The Report's species checklists contain repetitions, improper taxonomic classifications, and incorrect distributions, including 12 butterfly species not known to occur in northeastern India and a bat species found only in Africa.

Despite short surveys conducted using biased sampling methods, the Report provides direct evidence of 230 bird, 159 butterfly, 112 spider, 51 moth, 31 reptile, 14 amphibian, and 21 mammal species. Amongst these are several endemic (e.g., seven species of birds), range-restricted (e.g., six bird and three butterfly species), and threatened (e.g., eight mammal species) species, many of which are included in Schedule I of the Wild Life (Protection) Act, 1972. However, the Report ignores its own findings to outline mitigatory measures for some taxa while observing that "it was not possible to suggest any threatened species and habitat specific conservation plan" for others (e.g., mammals). Firstly, it is not clear how the FAC's singular mandate of conducting a study on '*biodiversity assessment*' was converted into a Wildlife Conservation Plan. Secondly, the few mitigatory measures recommended for some specific faunal groups in the form of butterfly, reptile parks, and nest boxes cannot be considered as well-designed ecologically meaningful measures. There appears to be an underplay of the negative impacts of the HEP throughout the Report. The section that relates to assessing socio-cultural impacts of the HEP suggests mitigation measures that lack a nuanced understanding of socio-cultural dynamics and interdependencies between people and the natural environment.

Overall, the Report assumes the project as *fait accompli* implying that the Report's findings have no bearing on the FAC's decision to approve the project, ultimately making this exercise appear futile. Crucially, studies that inform high-level decision-making on historically significant projects, such as the Etalin HEP (which would be one the largest hydropower projects in the country), must go through a transparent and scientifically recognised peer-reviewed process given the pitfalls, numerous discrepancies, and gaps highlighted in this review. Such decisions have irreversible impacts on lives, livelihoods, and the environment.

INTRODUCTION AND BACKGROUND

On 28 February 2017, the Forest Advisory Committee (hereafter FAC) met to discuss the 3097 MW Etalin Hydropower Project (hereafter HEP, or 'the project') to be developed by Jindal Power Limited (hereafter User Agency) in Dibang Valley District. In the minutes that were released later (F.NO. 8- 20/2014-FC), the FAC found the Environmental Impact Assessment (EIA) submitted by the User Agency "inadequate" and recommended that a "***multiple seasonal replicate study on biodiversity assessment***" of the 3097 MW Etalin HEP in Dibang Valley District be conducted by "an internationally credible institute". The Wildlife Institute of India (hereafter WII), Dehradun, was chosen to conduct the said study (vide letter no. FOR-279/CONS/2010/Vol-I/ 836-40, 23 June 2017 from APCCF and Nodal Officer (FCA), Arunachal Pradesh). In 2019, the WII

produced an extensive Technical Report (TR No/2019/01, hereafter 'the Report') titled 'Wildlife Conservation Plan for the impact zone of Etalin HEP, Dibang Valley District, Arunachal Pradesh'. The Report assesses the status of various taxonomic groups including mammals, avifauna, entomofauna, herpetofauna, and flora in the HEP site. It also documents the biodiversity value for and the natural resource dependence of the local Idu Mishmi people in the project site. Finally, it evaluates the impacts of the proposed project on the aforementioned taxa and natural resource needs of the local people and drafts a mitigation and conservation plan along with a financial budget for its implementation.

A group of Indian scientists, including botanists, entomologists, ornithologists, mammalogists, herpetologists, aquatic fauna specialists, geographers, hydrologists, and social scientists, many of whom have multiple years of research experience in northeastern India, including the Dibang Valley in Arunachal Pradesh have conducted a peer review of the Report. Overall, the review encountered considerable deficiencies and scientific biases in the Report which have compromised the quality and the veracity of its findings and conclusions. Before proceeding to an in-depth taxon-wise review, below are some key general observations:

(1) The FAC recommended a "*multiple seasonal replicate study on biodiversity assessment*". The entire study however appears to have been conducted over a short period from February 2018 to June 2018, which is under five months. February and March have been taken as winter/pre-monsoon and April to June as summer/monsoon. These do not represent seasonal patterns in Arunachal which has at least three seasons with distinct rainfall and weather regimes: (a) October–February: relatively dry season/winter; (b) March–April: pre-monsoon; and (c) May–September: summer/monsoon. The entire period from June/July to January was not sampled leading to a loss of important biological information, including on the region's many seasonal bird migrants. Additionally, multiple replicate sampling within seasonal periods was not conducted. Therefore, this cannot be considered a 'multiple seasonal replicate' study.

(2) The Report focuses its assessment within an area (112km^2) in the immediate vicinity of the project site, called the 'Zone of Influence' (hereafter ZoI), and defines it as the farthest influence of the HEP (page 35). It briefly mentions the impact sources that were taken into consideration while delineating the ZoI, pointing to 'section 4.3' for a detailed methodology used for the delineation (page 35). This section however does not exist, making it impossible to assess whether the ZoI adequately covers all the areas that will experience the direct and indirect impacts of the multiple components of the project. The project has over 50 components which include two large concrete gravity dams, diversion tunnels, penstock pipes, an underground powerhouse, a road network of over 50km, and four new bridges. The construction phase of the project will involve extensive mining, quarrying, slope undercutting, and muck disposal, including the disposal of hazardous waste (page 201). Crucially, nowhere does the Report mention whether the areas that will see the impacts of power evacuation infrastructure were integrated into the ZoI. Without a detailed description of all of the factors that were considered in the delineation of the ZoI, it cannot be ascertained whether the Report has assessed the true impacts of the project.

(3) The Report is a Wildlife Conservation Plan with the final chapter (Chapter 7) dedicated to mitigation and conservation measures. It is not clear on what basis the FAC's singular mandate of '*biodiversity assessment*' was converted into a Wildlife Conservation Plan.

(4) The Report does not refer to recent and relevant peer-reviewed work on social, ecological, physical, and geomorphological

aspects of the study region, instead relying on limited and often outdated material. The sections below highlight some of the crucial literature that should have been perused.

(5) Several groups of taxa were not surveyed, including numerous insect orders and other taxa such as crustaceans (crabs and shrimps), molluscs (snails), and protozoans despite evidence of high levels of diversity and endemism in the Dibang River basin (See Appendix I for a checklist of protozoans and Appendix II for a checklist of insects and crustaceans reported from the Dibang River basin in previous studies).

(6) Throughout, but particularly in Chapters 6 and 7, the Report segregates the impacts of the project neatly between 'Physical', 'Biological', and 'Social' components. Such a categorization represents a highly narrow, misinformed, and flawed understanding of the interconnections between physical, biological, and social processes. In developing this schema, where the assumption is that the construction of many components of the HEP will only have biological but no knock-on social impacts (see impact matrix in Table 6.1), the Report seems to have ignored vast and widely-popular multi-decadal literature on the interconnections between social and ecological systems (SES) (e.g., Adger 2000; Young et al. 2006). If changes in ecology indeed have no knock-on impacts on people's social lives, then how does the Report envisage explaining the devastating social, cultural, and economic impacts of decidedly natural/ecological phenomena such as climate change, locust infestations, and zoonotic diseases such as the ongoing COVID-19, to name a few?

(7) Even in the short survey conducted using biased sampling methods within a limited study area, the Report provides clear evidence for the existence of rich biodiversity. While many more species previously recorded from the study area have been omitted (see taxa-specific sections below), it nonetheless collected direct evidence of 230 bird, 159 butterfly, 112 spider, 51 moth, 31 reptile, 14 amphibian, 21 mammal species, and 11 odonate species. Amongst these, they found several species that are endemic (e.g., seven species of birds), range-restricted (e.g., six bird and three butterfly species), and threatened (e.g., eight mammal species), many of which are included in Schedule I of the Indian Wild Life (Protection) Act, 1972 (IWPA), affording them the highest degree of protection. The Report makes numerous statements that highlight the species richness and diversity of the region repeatedly stressing that it is critical to preserve these sites (e.g., "The presence of Rare, Endangered or Threatened [RET] or species of conservation significance along both the rivers, shows the importance of the habitat and plant species at each project activity site/impact zone for these species. Disturbance of any sort will lead to disappearance of that species..." page 82). Yet, and ironically, it deliberately ignores these findings to outline mitigation measures for some taxa (e.g., butterfly parks, nest boxes, etc.) while observing that "it was not possible to suggest any threatened species and habitat specific conservation plan" for others (e.g., mammals).

(8) At various points, the Report states that species and habitat specific conservation plans are not possible due to species diversity and their diverse dietary and foraging patterns, yet recommendations are still made for butterfly parks, reptile parks, and habitat restoration that clearly will not replace the loss of natural habitat and address the direct impacts on species. While the appropriateness and viability of these mitigative measures are assessed in greater detail in the taxon-specific sections, this process assumes the project as *fait accompli* implying that the Report's findings have no bearing on the FAC's decision to approve the project, ultimately making this exercise appear futile.

The main text of this review is divided into nine sections, each corresponding to a specific focal area of the Report. It begins with a critique of

the criteria used to delineate the HEP's area of impact ('Zone of Influence') and the analytical framework of the Report. Section 2 evaluates the geospatial analyses used to classify vegetation types. Due to limited research on Dibang Valley's botanical diversity, Section 3 offers a limited critique of the Report's assessment of the study area's flora. This is followed by six sections, each presenting a thorough review of field data collection and analytical methodology, suitability and accuracy of the findings, and validity of the conclusions for the specific taxon assessed in the Report. While a detailed social science critique of the methodology and results of the socio-cultural surveys is outside the scope of this review, the last section offers a broad response to the Report's findings on socio-cultural value of biodiversity. The review concludes with critical reflections on the reliability of the Report's findings to inform decision-making given the issues identified in prior sections.

Large projects such as the Etalin HEP are multifaceted issues that require attention to many different, yet interrelated, aspects including, but not limited to, socio-cultural realities, political and economic viability, engineering design, the natural environment, and local needs and perspectives. Decision-making on such historically significant projects is, therefore, unarguably complex. This review underscores the importance of paying attention to scientific processes, findings, and realities, which should be integral to informing any projects of this scale.

SECTION 1: REVIEW OF ZONE OF INFLUENCE AND ANALYTICAL FRAMEWORK

A detailed analysis of the process of delineation of the study area (the 'Zone of Influence') for biodiversity assessment, field sampling methodology and data analysis framework applied across all floral-faunal groups (Chapters 4 and 5) shows significant gaps raising serious doubts over the reliability of the Report's findings on biodiversity richness and the HEP's expected impacts. Furthermore, nowhere are the links between topography, habitat, biodiversity, phylogenetic distinctiveness, local people's priorities and potential impacts clearly established. These links are critical to ascertain which habitats and community land-use will be at high risk from landslides or erosion due to project related activities and which of these high-risk areas are occupied by endangered flora and fauna. Thus, the lack of a robust holistic scientific framework risks downplaying the potential threats of the HEP to the region's ecology, hydrology, and people. Specific comments are as follows:

Impacts of HEP extend beyond the Zone of Influence

Notwithstanding the lack of details on how the boundaries of the ZoI were chosen, the delineated zone of 112 grids (1×1 km each) does not consider areas upstream and downstream of the dams that will be severely altered due to storage of sediments and changes in flow regimes. In addition, effective management of debris is extremely important as waste from an affected site may end up in an unaffected site thus extending the ZoI.

Even within the limited ZoI, the Biodiversity Conservation Plan does not account for the expected damage to downstream river sections by the construction of over 50km of new roads and widening of an additional 30km of existing roads. The true ZoI due to road construction, quarrying, and debris dumping is likely to be much larger because of the extensive slopes on either side of the steep river valley, and their very-high susceptibility to landslides. Neither does it include the impacts of heavy blasting for subsurface tunnel construction that will be experienced over a much larger area and may trigger additional landslides. The landslide susceptibility of the region was not considered despite a global landslide susceptibility map developed by NASA, available at no charge (see Stanley & Kirschbaum 2017) (page 183). The Report fails to cite previous studies globally and in Dibang Valley on the detrimental

effects of landslides on forests, rivers, people, and biodiversity (Sassa & Canuti 2009; Athreya & Sheth 2016). The areas proposed for land acquisition have "high" and "very high" susceptibility to landslides according to the aforementioned global map (Stanley & Kirschbaum 2017). This is evident from satellite images acquired before and after 2018 showing several recent landslides due to ongoing highway construction and extreme precipitation events.

Finally, the Dibang Valley lies in the Zone-V of the earthquake hazard zone making it highly prone to earthquakes and its associated impacts. Given the factors discussed here, the ZoI, thus, appears greatly under-defined and not based on a careful consideration of topographical, hydrological, anthropogenic, and geological factors known to impact mountain ecosystems. Consequently, the Report undermines the severity of risks entailed in carrying out large-scale infrastructure projects in fragile landscapes and does not present a holistic perspective of how the HEP's impacts on biodiversity could eventually impact human well-being.

ZoI not surveyed effectively

Even within the under-defined ZoI, the sampling was inadequate. The Report states that the elevation range within the ZoI is 540–2,327 m (page 69); however, the sampling for all taxonomic groups was restricted to a very narrow range of 600–1,500 m (pages 24, 31, 176). This has excluded many species that occur within the ZoI and may be impacted by the project.

Moreover, and as highlighted in previous sections, the study neither sampled across the three seasons observed in Arunachal, nor conducted multiple replicates within each season. Consequently, many species of mammals, fish, birds, herpetofauna, and entomofauna that undertake seasonal altitudinal migrations in the Himalaya, using different elevations and habitats at different times of the year (Katuwal et al. 2016; Srivastava & Kumar 2018; also see taxa-specific sections for further details) would not have been detected and have been effectively excluded from the Report.

Furthermore, in mountainous habitats, species richness peaks at different elevations for different taxa, highlighting the importance of surveying a wide elevational range. These are well established ecological principles (Colwell & Lees 2000; McCain & Grytnes 2010). Yet, the study does not sample across different elevations to ascertain species richness-elevation relationships. Prior work in Eastern Himalaya has shown that species richness increases with elevation in certain taxa (Marathe et al. 2020; C. Sheth 2020 pers. comm.), while peaking at mid-elevations for others (Acharya et al. 2011).

In the same vein, Roy et al. (2018) surveyed an elevation range of 200–3,500 m in the Dibang River basin documenting 38 amphibian species, 36 of which were found at 800–1,500 m, the elevation range where the proposed HEP and associated infrastructure will be located. Long-term amphibian studies in western Arunachal also show this mid-elevation zone to contain the highest number of species (Athreya & Sheth 2016). Further, the mid-elevation peak in species richness observed in the Eastern Himalaya also suggests that these regions act as important biogeographic transition zones, where taxa from different biogeographic regions overlap (Kreft & Jetz 2013). The lack of sampling across multiple elevations in the ZoI may have likely underestimated the biodiversity value, evolutionary importance, and impact assessment of the HEP in the study area.

Inadequate sampling, yet Dibang Valley is rich

The overall biodiversity of the area is several orders of magnitude larger than has been reported (see below) since the study does not appear to have taken microhabitats into account. A grid size of 1×1 km may not be

appropriate for all taxa and the Report gives no justification for such a study design. Smaller taxa need to be sampled for richness at a much finer spatial scale that adequately samples all habitats, micro-habitats, elevations, and stream orders. A nested survey design may be best to survey multiple taxa.

Species accumulation curves are standard practice in biodiversity assessments as they provide an estimate of the total species richness as a function of area and time, and indicate the adequacy of a survey in representing the fauna of a particular area. Apart from fish, the Report does not present species accumulation curves for other taxa (page 62). The study also focuses on largely diurnal species (except for mammals). The sampled grids for all taxa (approximately 17 grids for plants, 26 for fish, 32 for mammals, 43 for entomofauna, 59 for birds were sampled out of 112) were restricted to areas that are accessible (along Etalin-Anini and Etalin-Maliney road), disturbed and designated for land acquisition. Given Dibang's challenging mountainous terrain, sampling may not be possible everywhere; however, this drawback was not accounted for statistically or acknowledged in the report. Thus, species richness is expected to be high for sampled grids and low for unsampled grids (page 53). Despite these statistical flaws and deficiencies in sampling strategy, coupled with a less-than-ideal sampling season, the Report finds endemic and RET species even in ecologically disturbed areas such as roads, contradicting its claim that the impact potential in undisturbed areas would be low (Map 6.1; page 148).

The approach used to assess biodiversity values and score the HEP's impacts on biodiversity is not based on any of the scientifically published methods (pages 53–57). The various threshold values and weights used are not properly explained and appear to have been selected in an ad-hoc manner. Importantly, within the ZoI, the grids that were not surveyed were assigned no biodiversity values. Yet, the potential impact of the HEP on those grids was judged to be "low" (page 148). This approach is lacks scientific rationale.

SECTION 2: REVIEW OF GEOSPATIAL DATABASE

The geo-spatial database has several methodological shortcomings with respect to the quality of satellite imagery and the image classification process. Importantly, the land-use land-cover data have not been integrated with datasets on biodiversity richness, geohazards, and topography to comprehensively understand interlinkages between landscape drivers, biodiversity richness, and potential impacts of the HEP. Specific issues with geo-spatial analyses in the Report are detailed below:

Satellite image analysis and interpretation

- While the Report does not explicitly state how many bands are used for land-use land-cover classification, it appears that only two bands (out of 9 medium-resolution bands) of Sentinel-2 and two bands (out of 9 medium-resolution bands) of Landsat 8 were used (page 63). This is important because the image-classification accuracy tends to improve as more bands are used (Forkuor et al. 2018). Further, the images are only from the post-monsoon season when the sun-angle is low creating larger shadows which can obscure many slopes (Cingolani et al. 2004). These shadows reduce the effective area that can be classified.

- The Report does not clarify how different land-use and land-cover categories are defined (e.g., what was the basis of defining a particular habitat as evergreen forest vs. secondary growth). Distinguishing between primary evergreen and/or secondary forest is difficult in Arunachal, and even more so in the post-monsoon season, especially without a robust ground-truth sampling design. While the Report states that ground- truthing data were collected, no

statistics, including the number of pixels for each land cover category, are presented for scrutiny (page 60).

• The NDVI/MSAVI indices used in the Report are not ideal for image classification when used on their own as they simply provide an index of vegetative biomass (Jackson & Huete 1991). For areas with high vegetation biomass, the more sensitive enhanced vegetation index (EVI) is recommended. Further, the recommended best practices for land-use and land-cover classification are to provide a statistical measure of the performance of classification models (Olofsson et al. 2014). However, the Report does not provide any details or statistics (e.g., confusion matrix, commission-omission errors) to allow the accuracy of the classified imagery to be assessed.

• Due to its narrow focus on the individual components of biodiversity, the Report fails to look at the impact of the proposed activities on the ecosystem processes that sustain high-levels of biodiversity. Further, it misses the opportunity to utilise various freely available gridded climatic data products (precipitation, temperature, etc.) to further explore the nature of interlinkages between climate and biodiversity in the region and how such a mega-project may exacerbate the potential impacts of warming, precipitation changes, phenological shifts, and increase in extreme events on the region's floral and faunal diversity.

SECTION 3: REVIEW OF FLORA

Due to limited long-term multi-sited botanical research in Arunachal Pradesh, and particularly in Dibang Valley, this peer review does not present an exhaustive review of the floral sections of the Report, including proposed mitigatory measures and compensatory afforestation. In this section, only a few key concerns have been highlighted.

Despite limited long-term botanical research in Arunachal Pradesh, the state is known to host an outstanding floral diversity (Rao & Hajra 1986). Dibang Valley hosts several endemic plants, many of which are new to science and have been recorded from within the ZoI. Following are some noteworthy plants recorded in Dibang Valley:

1. New species of *Impatiens* (commonly known as Balsams) such as *Impatiens ashihoi, Impatiens albopetala, Impatiens dibangensis*, and others (Gogoi & Borah 2015, 2016).

2. Araceae members (Aroids) such as *Arisaema gracilentum, Colocasia dibangensis*, and several others have been described as new to science, distribution and status of which are yet to be studied properly (Gogoi & Borah 2013; Bruggeman 2016).

3. *Sapria himalayana*, called 'a floral wonder', has also been recorded from Dibang Valley (Hohl & Sebastian 2014).

4. Members of the family Gesneriaceae are found in great diversity in Dibang Valley including many with a high ornamental value. The Report mentions *Henckelia mishmiensis* (*Chirita mishmiensis*) which is a Dibang Valley endemic that only grows in a specific niche.

Incomplete documentation of floral wealth

A mere 1.19% of the ZoI was sampled for its floral diversity. The ZoI has 112 grids (1x1 km), of which 133 vegetation plots of 10 x 10 m were sampled. Yet, even with such limited sampling, the Report mentions that 398 plant species belonging to 106 families and 286 genera were encountered indicating very high floral diversity. However, even this is likely to be an underestimate based on the findings of previous studies (e.g., Liden & Adhikari 2019) that have reported numerous new records for India from the high elevation areas of Dibang Valley. In particular, the tree diversity estimate

mentioned in the Report seems low when compared to tropical and subtropical forests from other studies within Arunachal Pradesh and in neighbouring states (Borah & Garkoti 2011; Dutta & Devi 2013a,b; Sarkar & Devi 2014; Borah et al. 2016; Saikia & Khan 2016; Bora & Bhattacharyya 2017; Borogayary et al. 2017; Barua et al. 2018). Since Dibang Valley is a hotspot for discovery of new plant species, the herbarium species collected during fieldwork should be re-examined (assuming they have been retained) as many of these unidentified specimens could turn out to be new to science. Much of this identified and yet-to-be-identified botanical diversity could be at risk from the proposed HEP and the Report does not do an adequate job of identifying these potential impacts.

Endemic orchid diversity not adequately sampled

The Report similarly underestimates orchid diversity identifying only 35 species in the ZoI. All of the recorded orchids are common species and a comprehensive survey with taxonomic expertise will reveal more species, including those that are rare and endemic. Existing studies have already documented 117 species of orchids belonging to 44 genera from Dibang Valley. Among these, 86 species are epiphytes, three are epiphytic as well as terrestrial, and 31 species are terrestrial including four saprophytes (Bhaumik & Pathak 2010). More recent surveys have reported up to 200 species with the highest diversity found in low-to-mid elevations areas, similar to the ZoI (Gogoi 2020 pers. comm.).

Under-reporting ethnomedicinal knowledge

The Report records only nine species of medicinal plants used in the area (Table 5.54). However, prior research has established that the Idu Mishmi have a vast knowledge of medicinal plants and use them regularly for a variety of ailments. Haridasan et al. (1995), reported more than 500 species of medicinal plants from Arunachal Pradesh. Although ethnobotanical studies have been scarce in the Dibang Valley, recent work has found 36 species in Lower Dibang Valley (Tangjan et al. 2011), more than 80 species between the two Dibang districts (Shankar & Rawat 2008) and 55 species within the Dihang Dibang Biosphere Reserve (Ghosh et al. 2014) used as medicinal plants.

SECTION 4: REVIEW OF ENTOMOFAUNA

Nearly 80 percent of the world's species are insects. Recent reports of decline in insect populations worldwide have raised alarms (Hallmann et al. 2017; Leather 2018; Sánchez-Bayo & Wyckhuys 2019), not least because insects provide crucial pollination services (Bartomeus et al. 2014). Arunachal Pradesh supports a rich diversity of bees with about 49 species recorded to date in limited surveys. These include the genus *Ceratina,* the family Megachilidae, and 13 other bee species recently recorded for the first time from Arunachal Pradesh (Saini et al. 2018). Very limited work exists on the honeybees of Dibang Valley and no comprehensive research has been done on the numerous other wild bee species of the district. So far only *Apis laboriosa*, *Apis dorsata*, and *Apis cerana* have been recorded from Dibang Valley (Gogoi et al. 2018).

Members of the order Lepidoptera, which includes butterflies and moths, are another diverse group of significant pollinators, second only to bees. The Lepidoptera, too, have experienced sharp population declines worldwide (Fox 2013; van Langevelde et al. 2018; Thogmartin et al. 2017). Beyond being a key pollinator, this insect group is also a significant bio-indicator of climate change, deforestation, and habitat degradation. Lepidopterans are also prey for birds, mammals, and reptiles, while their larvae are mostly plant herbivores. Finally, due to a paucity of long-term multi-sited research across Arunachal Pradesh, experts believe that numerous butterfly and moth species new to science are yet to be described from this landscape.

Dibang Valley as an important area for endemic and rare entomofauna

Three-hundred-and-eighty-one species of butterflies have been reported from Dibang Valley in the last 10 years (Appendix III). Many subspecies of butterflies occurring in southeastern Tibet and Yunnan also occur up to Dibang Valley (for example, the nominotypical subspecies of Chocolate Tiger *Danaus* [*Parantica*] *melaneus melaneus* butterfly is distributed in southeastern Tibet, Yunnan, and Dibang Valley).

The Brahmaputra River basin has been a barrier to the dispersal of many butterfly species resulting in high rates of endemism and speciation in Dibang Valley. For example, the Dibang Valley endemic Roy's Argus *Callerebia dibangensis* was only described seven years ago (Roy 2013), while many hairstreaks, rings, skipper butterflies, etc in the region are yet to be described. This rich diversity of butterflies and their colourful unique patterns (like the Northern Jungle Queen) have found a place in Mishmi lives and some of their traditional weaving patterns are inspired from butterflies (Elwin 1959). Some other range-restricted butterflies of Dibang Valley include False Tibetan Cupid *Tongeia pseudozuthus*, Chinese Silverline *Spindasis zhengweilie*, Khaki Silverline *Spindasis rukmini*, Evans Silverline *Spindasis evansii*, Tiger-mimic Admiral *Limenitis rileyi*, Mottled Argus *Callerebia narasingha*, Tibetan Brimstone *Gonepteryx amintha thibetana*, Grey Commodore *Bhagadatta austenia purpurascens*, Abor Freak *Calinaga aborica* (see Appendix III for an updated butterfly checklist for Dibang Valley).

All of these species, including endemics such as *Callerebia dibangensis*, occur in the elevation range of Etalin HEP raising serious concerns of the project's impact on their survival. Concerns and deficiencies in the entomofaunal assessment of the Report are detailed below with a specific emphasis on lepidopterans.

Threatened and endemic species missed in ZoI

The Report's account (159 species of butterflies, 51 species of moths, and 11 species of odonates) is low and may not be a true representation of the study area's species richness. Many threatened and endemic entomofauna, known to occur within the ZoI, have not been reported (see Appendix III). Some insect groups including bees, wasps, ants, and sawflies (Hymenoptera), flies (Diptera), cicada (Hemiptera), beetles (Coleoptera), and grasshoppers and crickets (Orthoptera), were not studied at all. Many of these unassessed groups are some of the planet's most diverse insect groups. For example, beetles alone constitute 25% of all known animal life-forms on the planet. Further, many species mentioned in the Report have been erroneously assigned to different taxonomic categories. Despite this, recording more than 200 entomofauna species with a limited sampling period and effort, underscores the immense evolutionary and ecological wealth, which is a serious underestimation of diversity of the area. Our specific comments are as follows:

- **Butterflies:** 381 species of butterflies have been reported from Dibang Valley in the last 10 years based on primary and secondary data (Gogoi 2020, unpublished data.), while up to 500 species are believed to exist in the region. However, the Report mentions a mere 159 species from the project site. The riparian habitat within the ZoI is likely to have around 290–300 butterfly species based: (1) a 4-month survey in a similar habitat in Lower Dibang Valley that recorded 294 species (Gogoi 2012); (2) surveys in comparable habitats in other parts of Arunachal Pradesh where up to 700 species have been recorded (Sanjay Sondhi, pers. comm, unpublished report).

- **Macro-invertebrates:** Benthic macro-invertebrates are considered one of the most important bioindicator groups for freshwater

ecosystems. Freshwater macro-invertebrate orders such as Ephemeroptera are poorly known from northeastern India as indicated by recently published new records and new species descriptions from Arunachal Pradesh (Chellappa et al. 2018; Vasanth et al. 2020). The Report poorly studies these key taxa identifying them up to family level only. Further, each family is assumed to compose of a single taxon (Tables 5.48 and 5.49). This is a gross underrepresentation of the actual diversity, as each family contains several species. Using family-level as opposed to species-level data, the richness of Ephemeroptera, Plecoptera, Tricoptera (EPT) taxa has been plotted in Figures 5.1 and 5.2 erroneously, obtaining a very low number (7–8) of species in all sites.

• **Odonata:** The Report states that 11 odonate species occur in the ZoI's riparian habitat. This is an extremely low number given that other studies, even from urban areas have reported many more species. More than 60–70 species are expected to be found in the Etalin area with adequate sampling and correct identification (A. Payra 2020 pers. comm.). The Report records only two damselflies, which is a significant underestimate for Dibang Valley. Even common species observed at virtually all water bodies across India, including across Dibang Valley such as *Ischnura rubilio, Ceriagrion coromandelianum, Calicnemia miles*, and *Pseudagrion rubriceps*, have not been included, indicating inadequate sampling. A species new to India, *Echo perornata* recently reported from Hunli-Anini road in Dibang Valley (Gogoi & Payra 2019), does not make it into the Report as well. As for dragonflies, eight families are known to occur in India (Subramanian & Babu 2017), all of which are found in Arunachal Pradesh. However, only the most common family Libellulidae is reported. The dragonfly family Gomphidae and damselfly family Lestidae are incorrectly reported with benthic invertebrates (pages 123–124) and not in the odonates species list (page 255).

• **Moths:** The report's account of 51 moth species is an extremely low number for this group. Three-hundred-and-fifty-six species of moths were recorded from Dihang-Dibang Biosphere Reserve, of which Dibang Valley is a part, by the ZSI in 2019, including 24 species that were reported from mainland India for the first time (NMHS-Fellowship Annual Progress Report 2020). Additionally, two new species *Mustilizans zolotuhini* (Chandra et al., 2019), and *Nerice* (*Nerice*) *mishmiensis* (Mazumder et al., 2020) were described from Dibang Valley recently. In other similar habitats, such as in Eaglenest and Talle Valley wildlife sanctuaries (WS), the list of identified moth species exceeds 400 (S. Sondhi, unpublished report), with at least a similar number of additional species that are believed to be recorded if long term surveys are conducted. Many species in this habitat type and elevation are yet to be discovered. For example, in 2017, the Apatani Glory *Elcysma ziroensis*, a species new to science was described from Talle Valley WS (Chada et al. 2017). It remains the only known location in the world that this species is known from. Similar moth diversity can be expected from the ZoI.

The Report has ignored the evaluation of butterflies and other entomofauna using their criteria of 'Rare Endangered and other Threatened' species (RET). For example, Himalayan Mottled Argus *Callerebia narasingha narasingha* (Moore, 1857), included in the report's butterfly checklist, is endemic to Eastern Himalaya and would qualify as an RET species. Similarly, a Dibang Valley endemic - Roy's Argus *Callerebia dibangensis* - likely to occur in Etalin given the elevation range, has not been assessed.

The review of secondary literature has omitted important references. Some notable published omissions include several populations of range-restricted butterflies such as the False Tibetan Cupid *Tongeia pseudozuthus* known to occur between Hunli-Anini, Tibetan Brimstone

Gonepteryx amintha thibetana reported from Dri valley and Roing-Anini road (Sondhi & Roy 2013; Das & Gogoi 2020 pers. comm.), and the Blue Posy *Drupadia scaeva cyara*, which was rediscovered for the first time in India from the area around Etalin (Das et al. 2018). None of these important references have been included, effectively downplaying the potential impacts of the HEP to these extremely rare and endemic species (page 194).

Ineffective mitigation plans

The Report has indicated that four to five 'Open Butterfly Parks' will be set up as part of a Species Group Conservation Plan to attract a portion of the 159 species of butterflies identified. However, the host plants of these threatened and endemic butterflies are still unknown, questioning the viability of such measures. Of the 159 butterfly species mentioned in the Report, the feeding plants of only 23 species and the host plants of 13 of the most common species have been provided. Baseline data on larval host plants for many of Dibang's endemic and range-restricted species, such as *Callerebia dibangensis*, are still missing. The purpose of a butterfly park will be defeated if the only known habitat and host plants for these endemics are lost. In any case, the establishment of a butterfly park cannot compensate for the direct loss of the habitat/ microhabitats of butterflies and the consequent impacts on their population, persistence, and survival. It also does not suggest mitigation strategies for any other entomofauna groups that were assessed.

The Report highlights the common dragonfly Wandering Glider *Pantala flavescens* as "specific species of conservation interest in the Etalin HEP study area" (page 87). This is one of the most common species across India and much of Asia, and is therefore not of conservation interest by any accepted standards such as the IUCN Red List (Status of *P. flavescens* is Least Concern). Wandering Glider *Pantala flavescens* breeds in stagnant pools and does not require creation of special habitats. Moreover, these mitigatory measures suggested for common species do not provide adequate solutions for rare damselflies like *Echo perornata*, which are forest dwelling species requiring fast-flowing streams for reproduction and survival. Damselflies such as *Calicnemia miniata* (recorded in the Report, IUCN Status: not evaluated) require streams with riparian and aquatic vegetation to breed, the report fails to mention mitigation measures for such species, which are sensitive to changes in habitat and will be adversely affected by the HEP.

Additional errors in entomofauna sections

There were several errors in the report. Twelve species of butterflies mentioned in the checklist are not distributed in northeastern India at all. Some other species in the checklist are doubtful as their presence in Arunachal Pradesh is unlikely and has not been confirmed. Additionally, some of the subspecies mentioned in the butterfly checklist are not distributed in the Dibang Valley (e.g., subspecies like *Parantica melaneus plataniston, Celastrina argiolus kollari, Dodona ouida phlegra*, etc.). Further, the butterfly checklist has numerous errors in assigning correct family names, while one species has been repeated twice with different generic combinations.

These details are mentioned below:

- The extremely rare Scarce Jester *Symbrenthia silana* is mentioned in the Report as Scarce Jester '*Symbrenthia silana de*' (page 172). Firstly, the 'de' should have been 'de Niceville', the author of the species. Secondly, the species is endemic to Eastern Himalaya, which has not been highlighted, which would make it an RET species.

- *Faulty distribution*: A total of 12 species of butterflies mentioned in the report's checklist do not occur in northeastern India at all. Most are distributed in the western Himalaya or peninsular India (Gasse 2013).

These species are:

1. *Heliophorus oda* (Hewitson, 1865) Eastern Blue Sapphire
2. *Curetis thetis* (Drury, 1773) Indian Sunbeam
3. *Lycaena phlaeas* Small Copper
4. *Euploea crameri nicevillei* Spotted Black Crow
5. *Euploea tulliolus* Dwarf Crow
6. *Ypthima asterope mahratta* (Moore, 1884) Common Three-ring
7. *Ypthima sakra sakra* (Moore, 1857) Himalayan Five-ring (*parasakra* occurs in northeastern India)
8. *Dodona durga durga* (Kollar,1844) Common Punch
9. *Papilio crino* (Fabricius, 1793) Common Banded Peacock
10. *Pareronia hippia* (Fabricius, 1793), Common Wanderer
11. *Pareronia* sp. Dark Wanderer
12. *Pieris rapae meleager* (Hemming, 1934) Small Cabbage White

• The following species reported as occurring in Dibang Valley are doubtful:

1. *Taractrocera maevius* Common Grass Dart
2. *Graphium megarus megarus* (Westwood, 1844) Assam Spotted Zebra
3. *Gonepteryx rhamni nepalensis* (Doubleday, 1847) Himalayan Brimstone
4. *Charaxes moori* (Distant, 1883) Malayan Nawab
5. *Heliophorus moorei tytleri* (Riley, 1929) Naga Azure Sapphire

• The following species reported as occurring in elevation range of the ZoI are doubtful:

1. *Delias descombesi* (Boisduval, 1836) Red-spot Jezebel
2. *Delias hyparete* (Linnaeus, 1758) Painted Jezebel
3. *Catopsilia pomona* (Fabricius, 1775) Common Emigrant
4. *Catopsilia pyranthe* (Linnaeus, 1758) Mottled Emigrant
6. *Papilio polytes* (Linnaeus, 1758) Common Mormon
7. *Eupolea core* (Cramer, 1780) Common Crow
8. *Hasora chromus* (Cramer, 1780) Common Banded Awl

• The following species are wrongly placed under the family Papilionidae, they should be under the family Pieridae

1. *Appias lalage lalage* (Doubleday, 1842) Spot Puffin
2. *Colias fieldii fieldii* (Menetries, 1855) Dark Clouded Yellow
3. *Gandaca harina assamica* (Moore, 1906) Tree Yellow
4. *Gonepteryx rhamni nepalensis* (Doubleday, 1847) Himalayan Brimstone

• The following species are wrongly placed under the family Pieridae; they should be under the family Riodinidae

1. *Abisara neophron neophron* (Hewitson, 1861) Tailed Judy
2. *Dodona adonira adonira* (Hewitson, 1865) Striped Punch
3. *Dodona dipoea dipoea* (Hewitson, 1865) Lesser Punch

• The following species are wrongly placed under the family Nymphalidae; they should be under the family Papilionidae

1. *Papilio helenus helenus* (Linnaeus, 1758) Red Helen
2. *Papilio paris paris* (Linnaeus, 1758) Paris Peacock
3. *Papilio polytes romulus* (Cramer, 1775) Common Mormon

• Two species mentioned are synonyms of each other and should not be listed separately. *Precis iphita* is a junior synonym of *Junonia iphita*

1. *Junonia iphita iphita* (Cramer, 1779) Chocolate Pansy
2. *Precis iphita iphita* Chocolate Soldier

• Two out of the four photographs of dragonflies are wrongly identified (page 91).

1. The photo labelled as *Orthetrum taeniolatum* is an *Orthetrum luzonicum* immature male.
2. The photo labelled as *Pantala flavescens*, one of the most common species of dragonflies worldwide, is a female *Orthetrum pruinosum*.

• *Calicnemiinae* reported as the family for the two species below is actually a subfamily. The correct family name is *Platycnemididae* (Subramanian & Babu 2017).
1. *Calicnemia miniata* (Selys, 1886)
2. *Calicnemia* sp. 2

In conclusion, the Report severely underestimates the diversity of the ZoI. Many groups were not assessed at all, while those that were assessed, show omissions, errors, and under-valuations. In particular, the Report appears to consider the importance of butterflies, dragonflies (and other insects) only in terms of pollination services ("it is very important to conserve butterfly species, as they help in pollination" (page 172)). It must be highlighted that the butterflies in Dibang Valley are important not only because they are essential pollinators, but also because they are key prey for other species, have cultural significance, existence value, and are vital for ecotourism.

SECTION 5: REVIEW OF AQUATIC BIODIVERSITY

Arunachal Pradesh's extensive river system sustains well over 250 species of fish from 105 genera, 34 families, and 11 orders underscoring its evolutionary diversity (Bagra et al. 2009). Of these, 32 species are endemic to the state. Many fish species new to science have been reported from Arunachal Pradesh within a short span of time; most from the Siang, Noa-Dihing, Dibang, and Subansiri rivers and their tributaries (refer to Appendix VIII for a checklist of fish species from Dibang River basin). These rivers feed the Brahmaputra making it the world's 11th richest river system for fishes (Dudgeon 2002).

Underreporting fish species from Dibang Valley

In the Dibang River basin, Darshan et al. (2019) recorded 32 species, many of which were documented in the last 10 years, suggesting the high potential for new discoveries from this species-rich region. However, the Report records only 12 species from the ZoI (including both Dri and Talõ basins) underscoring the need for multi-season multi-year sampling. The species accumulation curve does not plateau indicating several unrecorded species in unsampled stream orders. Ichthyofaunal studies in Dibang Valley have been limited and only recently have researchers started to document the region's aquatic diversity. Work by Darshan et al. (2019) in Dibang Valley indicates the presence of many endemic species, especially the highly sensitive and stenotopic glyptoternoids like *Exostoma, Creteuchiloglanis, Parachiloglanis, Pseudolaguvia*, and *Pseudocheineis*. The Report, however, only acknowledges one RET species (*Schizothorax richardsonii*). It further argues that other recorded species might not have global significance with reference to their threatened status, but that they might have high regional importance. As the current knowledge of these species' ecology and conservation status is limited, definitive assessments such as these are speculative at best.

Threats to aquatic fauna underassessed

The HEP's potential threats to the aquatic fauna of these high-altitude rivers have not yet been adequately explored. The threats to migratory fish such as *Schizothorax* and *Tor* species remain uncertain as there is inadequate knowledge on their migratory ranges and breeding ecology. The location of the HEP at an altitude of 500–1,500 m is favourable for many "Intermediate Forms" of hill stream fishes including *Schizothorax*, *Garra*, *Tor*, *Bangana*, and *Neolissochilus*. These are potential "Cold Water Fishes" that migrate downstream to mid-to-low altitudes during winter. The Report recommends no species-

specific mitigatory measures, such as fish-ladders, to allow for upstream to downstream movement of these fish species. Further, any such recommendation should be based on a thorough study of species biology.

Fishing through traditional traps is an important source of dietary protein for the indigenous Idu Mishmi people, the availability of which may be affected by the disturbance related to the HEP. Further, the delineated ZoI does not take into account areas upstream and downstream of the dams that will be severely altered due to storage of sediments. Dams trap sediments in the reservoir. Sediment deprived discharge from hydro-power dams can cause erosion and destruction of natural and human habitats, sometimes for hundreds of kilometres (Schmidt & Wilcock 2008; International Hydropower Association 2019).

Inadequate mitigation plan for hydrology

Hydrological monitoring of the streams to assess impacts of road construction, habitat modification, and management of aquatic biodiversity has not been recommended. This is critical to measure low flows and water quality changes pre- and post- dam construction (page 15). In addition:

- The mitigation plans recommend that critical minimum flows (environmental flows) should be maintained in all the streams and the main river. However, the Report fails to provide a detailed methodology to estimate environmental flows (at different times of the year) for streams/rivers of different sizes. The Report also fails to address the fact that multi-year, multi-season hydrological monitoring, coupled with monitoring of aquatic biodiversity, is crucial for deriving biologically meaningful estimates of environmental flows.
- There is a proposal to "*prevent the impact of road-cutting through the construction of culverts/small dams across all the streams cutting across by the proposed road is an effective mitigation plan*" (page 200). However, this is only feasible for a few streams. Most first order streams do not get individual culverts and are diverted to the nearest culverts. This increases the runoff in the stream leading to higher erosion and bank instability.
- The impact of the project on long-term sediment dynamics downstream have not been considered although short term effects of increased sedimentation during construction and immediate post-construction phase have been addressed to some extent. This is of concern given that both rivers, Dri and Talõ, originate from heavily glaciated valleys (Dasgupta et al. 1997; Raup et al. 2007). Sediment trapping in the reservoir creates a sediment depleted river downstream. The energy of the river and the lack of sediment in the water may cause bank erosion, bed erosion, changes in the particle size of the sediment along the rivers making them coarser, and changes in channel geometry (Sharma & Sharma 2014). This has negative implications for capture fisheries and downstream ecosystem services and the welfare of river dependent communities. Suggested mitigation measures include dynamic and spatial tracking of particle size, mapping risk to downstream river habitats and livelihoods, planning for a sediment release, and preparing a sediment augmentation mitigation plan (Wohl & Rathburn 2003). The proposed project has no such mitigation measures in place.
- The Report fails to provide restoration protocols for the effects of tunnels and environmental flow on aquatic life. As aquatic life-forms cycle nutrients from organic debris via the zone of exchange between surface and ground-water, their loss can have cascading effects on fishes, amphibians, birds, and mammals (Hauer et al. 2016).
- The Report states that its impact potential calculations within the ZoI are

underestimated and underscore the need for natural flow data. Even without the requisite baseline data on flow dynamics of the river, the Report suggests the most minimal mitigation measures for such complex ecosystems.

- The Report suggests disposing of hazardous waste in a flat area far from forests, river and human habitation where rainfall is low (page 201, Table 7.14). Such an area may not be present in the mountainous Dibang Valley and will need rigorous implementation strategies, starting with, but not limited to: identification of hazardous waste, experimental tests of efficacy of such waste disposal and finally, acquisition of advanced technology to handle/store hazardous waste.
- The impacts of altered flow, flooding, and sediment regimes on riparian vegetation have not been addressed. This is important as large-scale forest dieback has been observed in areas where dynamic floodplain systems were eliminated (Hauer et al. 2016).

SECTION 6: REVIEW OF AVIFAUNA

Dibang Valley is special for its birds even within Arunachal Pradesh (which has the second highest number of bird species globally for any state; Grenyer et al. 2006). Five-hundred-and-sixty-three species have been reported from Dibang Valley (eBird 2020, see Appendix IV for a checklist of birds of Dibang River basin following the taxonomy outlined in the Clements Checklist (Clements et al. 2019)) making the two districts of the Dibang Valley (Dibang Valley and Lower Dibang Valley) among the richest in the country (Figure 1).

Of the 101 species of High Conservation Concern (HCC) that were identified for the country in the State of India's Birds 2020 report (SoIB 2020) (which involved a collaboration between 10 governmental and non-governmental institutions including the WII), 30 have been reported in Dibang Valley (eBird 2020). The region contains a remarkably high concentration of priority species for conservation and is therefore particularly important in the context of India's birds (Figure 2). These HCC species include the Rusty-throated Wren Babbler *Spelaeornis badeigularis* (found nowhere else in the world), Sclater's Monal *Lophophorus sclateri*, Blyth's Tragopan *Tragopan blythii*, Bengal Florican *Houbaropsis bengalensis*, White-rumped Vulture *Gyps bengalensis*, Slender-billed Vulture *Gyps tenuirostris*, Rufous-necked Hornbill *Aceros nipalensis*, Beautiful Nuthatch *Sitta formosa*, Swamp Grass Babbler *Laticilla cinerascens*, and Large Blue Flycatcher *Cyornis magnirostris*. Many of these species are especially sensitive to disturbance because they have either suffered rapid and substantial population declines (e.g., Vultures, see SoIB 2020; BirdLife International 2017) or have extremely restricted ranges. Ward's Trogon, Sclater's Monal, and Swamp Grass Babbler have estimated range sizes of less than 2,500km2 (SoIB 2020), a large part of which falls within the Dibang River basin. Such habitats are therefore critical for the long-term persistence of these species.

In addition, despite the high documented richness, this region continues to regularly host new avian records for the country. Some recent new records for India from the region are Black-headed Greenfinch *Chloris ambigua*, Elliot's Laughingthrush *Trochalopteron elliotii*, and Chestnut-flanked White-eye (Dalvi 2013; Lobo et al. 2018). Arunachal Pradesh, including Dibang Valley, also has the highest richness of riverine birds in the Eastern Himalaya (Buckton & Ormerod 2002). These species are entirely dependent on the rivers and riverbank habitat of Dibang and its tributaries.

Missing the elevational migrants

The Report studied the birdlife along the Talõ and Dri rivers using point counts and line transects from February to May 2018. While the objective was to conduct a multi-season replicate study, the entire fieldwork was conducted in under four months from February to May 2018—a relatively short time

period to assess birdlife of any Himalayan region, especially the species-rich Dibang Valley. Therefore, a study restricted to four months cannot provide a complete picture of the region's birdlife. Secondly, most species in Arunachal Pradesh are elevational migrants (Rasmussen & Anderton 2005), breeding at higher elevations and spending the winter lower down. Based on studies in other parts of Arunachal Pradesh, the importance of a range of elevation for wintering bird species is likely to be considerable in Dibang Valley too (Srinivasan et al. 2018). Unfortunately, it is not possible to assess this with the limited information presented in the Report.

Underestimation of species, abundance and threatened species

The Eastern Himalayan bird community is exceptionally diverse (Grenyer et al. 2006), and point count and line transect techniques in the tropics requires identification of hyperdiverse bird communities by both sight and sound (Raman 2003); such skill takes years of dedicated site-specific effort to develop. Indeed, as many as 80% of bird detections on line transects in the tropics are from sound alone (Raman 2002; Srinivasan et al. 2018). Over such a limited sampling period, it is likely that a significant proportion of species were not recorded by the study.

The report of 230 species from the study area is almost certain to be an underestimate (see Appendix IV), because: (1) multi-season surveys were not conducted (as outlined above), (2) only a small proportion of the ZoI was surveyed, and (3) species may have not been recorded during the survey due to poor detectability. Indeed, the Report specifically states that "the vegetation was dense and the detectability (of birds) was less...". Given the low detection probability and large number of detections of singletons and doubletons, the Report should have, but did not incorporate a formal statistical technique that could potentially account for the number of species "missed" (such as rarefaction-related or other species-richness estimators; Hortal et al. 2006). No species accumulation curve has been presented to demonstrate whether sampling of the entire bird community was adequate. Based on data from other similar areas in Arunachal Pradesh, there is a high likelihood of presence of species of HCC (SoIB 2020) such as the Blyth's Tragopan and Beautiful Nuthatch (also globally threatened (BirdLife International, 2016)) in the area, which the Report does not list.

On one hand the Report outlines that detectability was poor because of dense vegetation, but proceeds to classify the abundance of all birds that were recorded as 'very low or low'. Given low detection probability of species, abundance cannot be inferred without statistically accounting for the detection probability (Buckland et al. 1993). Further, the Report does not mention the number of repeat sampling for each line transect or point count location – parameters that are typically reported in studies that deploy these field sampling methods.

Finally, community-owned forests in Dibang Valley, such as those that will see the impacts of the HEP, are exceptionally rich in bird diversity, recording 529 species, which is 55 species more than the Dibang and Mehao wildlife sanctuaries combined (eBird 2020).

Contradictions and inadequate mitigation plans

The Report makes numerous statements that highlight the exceptionally high bird species richness and diversity of the region. A noteworthy point is that even with this four-month study combined with effort/sampling limitations, the Report finds high bird species richness including endemics/range-restricted species within the ZoI and repeatedly stresses that it is critical/crucial to preserve these sites. Yet, despite their own findings of the study area's importance of birds, the Report suggests

mitigation/conservation plans that evidently will not address the loss of natural habitats and the direct impacts on bird populations. For example, no mitigation measures have been suggested for the loss of habitat for riverine birds. Further, it is increasingly clear that no alternative land use type (e.g., compensatory afforestation) can replace primary/old-growth forest in terms of preserving irreplaceable tropical biodiversity (Gibson et al. 2011). Finally, the Report also makes contradictory assertions, by admitting that it is not possible to suggest any threatened and habitat specific conservation plans (which is true), but subsequently suggests "*Habitat Rehabilitation and Restoration Plans*" that would purportedly enhance the overall habitat quality and benefit for species of conservation significance.

Limitations of habitat and species-specific mitigatory plans

To mitigate or compensate the impacts on birds, the Report suggests the installation of nest boxes that will help the 32 cavity-nesting species of the 230 bird species recorded. This mitigation plan has several flaws and limitations, the most important of which are outlined below:

- Cavity-nesting species depend not only on nesting habitat, but also need food, foraging areas and habitat to survive and breed. If the habitat (with nearly 2,800,00 trees and other forms of vegetation and associated natural processes) are lost, birds will be directly impacted including the cavity-nesting species (which belong to a diversity of feeding guilds). The direct loss of the habitat/trees and submergence would reduce bird populations. This cannot be compensated for by installing a limited number of nest boxes in adjacent areas.

- The 32 cavity-nesting species listed in the Report are both diurnal and nocturnal species, with diverse dietary and foraging strategies and a range of body sizes. These species range from tits, nuthatches, woodpeckers, barbets, to trogons and hornbills, and raptors such as kestrels, hobbies and owls. The design and placement of nest boxes for any particular species would require a much greater ecological understanding of the requirements of specific species than one simple design based on differing entrance hole sizes catering to all species (Zingg et al. 2010). The internal dimensions and specifications of suitable nest boxes will also vary between different cavity-nesting species based on body size and other criteria.

- The suggestion to augment only one type of breeding habitat (that for cavity-nesting birds) by introducing nest boxes ignores other bird species that do not rely on cavities to breed (according to the Report, this would be the vast majority of species). The impacts of the loss of vast expanses of forest cannot be mitigated for species belonging to other guilds, such as ground nesters and understorey insectivores (Lampila et al. 2005).

- The Report recommends that initially 400 nest boxes should be set up in two locations (200 each) in forest patches around the staff colony and office premises. This proposal is suggestive of an experimental framework and cannot be considered a mitigation strategy.

- However, at several points, the Report assumes, without evidence, that nest boxes as a mitigatory measure is sure to help cavity-nesting birds. Till date, there have been no successful projects that have proved the use and efficacy of nest boxes for cavity-nesting bird species in India. In India, nest boxes have been tried for a handful of bird species in urban areas, and for certain hornbill species in a limited number of locations based on years of ecological research that showed a limitation in the availability of natural cavities. Several of these projects, especially for Asian forest hornbills, have not yielded any significant results except in a few sites where success

has depended on careful and dedicated long-term engagement (Poonswad et al. 2005).

- In the case of hornbills or other large hole-nesting birds, installation and design of nest boxes is a painstaking task requiring multiple skills and equipment. In addition, nest boxes made of wood (as shown in the report) are also not at all ideal in places like Arunachal Pradesh because of the high humidity and rainfall, where such boxes will rot after the first two years. Nest boxes often take a long time to be accepted and used by birds (James et al. 2011).
- In some cases, nest boxes have been studied to have unintended negative consequences on the reproductive success of birds (Mänd et al. 2005).

Lastly, at least two identification errors in the photographs were observed. The Rosy Pipit has been wrongly identified as the Olive-backed Pipit and the Yellow-bellied Fairy Fantail, a common bird in this area, has been wrongly identified as the Yellow-throated Fulvetta.

SECTION 7: REVIEW OF MAMMALIAN BIODIVERSITY

Dibang Valley hosts an extremely rich mammalian assemblage with reports of as many as 75 species from the greater landscape of Dihang Dibang Biosphere Reserve (Choudhury 2008). To assess the ZoI's mammalian diversity, the Report used a combination of camera traps and secondary sources. It claims evidence of 21 species within the ZoI from direct and indirect sources. In compiling data on mammals, the Report ignored key published checklists from the region (e.g., Alfred 2006a; Choudhury 2008) instead opting for the EIA report (2015) that the FAC (2017) deemed "completely inadequate" leading to the commissioning of the current study (see Appendix V for a checklist of mammals of Dibang Valley). They seem neither to have taken note of globally unique evolutionary phenomena reported from Dibang Valley (e.g., six different colour morphs of the Asiatic Golden Cat *Catopuma temminckii* from the same region (Nijhawan et al. 2019)), nor the seven species of gliding squirrels, at least one of which (Mishmi Hill Giant Gliding Squirrel *Petaurista mishmiensis*) is endemic to the Dibang River basin (Krishna et al. 2016). The Asiatic Golden Cat population in the Dibang Valley is likely to be contiguous with populations across the border in Tibet (Wang et al. 2019). An ongoing compilation of Golden Cat coat colour and pattern diversity across its global range suggests that the Eastern Himalaya and especially Arunachal Pradesh has the highest diversity of morphs (Mukherjee et al. 2016; Nijhawan et al. 2019; Wang et al. 2019). The sections below discuss the various deficiencies and shortcomings in field and analytical methods, results and finally, the Report's conclusions on mitigation measures for mammals.

Flawed data collection methodologies

In Section 4.1.1.5 (page 48), the Report states that "each camera was deployed for an average of 20-30 days" without explaining how this sampling period corresponds to the Objective (a) (page 28) "covering multiple seasons". A period of 20–30 days appears inadequate to sample a range of species, many of which are wide-ranging and/or rare (Wearn & Glover-Kapfer 2017). A camera-trapping study in Eaglenest Wildlife Sanctuary in West Kameng District reported a minimum period of 45 days at each location to record most of the 27 species that were eventually recorded, with new species being recorded on the 100th day as well (Mukherjee et al. 2016). Further, there is no mention of how this sampling period is divided across different seasons as temporal replicates. Even if one assumes that 30 days were distributed equally across the two seasons identified in the report, a period of 15 days at any location is extremely unlikely to provide accurate estimates of species richness, distribution, and abundance, particularly for

wide-ranging animals such as Tiger *Panthera tigris*, Asiatic Wild Dog *Cuon alpinus*, and Clouded Leopard *Neofelis nebulosa* and the more arboreal and rare species such as the Marbled Cat *Pardofelis marmorata*, Red Panda *Ailurus fulgens*, and Spotted Linsang *Prionodon pardicolor*.

A relatively narrow range of elevation (600–1,800m) was surveyed within the ZoI from a full elevational profile of 540–2,327m. This excludes both those mammal species that are permanent residents of mid elevations (e.g., Gonghsan Muntjac *Muntiacus gongshanensis*) and those that migrate seasonally between low-mid-high elevations (e.g., Mishmi Takin *Budorcas taxicolor taxicolor*, Red Goral *Naemorhedus baileyi*, and Red Panda *Ailurus fulgens* (Choudhury 2008)). Many mammal species are known to use different elevations at different times of the year, changing their distribution patterns based on resource availability in response to seasonal and altitudinal variation (Srivastava & Kumar 2018). Short survey durations restricted to specific elevations and seasons are sure to underestimate mammal presence.

The description provided under 'Random sampling' (page 48) does not correspond to any acceptable ecological

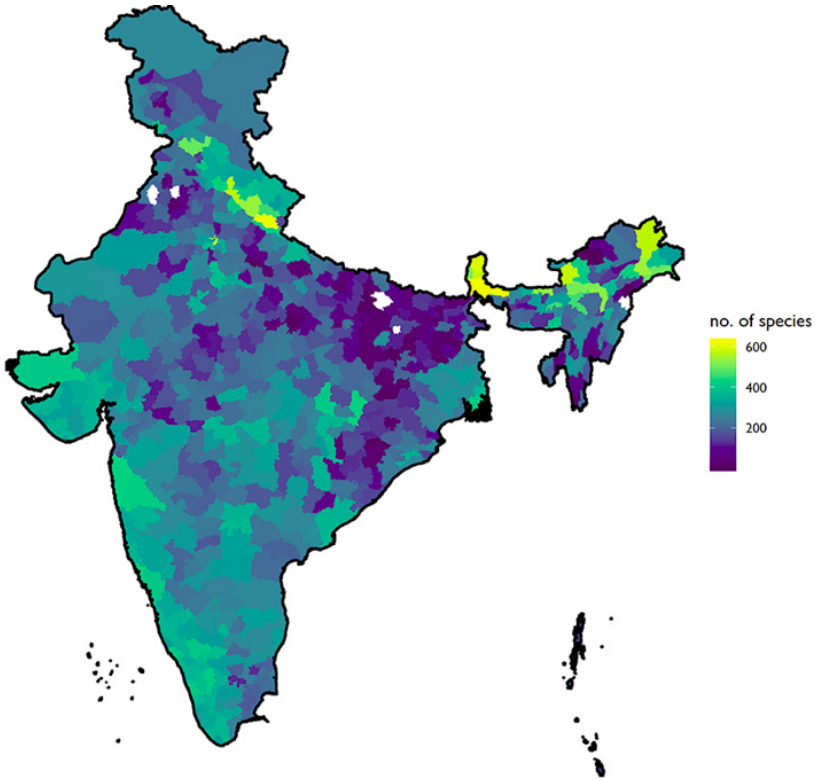

Figure 1. Number of bird species reported across Indian districts (from eBird 2020; district boundaries are as of 2011). Lower Dibang Valley and Dibang Valley districts have been combined as many bird species utilize large areas of the Dibang River basin.

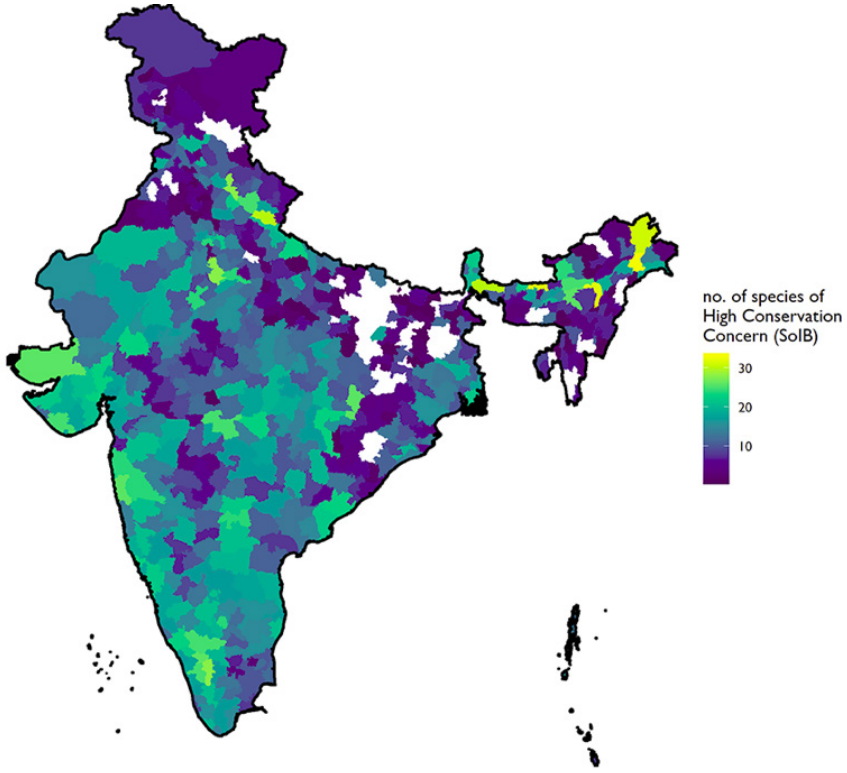

Figure 2. Number of bird species of High Conservation Concern (SoIB 2020) across Indian districts (from eBird; district boundaries are as of 2011). Lower Dibang Valley and Dibang Valley districts have been combined as many bird species utilize large areas of the Dibang River basin.

sampling method. No rigorous and robust inference can be drawn on species absence from a sampling approach that conducts 'opportunistic surveys based on information given by local people'. Relying entirely on the information provided by local people, though valuable, is likely to bias species capture probabilities, in particular for wide-ranging and rare species such as large carnivores that may avoid human settlements or smaller species which use relatively undisturbed forest areas such as the Marbled Cat and Red Panda (Schuette et al. 2013; Glatston et al. 2015; Ross et al., 2016).

The Report claims to have conducted camera trap surveys in 53km^2 of the 112km^2 demarcated ZoI divided into 1x1 km grids (page 48). This means that 48.18% of the ZoI was sampled. There are several concerning issues with the sampling methodology:

- All of the grids sampled are concentrated in the immediate vicinity of the river, human settlements and the district road. No grids higher up on mountain slopes within the ZoI were surveyed. This survey design is likely to have favoured the detection of species that are either found close to human settlements (e.g., some rodents and some small carnivores) or are more likely to visit exposed riverbeds (such as otters and some small cats), effectively excluding a range of species found farther away from human settlements.
- The Report does not provide the GPS coordinates of camera trap locations. However, Map 4.5 makes it clear that most of the cameras were placed within the roughly 32 of 112 grids, clustered close to the river, roads, and settlements. The Report provides no rationale for purposefully selecting sampling grids and camera locations within them in areas known to be impacted by human presence, while leaving a significant majority of the ZoI unsurveyed. Furthermore, it is unclear how the Report concluded that an area of 53km^2 was surveyed when so few grids have been effectively sampled.
- There is no mention of the minimum distance between two camera trap locations, therefore it is not possible to determine whether spatial autocorrelation in the photocapture data skewed estimates of the species richness and relative abundance.
- No methods appropriate for small (e.g., rodents, shrews) and arboreal mammals (e.g., gliding squirrels, bats), such as live trapping, have been applied. These groups of mammals are important seed dispersers and form the prey of small carnivores, contributing to the overall forest health and diversity (Jansen et al. 2012).

A short survey duration coupled with non-representative sampling that unequally distributed sampling effort within a relatively small area (53km^2) render this study's findings on the study area's mammalian diversity inadequate. Yet, despite these methodological flaws, the Report recorded 21 species of mammals, including the Critically Endangered Chinese Pangolin *Manis pentadactyla*, and seven other RET species pointing to the ZoI's importance for diverse, rare, and threatened mammals.

Unscientific data analysis methods

The biased sampling strategy adopted in the Report does not meet the assumptions necessary to produce reliable estimates of species richness, distribution, and abundance (Wearn & Glover-Kapfer 2017). Consequently, richness and abundance analyses reported here (pages 122–132) carry little significance. Yet, if one assesses this section on its own merit, there are several concerns. Most importantly, the Report does not specify which method was employed to calculate species capture frequencies: 30-minute interval (O'Brien et al. 2003), 'independent encounter' (Rowcliffe et al. 2008) or another method. In addition

to this key omission, there are following shortcomings:

- The Report does not consider differences in species detection probabilities and abundances when comparing species capture frequencies against one another (i.e., assigning the same weightage to captures of rare species with large home ranges, such as Asiatic Wild Dog and Himalayan Black Bear *Ursus thibetanus*, and those with smaller home ranges, such as Masked Palm Civet *Paguma larvata* and Yellow-throated Marten *Martes flavigula*). Meaningful comparisons in abundance across species cannot be made without accounting for inter-species variation detection (Sollmann et al. 2013).
- No scientific reasoning is provided for setting the thresholds of abundance categories (very low to very high). No statistical tests are run either to test the significance of difference between the categories.
- Since the camera traps were only deployed for 20–30 days each (page 48), it is unclear whether saturation (species accumulation) was reached in order to compile a comprehensive mammal checklist or to ascertain species richness, suggesting that the ZoI could contain many more species than were detected during this short and spatially restricted survey.

Flawed inference

The Report's claims of 'very low abundance' of mammals in the study area (page 115) are unsubstantiated given the issues with data collection and analysis outlined above. Relative abundance index (RAI) is a poor estimator of abundance if species, survey and camera trap model-specific factors are not accounted for (Sollmann et al. 2013). The Report neither incorporates these factors nor employs published methods such as the Random Encounter Model (Rowcliffe et al. 2008) or the Camera Trap Distance Sampling (Howe et al. 2017) used to produce reliable and robust estimates of species abundance from camera trapped data. An extensive long-term camera trap study in Dibang Valley that estimated species abundance using the Random Encounter Model (REM) showed that mammal abundances in Dibang's community-owned forests were comparable to other tiger reserves in India with similar ecological carrying capacities (Nijhawan 2018).

The stated rationale that since Dibang WLS is located around 13km from the ZoI (page 116), the species found there should be excluded from the study area is at odds with widely known information on movement ecology and habitat preference of many of the area's species. An aerial distance of 13km is well within the limits of species with large home ranges especially big cats such as the Tiger, Asiatic Wild Dog, and Clouded Leopard that have been recorded in significant numbers in the region (Nijhawan 2018), even by WII's own scientists (Adhikharimayum & Gopi 2018).

Table 5.45 fails to mention the Chinese Pangolin as Schedule I (Part I) species while Asiatic Wild Dog, Smooth-coated Otter *Lutrogale perspicillata*, and Himalayan Black Bear are included in Schedule II of the IWPA, meaning that these species are legally protected by provisions of the Act. The Himalayan Serow is classified as Near Threatened which the table also omits. Additionally, claims that threatened species such as Spotted Linsang and Clouded Leopard would not exist in the area (page 117) are easily refutable as both have been reported from elevations lower than and similar to the ZoI in Dibang Valley (Nijhawan 2018), Namdapha (Datta et al. 2008a,b), Manas (Lahkar et al. 2018) ,and Dampa Tiger Reserves (Singh & MacDonald 2017).

Map 6.1 spatially displays the potential impacts of the proposed HEP divided into four categories from 'Very High' to 'Low'. This assessment compounds the methodological issues of data collection and analysis

explained in prior sections. Thus, any results it generates are entirely unreliable. Beyond this, a striking pattern becomes clear if one compares Map 6.1 with Map 4.5. The grids identified as medium-to-high impact ('very high', 'high', "medium') coincide with the grids where camera traps were placed. Therefore, if more extensive and longer camera trapping surveys had been conducted, species captures would have been higher. In sum, the impact assessment, and any mitigative measures by association, do not correspond to the true species abundance in the study area.

Finally, Annexure 5.1 (page 271) includes a species of bat, the Long-tailed House Bat *Eptesicus hottentotus*, not found in India. This species is known to occur only in semi-arid savanna in southern and eastern Africa.

Contradictory and false claims regarding tiger use of project area

The Report relies on another long-term monitoring study by WII scientists focusing on "mammalian fauna in Dibang WLS" to claim that "[this study] has recorded presence of few tigers outside sanctuary" (page 177). This particular study, which focuses primarily on "mammalian fauna in Dibang WLS", could not possibly ascertain that "few tigers" exist outside the sanctuary because it was designed to document tiger presence "in Dibang WLS". To scientifically infer that tiger presence differed significantly within and outside Dibang WLS would require comparable sampling effort in protected area and community-owned forests, both in terms of sampling area and effort (i.e., number of camera traps deployed and total number of trap nights). This, however, does not appear to be the case.

Maps 6.6 and 6.7 in the Report indicate that the sampling effort inside Dibang WLS (shown in yellow points in Map 6.7) was many magnitudes lower than the effort outside it. Despite this, tigers were photographed in a large majority of the few camera traps placed outside the sanctuary in the community-owned forests. Indeed, in November 2018, WII scientists published an article in the *Journal of Threatened Taxa* in which they recorded India's "highest tigers" outside Dibang WLS in the community-owned forests (Adhikarimayum & Gopi 2018). One of the camera traps that recorded tigers was located at a distance of 10.2km from the project site (page 177), and well under 10km from the boundary of the ZoI (Map 6.7). Multiple studies have recorded that dispersing tigers travel distance ranging from 20 to 375 km across the human dominated landscape (Krishnamurthy et al. 2016; Singh et al. 2018). Evidence of tiger dispersal has been recorded between habitat patches as far as 650km based on genetic assessment (Joshi et al. 2013). In addition, studies on tigers in Eastern Himalayan mountain ecosystems have recorded large home ranges varying between 70 to 675 km^2 depending gender and habitat type (Tempa 2017). In comparison, 10km is a very small dispersal distance for a wide-ranging species such as the tiger. The Report dismisses this significant finding and makes contradictory claims, arguing on the one hand that "Tiger presence and movement in the project area cannot be completely ruled out based on this few months' survey, as they are long ranging species" (page 6), and accepting that "the project area is a potential habitat for tigers" (page 177) and, on the other hand asserting that "this hydropower project is not visualized to restrict the movement of tigers occurring in and around the DWLS into any direction in the entire Dibang Valley" (page 7). The Report uses interview data with local people to corroborate that tigers do not use the project area, but it provides no information about the number of interviews conducted, with whom and the type of questions asked.

Importantly, the Report fails to cite earlier studies (e.g., Nijhawan 2018, 2019) that have used camera traps to sample both the Dibang WLS and community-forests equally to show that tigers were widespread across the Dibang Valley. They reported 12 individual tigers (8 adults, 2 sub-adults, and 2 young cubs), eight

of which were recorded in various community-owned forests (Nijhawan 2018). Nijhawan et al. (in prep) used a large sample of camera-trap data to estimate that the larger landscape of Dibang Valley could harbour as many as 52 (22–144) adult tigers, a large majority of which are likely to hold permanent home ranges in the district's community-owned forests.

Mitigatory measures and impacts on mammals

The Report does not suggest any mitigatory measures for region's medium-to-large sized mammals impacted by the project, instead stating, "low abundance status of most of the species and few individuals of threatened species, along with predomination of forest and river habitat and absence of any critical habitat, it was not possible to suggest any threatened species and habitat specific conservation plan" (page 185). However, low abundance is expected in rare species, and is the reason why such species require much larger sampling efforts and are often the focus of targeted conservation efforts. The claim of absence of 'critical habitat' contradicts both the FAC's observations that "The type of forests appears to be predominantly Subtropical Evergreen broad-leaved forest and Subtropical rain.... The vegetation is of multi-strata and can truly be said to be irreplaceable", and the fact that Dibang Valley is part of a Global Biodiversity Hotspot – 36 such places that constitute 2.4% of the earth's surface but host 60% of all biodiversity on earth. The region is certainly critical habitat for several endangered and rare species (Choudhury 2008), which the Report fails to adequately document because of its flawed methodology.

The Report identifies only two areas within the region as being 'ecologically sensitive' – Dibang and Mehao wildlife sanctuaries – without providing any explanation of how only these were deemed 'sensitive' and the community forests were not. Results from several studies contradict this assumption. A previous long-term study in Dibang Valley showed that many community forests in fact supported higher species richness and abundance for mammals than Dibang WLS (Nijhawan 2018). Furthermore, and paradoxically, the Report concludes that "Nevertheless, continuous monitoring of movements of key mammalian fauna covering 10km radius from the project study area is very important", "[the] monitoring of tiger distribution and movements need to be continued in upper and lower Dibang Valley", and "it is essential that long-term monitoring and conservation efforts are planned particularly for species of conservation significance (Table 5.46) such as Mishmi Takin (endemic species), Alpine Musk Deer, Red Goral, Clouded Leopard, Snow Leopard, Spotted Linsang, ***in and around the study area***" [emphasis added]. These statements imply two assumptions: (1) that the HEP's impacts will be experienced within 10km of its radius and (2) the species of conservation exist within or close to the study area. If these are indeed true, then by not adequately surveying the area inside the small ZoI and within 10km of the proposed site, the Report has failed to present a comprehensive and reliable assessment of the study area's biodiversity and the HEP's impacts on it. In the same vein, one is hard-pressed to understand why the Report ignores the outcome of another long-term WII study (Adhikarimayum & Gopi 2018) that found camera trap evidence of tigers within 10km radius of the HEP site, if indeed the "10km radius from the project study area is very important". Finally, these statements on the need for a monitoring study contradict the report's mandate which was to assess biodiversity to determine the potential impacts of HEP on it **before** the construction of the HEP and not after.

SECTION 8: REVIEW OF HERPETOFAUNA

Amphibians and reptiles are declining globally due to habitat fragmentation, climate change, and diseases (Gibbons 2000). Amphibians, in particular, show high rates of endemism and

niche specialisation (Hu et al. 2012; Brown et al. 2016). Both groups feed on insects, fish, small mammals and other reptiles, and provide key ecosystem functions by distributing nutrients across and within different trophic levels. Population declines in either of these groups could potentially lead to a collapse in these nutrient transfer networks (Odum 1971). Furthermore, such declines may lead to consequent population increases in groups that may be harmful to human health (e.g., insects and rodent pests), or decreases in predatory mammal and bird species that depend on them (Aguilar et al. 2013; Hocking & Babbitt 2014). Simple counts of species richness or diversity estimates do not capture the importance of such vital trophic interactions.

Dibang Valley has many undiscovered species

At least 90 species of herpetofauna have been reported from the Dibang River basin (Appendix VI for the amphibian checklist and Appendix VII for the checklist of reptiles), including 48 amphibians, 11 lizards, 30 snakes, and one turtle (Borah & Bordoloi 2003; Athreya & Sheth 2016; Ahmed & Roy 2016; Roy et al. 2018; Ohler et al. 2018). Several of these species have previously only been reported from neighbouring Myanmar and China (e.g., *Rhacophorus translineatus, Theloderma moloch, Liurana medogensis, Nanorana chayuensis*, and *Trimeresurus medoensis*). Comparisons with recently published herpetofauna records from northeastern India, southern China, and northern Myanmar suggest that many of the newly reported species from Dibang River basin, could be new to science (Agarwal et al. 2014; Biju et al. 2016, 2019; Jiang et al. 2016; Mahony et al. 2018; Rahman et al. 2020). The taxonomic status of 11 of these newly reported amphibians is currently being determined through molecular approaches. These include species within the following genera: *Amolops, Bufo, Cyrtodactylus, Ingerana, Kurixalus, Microhyla, Nasutixalus, Oreolalax, Philautus, Theloderma*, and *Xenophrys*. Further, recent studies in the Western Ghats have used similar molecular approaches to show that many species previously thought to be widespread across these mountains' complex topography may in fact be entirely distinct species (Dahanukar et al. 2016; Garg et al. 2017). This is extremely likely to be the case with herpetofauna in Dibang River basin as it's numerous mountain ridges and deep valleys can act as barriers to dispersal, resulting in speciation and endemism (Wollenberg et al. 2008; Che et al. 2010).

Underreporting due to inappropriate methodology and under-sampling

The Report's documented evidence of 14 amphibian and 31 reptile species is significantly lower than the total number of species reported (90) in all previous studies in Dibang River basin conducted in habitats and elevation gradients comparable to that of the ZoI (Borah & Bordoloi 2003; Athreya & Sheth 2016; Roy et al. 2018; Ohler et al. 2018). The Report fails to record a *Bufo* species (an Indo-Chinese toad), locally called 'Pahu', which is abundant in Dibang Valley even during the season when the fieldwork was conducted. *Amolops viridimaculatus* locally called 'Pali', *Nanorana* species 'Pari' and 'Pambo' and many *Philautus* species have not been reported. Furthermore, the following species reported in the Report's checklist: *Feihyla vittatus, Ingerana borealis, Clinotarsus alticola, Polypedates teraiensis* - are unlikely to occur in the ZoI given that previous multi-year studies have failed to record these (Roy et al. 2018). Moreover, even if found, it is unlikely that these species would be encountered during fieldwork conducted between February and May/June, which is well outside their active breeding period. These and many more discrepancies are a result of very limited sampling which has led to an overall underestimation of the study area's herpetofauna diversity. These and additional shortcomings are discussed in detail below:

- Roy et al. (2018) reported 38 species of amphibians from field surveys conducted

across all seasons, including monsoon, over three consecutive years covering 24km of transects along streams, forests, grasslands, and wetlands across the Dibang River basin. Roy et al. (2018) encountered a higher number of species because they sampled different habitats spread over a larger elevation range across seasons (200–3,500 m). The Report does not refer to this highly relevant piece of work.

- The study did not survey all habitats present in the ZoI including the various successive stages of evergreen and temperate broad-leaved forest, grassland, rivers and streams, wetlands, and ponds (Roy et al. 2018). Instead, the sampling was conducted almost entirely along roads (page 44). The Report does not provide a rationale for the focus on roads which are widely known to create disturbance and barriers to movement in addition to being non-ideal habitats for herpetofauna (Carr & Fahrig 2001; Bennett 2017; Marsh et al. 2017). Ongoing highway construction between Anini and Etalin has further increased the level of disturbance in these already disturbed areas. Road surveys only allow for the detection of few ground-dwelling species that access these areas. Furthermore, only 38km of road length was surveyed. Because these roads are present only on the left banks of the Dri and Talõ rivers, the survey missed 70 of the 112 sampling grids, effectively accessing roads in a mere 37.5% of the 112km^2 ZoI.

- Streams were not sampled thoroughly. Amphibians are water-dependent and are found in abundance in streams and other water bodies. Additionally, different stream orders host different amphibian communities with headwater streams being keystone habitats for montane amphibians (Gillespie et al. 2004; Stoddard et al. 2004; Ficetola et al. 2011). The study does not provide any information on how and what type of streams were selected for surveys. Furthermore, the sampling time window of 5–10 minutes allotted for streams is much too short and is certain to have missed many rare and difficult to observe species.

- Tree frogs were severely under-sampled based on comparisons with studies in Dibang Valley and other parts of Arunachal Pradesh (Pawar & Birand 2001; Roy et al. 2018). The largest land-cover in the ZoI are different types of forests and even these have not been surveyed thoroughly, casting doubts over the representativeness of the survey's findings.

- A sizable population of Keeled Box Turtle *Cuora mouhotii* (IUCN Endangered), locally called 'Ichimbo', was recorded from forest patches of 200–1,000m elevation range downstream of the project site (Ahmed & Roy 2016). Predictive habitat suitability modelling has indicated that there is a very high likelihood of this species being present around Etalin which has similar habitat type and elevation range (Ahmed & Roy 2016). Due to large-scale habitat change in the area, this little-studied, extremely rare turtle may be pushed towards local extinction.

Inadequate mitigation plan for herpetofauna

The Report ignores the need for conservation of amphibian species in Dibang Valley and recommends an 'open Reptile Park'. Recent studies from South America reveal the collapse of tropical snake communities after the catastrophic loss of amphibians due to chytridiomycosis (Zipkin et al. 2020). Thus without a conservation plan for amphibians, the success of a reptile conservation plan would be ineffective, given the strict dependence of many reptilians on amphibians for food. The conservation plan of reptiles is unusual as it recommends the creation of microhabitats for reptile conservation in waste/dumping land. This land may not be suitable for reptiles given their reliance on a diverse assemblage of insects, amphibians, other snakes, and rodents, all dependent on habitats of varying complexity and disturbance. It is highly unlikely that few, if any of these groups could survive in 'waste

lands'. Even with the above-mentioned biases, the study found 14 species underscoring the richness of the habitat in the project area. In sum, since amphibian richness and abundance were not adequately sampled across the ZoI, the Report has understated the true impacts of the HEP on this globally threatened faunal group. Most of these herpetofauna species remain data deficient according to the IUCN's Red List data underscoring the importance of comprehensive studies to ascertain their ecology and conservation status.

SECTION 9: LIMITED CRITIQUE OF SOCIO-CULTURAL SURVEYS

Overall, the parts of the Report related to assessing socio-cultural impacts of the HEP and corresponding mitigatory measures show a lack of understanding of complex socio-ecological dynamics and nature-culture interdependencies. Although the report envisions a 'People's Biodiversity Conservation Plan' (page 204, Section 7.7.2.2), the participation of the affected local Idu Mishmi members is mostly favoured in terms of labour involvement and livelihood beneficiaries, and not as planners, implementers, and decision makers. The Report does not reference recent and widely-distributed published work on the relations between the Idu Mishmi, the natural environment and transboundary issues (e.g., Aiyadurai 2016; Aiyadurai & Lee 2017; Aiyadurai 2018), ethnobiological knowledge (e.g., Ghosh et al. 2014) and publications by Idu Mishmi scholars on local belief systems (e.g., Mihu et al. 2018). While a detailed socio-anthropological critique of the Report is outside the scope of this review, the points below highlight some particularly concerning trends:

- **Basic population figures are incorrect:** The Report cites the 2011 All India Census incorrectly in stating that the Idu Mishmi population of Dibang Valley is 8,004 (page 34). While the 2011 Census does not specify the Idu Mishmi population of the district, it clearly mentions that 71.23% (5,701) of the total population is Scheduled Tribe (ST). Since the Idu Mishmi is the primary ST in Dibang Valley, a large majority of the 5,701 STs are likely to be Idu.

- **Inadequate information on livelihood questionnaires:** The Report does not provide the questionnaire used in the surveys making it difficult to review the nature of questioning. However, an examination of the results indicates that the questionnaire was predominantly quantitative with a focus on representing local life and livelihoods in strictly numerical terms. Such a representation does not reveal the complex interplay between livelihoods, lived realities, perceptions, and aspirations, which are best understood through qualitative methods. Additionally, no overarching and established frameworks to study livelihood choices have been adopted. For example, current sustainable livelihood frameworks see livelihoods as a result of interplay between five capitals: physical (assets, machines, water harvesters, etc.), financial (income, saving, expenditure, banking literacy, etc), natural (water availability, soil quality, livestock, etc), human (skill, capability, etc), and social (social networks) (see UNDP 2017). Such a framework allows one to understand why people choose certain livelihoods and how livelihoods transitions are made (UNDP 2017). Since the HEP would require large-scale transition of local livelihoods, which are predominantly linked with forest and its resources, the Report should have examined this in greater detail. Furthermore, and importantly, the perceptions of Project Affected Families (PAFs) about the project are presented as neat, mutually exclusive positive and negative views (page 146, Table 5.57) separated from the overall concerns of the respondents. Similarly, a pie-chart (Figure 5.13) on people's perception towards the proposed HEP uses a closed-ended questionnaire of four options without any accompanying narratives. The lack of qualitative data to supplement the

simplistic questionnaires does not allow the respondents' apprehensions to be recorded even if they did voice them.

• **Flawed understanding of local livelihoods:** In various places, the Report claims that "about 38.2% of PAFs are dependent on forests and their resources, as being their primary source of income....", and "only 4% of the people are dependent on agriculture for their livelihood income..." (page 136; Table 5.55; Figure 5.10). These data and resulting conclusions seem to have a flawed idea of local livelihoods, assuming that those who are engaged in 'non-forest' livelihoods such as 'business', 'contract', 'labour', etc., do not simultaneously depend on forest-based products. Local livelihoods in Arunachal Pradesh cannot be categorized neatly into one form or another as people depend upon a variety of sources throughout the year. Thus, people who have been categorised as dependent upon 'contract', 'labour', etc, may also be dependent upon forest-based products as well as agriculture at different times of the year to supplement their food and cultural needs. Based on the report's own findings that 86.3% of those surveyed were involved in NTFP collection (page 139), even the households characterised as being dependent on government jobs are sure to be involved in both agriculture and extraction of forest products at different times of the year. Finally, years of sociological research has shown that livelihood strategies in traditional societies aren't simply a source of cash income, they carry complex socio-cultural meanings and purposes which the Report entirely ignores (Shackleton et al. 2011; Singh et al. 2017, 2018).

• **Romanticised notions of livelihood transitions:** The Report documents the livelihood profile of the PAFs and finds an overwhelming importance of natural resources in everyday life. To reduce dependence on natural resources, it proposes various activities (job opportunities, creating supplementary income generating sources, health care, and improved education) as part of the User Agency's Corporate Social Responsibility (page 202; Section 7.7.2). Some of the jobs listed and described as 'decent' are welder, fitter, plumber, electrician, etc. It adds that since providing jobs to members of all affected families is not possible, the User Agency will support various income generating programmes to further reduce local natural resource use. These measures assume without evidence that a shift from forest dependency to these jobs will automatically enhance well-being and quality of life. Further, the nature of jobs proposed are largely alien to most highland farmers and rests on the assumption that people can make an effortless transition to new livelihoods immediately after the shock of resettlement. Studies on dam-induced displacement have found that such events have negative impacts on employment rate, income level, income resource, and overall well-being of people (Nusser 2003; Baran & Myschowoda 2009; Richter et al. 2010; Zou 2011; Huang et al. 2018). Sudden restrictions on access to natural resources can have further negative consequences as natural resources and subsistence agriculture often act as safety nets during such livelihood and lifestyle transition periods, particularly for the most vulnerable sections of the society (Kura et al. 2017). More broadly, this reflects an inherent bias that treats rural livelihoods, such as jhum cultivation and NTFP gathering, as being inferior to jobs related to dam-building and operation (pages 184 and 203–204).

• **Outdated perspectives on jhum agriculture:** The Report asserts that "*jhum* agriculture or shifting cultivation is known for causing loss of forest cover and associated biodiversity values" (page 136). This is an outdated and flawed statement that is not supported by research within the last

50 years. Many of these misconceptions around *jhum* have been dispelled by seminal work over the years (Conklin 1954; Ramakrishnan 1990, Mandal & Raman 2016). Contrary to state policies targeting *jhum*, long-term research on medium to long-fallow *jhum* (10–15 fallow years) has found that these systems contribute substantially to subsistence livelihoods while being environmentally sustainable and supporting rich biodiversity within fallows. Recent work on *jhum* among the Adi community in the nearby Siang Valley highlights the importance of *jhum* in providing direct and indirect benefits as well as being a critical resource for poorer families who may not have alternate sources of income (Teegalapalli 2017; Datta-Roy 2019). For communities practicing shifting cultivation, it is not merely a system of cultivation, but a socio-cultural activity that provides meaning to land and reifies individual and group identities.

• **Undermining the local importance of mithun:** The Report notes "people prefer wild meat but tend to consume domestic meat more often" (page 143) highlighting the importance of domestic meat in the lives of Idu Mishmi. However, it entirely fails to mention that one of the most important components of domestic meat (in terms of biomass as well as socio-cultural aspects) is the mithun *Bos frontalis*. An adult mithun weighs about 500kg and its meat forms a key source of protein for remote villages. The mithun holds a strong cultural meaning for the various native peoples of northeastern India and continues to be used as a token of currency and social status. They are sacrificed during specific festivals, such as the Idu festival of *Rẽ*, making them an unalienable component of socio-cultural lives as well as an important part of local economy (Nijhawan 2018). Mithuns are free-ranging, utilising the forests around the village with occasional visits to the village. The HEP, in particular the displacement of entire villages, will have significant impacts on the mithun. In response to local people's concerns about impacts on mithun ('loss of grazing land for the mithun' in Table 5.57), the Report proposes mitigation measures that seem to have no relevance for the free-ranging mithuns in the area (e.g., "All the three action plans will be implemented and developed within the village Gaucher land (land allotted for grazing)"). The proposal to plant nutritional grasses in additional parcels of land ignores published research that mithun are browsers that depend on 42–60 distinct species of naturally occurring trees, lianas, shrubs, and herbs (Taba et al. 2015). Does the Report envision re-creating these entire forest ecosystems for the mithun?

• **Undermining the impacts of migrant labour:** There appears to be a minimization of the negative impacts of the project and local concerns about them throughout the Report (e.g., various repetitions in the top half of Table 5.57). For example, the expected increase in the local population from the influx of an estimated 12,000 additional in-migrants during the construction phase is incorrectly reported to be 150% given that the entire population of the district is 8,004. The many serious socio-cultural, economic, and safety issues resulting from such enormous and sudden demographic changes are lumped under "Cultural Issues" (Table 7.22) leaving the mitigation up to "high-level village committees". In doing so, the Report seems to be arguing that issues of local sovereignty and women's safety (Table 7.22) are cultural matters. What exactly will the User Agency and the new "committees" do to address these very serious threats to local safety and well-being is left unanswered.

• **Contradictory mitigation proposals:** The Report recommends that villagers should be encouraged to do "large scale vegetable and fruit gardening" (Table 7.17). In principle, an attention to the importance of generating alternative sources of local

income is to be appreciated. However, such recommendations directly contradict the mitigation measures the Report proposes for conservation of biodiversity in earlier sections such as compensatory afforestation (page 183). This implies that biodiversity faces direct impacts not only from habitat loss due to the project but also due to "large-scale" agriculture. Furthermore, it refers to these recommendations as "a kind of people's biodiversity conservation plan and will also improve their life quality of villagers". However, how an exercise like the People's Biodiversity Register (PBR) qualifies as a mitigation measure against loss of habitat and associated socio-cultural-economic benefits is left entirely unexplained. Finally, this raises an important question: shouldn't a PBR exercise that documents local knowledge on biodiversity be conducted before and not after the project is developed?

CONCLUSION

At the outset, it is important to highlight that the FAC (2017) concludes an appropriate assessment of the irreversible direct and the indirect impacts of the HEP on the area's biodiversity: "The land in which the project is proposed is in pristine forests with riverine growth that once cut cannot be replaced", and "[the] proposed project falls under the richest bio-geographical province of the Himalayan zone and falls under one of the mega biodiversity hotspots of the world". Study after study has demonstrated that this region and its biodiversity is important both from a regional and a global perspective.

The Report suffers from several technical shortcomings. The sampling was done in a much smaller area (the ZoI) than will see the direct and indirect impacts of the HEP. Even within the ZoI, not all grids were surveyed, ignoring the potentially disastrous impact of the HEP on yet undiscovered and endemic taxa. In the few sampling grids that were surveyed, unscientific and biased methods were often used and not all elevations were sampled despite ample evidence that elevational gradients contribute to the high biodiversity in the Eastern Himalaya. Moreover, several groups of taxa were not surveyed, including numerous insect orders. Excluding highly diverse taxa such as insects and arthropods underestimates biodiversity values. Finally, traditional ecological knowledge and the intricacies of nature-human relations of the local people that inhabit and use these landscapes has been undervalued. Importantly, the report seemed to have ignored a large majority of high quality relevant published literature on Dibang Valley's ecology, geology, and anthropology. Overall, this has resulted in significant discrepancies in assessing the true biodiversity value of the impacted area, including the many RET/endemic species.

Incomplete and inaccurate data lead to an erroneous and inadequate assessment of the impact potential of the proposed HEP on biodiversity. The assessment of impact potential was not based on peer-reviewed methodologies and did not account for the grids that were not sampled, underestimating the biodiversity impacts of the proposed HEP. Moreover, the estimated potential impacts do not account for the loss of feedbacks between trophic levels due to the loss of certain keystone species or habitats. This can and will have far-reaching consequences for the overall stability and resilience of the ecosystem. Trophic interactions are the result of millions of years of evolutionary processes and do not stabilize in a short time when disrupted. Thus, the impact potential reported cannot be used to assess the appropriate mitigatory measures on the potential damage to wildlife and habitat.

The Report's claim of 38.2% of the PAFs being dependent upon forest resources is an underestimate and does not consider the entire range of services that are utilised by forest-dependent communities. Decades of social science research has shown that livelihood strategies in traditional societies are not simply

means for providing cash income, but that they also carry complex socio-cultural meanings and values, which the Report entirely ignores.

Despite the many methodological flaws, and that the study was shortened to under five months (for all taxa, and socio-cultural impact, despite the FAC mandate for a multi-seasonal replicated study), the Report still makes it evident that Dibang Valley is exceptionally rich in biodiversity as every grid cell that was sampled in the field, contained at least one RET/endemic species. It is then striking that based on these results, and without a mandate, the Report goes on to prepare a Wildlife Conservation Plan taking the HEP as a given. This was done without adequately evaluating or discussing the nature of impacts on specific groups, in particular, the Critically Endangered, Endangered, Vulnerable, range-restricted and endemic species that were recorded in the ZoI.

Data from several research studies show that the landscape is highly diverse in species, habitats and ecosystem processes. It is not difficult to see that a large fraction of this biodiversity will be impacted by any disturbance to the habitat. However, the recommendations of this report do not come close to mitigating the significant impacts of this HEP. The few mitigatory measures recommended for some specific faunal groups in the form of butterfly, reptile parks, and nest boxes cannot be considered well-designed ecologically meaningful measures. Further, the Report suggests these mitigation measures with the implicit assumption that they will work without any complications (e.g., whether or not nest boxes will be accepted by all of the 32 cavity nesting bird species and the durability of the nest boxes given the harsh weather). Given the unique and extreme importance of this landscape to regional and global biodiversity, the study does not even attempt to outline relevant and viable mitigatory measures and the extent of damage to wildlife habitats, ecosystem services, and local people. For instance, no mitigatory measures are provided for the loss of habitat either for mammals or riverine birds, despite Dibang Valley harbouring some of the highest riverine bird diversity in the world.

In other cases, the suggested mitigatory measures assume a patronizing attitude towards the local Idu Mishmi people and emerge from a lack of a nuanced understanding of socio-cultural dynamics and interdependencies between people and the natural environment. The Report recommends large-scale agriculture and a shift to cash crops, without considering the impact of such large scale (possibly monoculture) cultivation on biodiversity, local livelihoods and well-being. In the same vein, the conclusions on the impacts on mithun are short-sighted, and underestimate the cultural significance of these animals. By not accounting for a large influx of labourers and their impacts on the landscape, the wildlife habitat, and on the cultural identity, health and wellbeing of the local people, the Report consistently undermines the impact of this project on multiple fronts.

Finally, and crucially, studies that inform high-level decision-making on historically significant projects, such as the Etalin HEP which would be the largest hydropower project in the country, must go through a transparent and scientifically recognised peer-reviewed process given the pitfalls, numerous discrepancies, and gaps highlighted in this review.

A NOTE ON POLICY IMPLICATIONS

A comprehensive critique of the way impact assessment studies are done in India is beyond the scope of this review. However, whether it is an Environmental Impact Assessment (EIA) report prepared as part of the environmental clearance process under the EIA notification 2006, or specialised biodiversity impact assessment studies prescribed under the forest[i] or wildlife clearance processes[ii], one major concern is that institutions conducting such studies are currently not insulated from the project developers, and are in most cases

(barring a few rare exceptions) funded by the developers themselves. In this particular instance, the very mandate prescribed by the Forest Advisory Committee for the study was truncated and compromised after WII and the User Agency (project developers) were asked to conduct the study on 'mutually agreed terms and conditions' by the MoEFCC. As evident from the Memorandum of Understanding (MoU) signed between the Etalin Hydro Electric Power Company Limited (EHEPL) and WII, one of the terms was: "Whenever solicited, WII shall render its expertise as per the needs of EHEPL at mutually agreed commercial terms". The agencies or institutions conducting such vital biodiversity studies will thus need to be insulated from the project developers in multiple ways in the future. EIAs undertaken in this manner are likely to assume *fait accompli* and decisions resulting from such studies will have irreversible impacts on lives, livelihoods, and the environment.

[i] Diversion of forest land for non-forestry purposes under the Forest (Conservation) Act, 1980

[ii] Permissions from the Standing Committee of the National Board for Wildlife for development activities to be undertaken inside and in specific zones around protected areas as per requirements of the Wildlife (Protection) Act, 1972 or specific orders of the Supreme Court of India.

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Appendix I: Checklist of free-living Protozoans (Eukaryota) from Dibang River basin. Alfred (2006b) does not provide information on whether the species were recorded in Lower Dibang Valley District, Dibang Valley District, or both.

	Order	Family	Species	Source
1	Arcellinida	Arcellidae	*Arcella discoides*	Alfred (2006b)
2	Arcellinida	Centropyxidae	*Centropyxis aerophila*	Alfred (2006b)
3	Arcellinida	Centropyxidae	*Centropyxis ecornis*	Alfred (2006b)
4	Arcellinida	Centropyxidae	*Centropyxis laevigata*	Alfred (2006b)
5	Arcellinida	Centropyxidae	*Centropyxis spinosa*	Alfred (2006b)
6	Arcellinida	Centropyxidae	*Centropyxis sylvatica*	Alfred (2006b)
7	Arcellinida	Heleoperidae	*Heleopera rosea*	Alfred (2006b)
8	Arcellinida	Nebelidae	*Nebela dentistoma*	Alfred (2006b)
9	Arcellinida	Nebelidae	*Nebela tincta*	Alfred (2006b)
10	Arcellinida	Plagiopyxidae	*Bullinularia indica*	Alfred (2006b)
11	Arcellinida	Plagiopyxidae	*Plagiopyxis callida*	Alfred (2006b)
12	Arcellinida	Plagiopyxidae	*Plagiopyxis minuta*	Alfred (2006b)
13	Arcellinida	Trigonopyxidae	*Cyclopyxis arcelloides*	Alfred (2006b)
14	Euglyphida	Cyphoderiidae	*Corythion dubium*	Alfred (2006b)
15	Euglyphida	Euglyphidae	*Assulina muscorum*	Alfred (2006b)
16	Euglyphida	Euglyphidae	*Euglypha rotunda*	Alfred (2006b)
17	Euglyphida	Euglyphidae	*Euglypha tuberculata*	Alfred (2006b)
18	Euglyphida	Euglyphidae	*Tracheleuglypha dentata*	Alfred (2006b)
19	Euglyphida	Trinematidae	*Trinema complanatum*	Alfred (2006b)
20	Euglyphida	Trinematidae	*Trinema enchelys*	Alfred (2006b)
21	Euglyphida	Trinematidae	*Trinema linere*	Alfred (2006b)
22	Euplotida	Euplotidae	*Euplotes muscicola*	Alfred (2006b)
23	Haptorida	Spathidiidae	*Spathidium muscicola*	Alfred (2006b)

Appendix II: Checklist of arachnids, insects and crustaceans reported from Dibang River basin. Alfred (2006b) does not provide information on whether the species were recorded in Lower Dibang Valley District, Dibang Valley District, or both. *Recorded from Dibang Valley District but known to be present in both districts.

	Class	Order	Family	Species	Source
1	Arachnida	Opiliones	Sandokanidae	*Gnomulus roingii*	Alfred (2006b)
2	Arachnida	Scorpiones	Chaerilidae	*Chaerilus dibangvalleycus*	Alfred (2006b)
3	Arachnida	Thelyphonida	Thelyphonidae	*Uropoctus assamensis*	Alfred (2006b)
4	Insecta	Blattaria	Blaberidae	*Panesthia angustipennis cognata*	Alfred (2006b)
5	Insecta	Blattaria	Blaberidae	*Panesthia stellata*	Alfred (2006b)
6	Insecta	Blattaria	Blaberidae	*Pycnoscelus surinamensis*	Alfred (2006b)
7	Insecta	Blattaria	Blaberidae	*Salganaea raggei*	Alfred (2006b)
8	Insecta	Blattaria	Blaberidae	*Stictolampra plicata*	Alfred (2006b)
9	Insecta	Blattaria	Blattidae	*Blatta orientalis*	Alfred (2006b)
10	Insecta	Blattaria	Blattidae	*Homalosilpha ustulata*	Alfred (2006b)
11	Insecta	Blattaria	Ectobiidae	*Blattella germanica*	Alfred (2006b)
12	Insecta	Blattaria	Ectobiidae	*Blattella humbertiana*	Alfred (2006b)
13	Insecta	Coleoptera	Scarabaeidae	*Catharsius molossus*	Alfred (2006b)
14	Insecta	Coleoptera	Scarabaeidae	*Copris indicus*	Alfred (2006b)
15	Insecta	Coleoptera	Scarabaeidae	*Copris repertus*	Alfred (2006b)

	Class	Order	Family	Species	Source
16	Insecta	Coleoptera	Scarabaeidae	*Liatongus vertagus*	Alfred (2006b)
17	Insecta	Coleoptera	Scarabaeidae	*Oniticellus cinctus*	Alfred (2006b)
18	Insecta	Coleoptera	Scarabaeidae	*Oniticellus gayeni*	Alfred (2006b)
19	Insecta	Coleoptera	Scarabaeidae	*Onitis castaneus*	Alfred (2006b)
20	Insecta	Coleoptera	Scarabaeidae	*Onitis falcatus*	Alfred (2006b)
21	Insecta	Coleoptera	Scarabaeidae	*Onitis philemon*	Alfred (2006b)
22	Insecta	Coleoptera	Scarabaeidae	*Onthophagus bengali*	Alfred (2006b)
23	Insecta	Coleoptera	Scarabaeidae	*Onthophagus duporti*	Alfred (2006b)
24	Insecta	Coleoptera	Scarabaeidae	*Onthophagus luridipennis*	Alfred (2006b)
25	Insecta	Coleoptera	Scarabaeidae	*Onthophagus ramosellus*	Alfred (2006b)
26	Insecta	Coleoptera	Scarabaeidae	*Onthophagus rectecornutus*	Alfred (2006b)
27	Insecta	Coleoptera	Scarabaeidae	*Onthophagus remotus*	Alfred (2006b)
28	Insecta	Coleoptera	Scarabaeidae	*Paraphytus hindu*	Alfred (2006b)
29	Insecta	Diptera	Tabanidae	*Tabanus (Tabanus) nephodes*	Alfred (2006b)
30	Insecta	Hymentoptera	Apidae	*Apis cerana*[*]	Gogoi et al. (2018)
31	Insecta	Hymentoptera	Apidae	*Apis dorsata*[*]	Gogoi et al. (2018)
32	Insecta	Hymentoptera	Apidae	*Apis laboriosa*[*]	Gogoi et al. (2018)
33	Insecta	Hymentoptera	Formicidae	*Camponotus compressus*	Alfred (2006b)
34	Insecta	Hymentoptera	Formicidae	*Camponotus sp.*	Alfred (2006b)
35	Insecta	Hymentoptera	Formicidae	*Cardiocondyla nuda*	Alfred (2006b)
36	Insecta	Hymentoptera	Formicidae	*Hypoponera truncata*	Alfred (2006b)
37	Insecta	Hymentoptera	Formicidae	*Myopopone castanea*	Alfred (2006b)
38	Insecta	Hymentoptera	Formicidae	*Pachycondyla astuta*	Alfred (2006b)
39	Insecta	Hymentoptera	Formicidae	*Polyrachis dives*	Alfred (2006b)
40	Insecta	Orthoptera	Acrididae	*Apalacris varicornis*	Alfred (2006b)
41	Insecta	Orthoptera	Acrididae	*Catantops pinguis*	Alfred (2006b)
42	Insecta	Orthoptera	Acrididae	*Eyprepocnemis rosea*	Alfred (2006b)
43	Insecta	Orthoptera	Acrididae	*Heteropternis respondens*	Alfred (2006b)
44	Insecta	Orthoptera	Acrididae	*Phlaeoba assama*	Alfred (2006b)
45	Insecta	Orthoptera	Acrididae	*Phlaeoba infumata*	Alfred (2006b)
46	Insecta	Orthoptera	Acrididae	*Phlaeoba sikkimensis*	Alfred (2006b)
47	Insecta	Orthoptera	Acrididae	*Pternoscirta cinctifemur*	Alfred (2006b)
48	Insecta	Orthoptera	Acrididae	*Spathosternum prasiniferum*	Alfred (2006b)
49	Insecta	Orthoptera	Acrididae	*Sphingonotus longipennis*	Alfred (2006b)
50	Insecta	Orthoptera	Acrididae	*Stenocatantops splendens*	Alfred (2006b)
51	Insecta	Orthoptera	Acrididae	*Trilophidia annulata*	Alfred (2006b)
52	Insecta	Orthoptera	Acrididae	*Xenocatantpops humilis*	Alfred (2006b)
53	Insecta	Orthoptera	Pyrgomorphidiae	*Atractomorpha himalayiea*	Alfred (2006b)
54	Malacostraca	Decapoda	Gecarcinucidae	*Barytelphusa lugubris*	Alfred (2006b)
55	Malacostraca	Decapoda	Palaemonidae	*Macrobrachium hendersonii*	Alfred (2006b)

Appendix III: Checklist of Butterflies known from Dibang River basin. Key to abbreviations: DS indicates direct sighting in Gogoi (2012) and Gogoi 2020 (Unpublished data); sp. indicates a unidentified species; * reported exclusively from Lower Dibang Valley District; ! reported exclusively from Dibang Valley District.

	Family	Common name	Scientific name	Source
1	Papilionidae	Common Rose	*Pachliopta aristolochiae aristolochiae*	DS
2	Papilionidae	Common Birdwing	*Troides helena cerberus*	DS
3	Papilionidae	Golden Birdwing	*Troides aeacus aeacus*	DS
4	Papilionidae	Common Batwing	*Atrophaneura varuna astorion*	DS
5	Papilionidae	Lesser Batwing	*Atrophaneura aidoneus*	DS
6	Papilionidae	De Nicéville's Windmill	*Byasa polla*	DS
7	Papilionidae	Common Windmill	*Byasa polyeuctes polyeuctes*	DS
8	Papilionidae	Great Windmill	*Byasa dasarada dasarada*	DS
9	Papilionidae	Tawny Mime	*Papilio agestor agestor*	DS
10	Papilionidae	Lesser Mime	*Papilio epycides epycides*	DS
11	Papilionidae	Common Mime	*Papilio clytia clytia*	DS
12	Papilionidae	Common Mormon	*Papilio polytes romulus*	DS
13	Papilionidae	Lime Butterfly	*Papilio demoleus demoleus* *	DS
14	Papilionidae	Common Raven	*Papilio castor castor*	DS
15	Papilionidae	Red Helen	*Papilio helenus helenus*	DS
16	Papilionidae	Yellow Helen	*Papilio nephelus chaon*	DS
17	Papilionidae	Great Mormon	*Papilio memnon agenor*	DS
18	Papilionidae	Spangle	*Papilio protenor euprotenor*	DS
19	Papilionidae	Redbreast	*Papilio alcmenor alcmenor*	DS
20	Papilionidae	Common Peacock	*Papilio polyctor ganesa* *	DS
21	Papilionidae	Paris Peacock	*Papilio paris paris*	DS
22	Papilionidae	Krishna Peacock	*Papilio krishna*	DS
23	Papilionidae	Blue Peacock	*Papilio arcturus*	DS
24	Papilionidae	Fivebar Swordtail	*Graphium antiphates pompilius*	DS
25	Papilionidae	Fourbar Swordtail	*Graphium agetes agetes*	DS
26	Papilionidae	Common Jay	*Graphium doson axion*	DS
27	Papilionidae	Lesser Jay	*Graphium evemon albociliatis*	DS
28	Papilionidae	Veined Jay	*Graphium chironides chironides*	DS
29	Papilionidae	Tailed Jay	*Graphium agamemnon agamemnon*	DS
30	Papilionidae	Common Bluebottle	*Graphium sarpedon sarpedon*	DS
31	Papilionidae	Great Zebra	*Graphium xenocles xenocles*	DS
32	Papilionidae	White Dragontail	*Lamproptera curius curius*	DS
33	Papilionidae	Green Dragontail	*Lamproptera meges indistincta*	DS
34	Papilionidae	Brown Gorgon	*Meandrusa lachinus lachinus*	DS
35	Papilionidae	Yellow Gorgon	*Meandrusa payeni evan*	DS
36	Papilionidae	Black Windmill	*Byasa crassipes* *	Roy & Matsuda (Unpublished record 2018)
37	Pieridae	One-Spot Grass Yellow	*Eurema andersoni andersoni*	DS
38	Pieridae	Three-Spot Grass Yellow	*Eurema blanda silhetana*	DS
39	Pieridae	Small Grass Yellow	*Eurema brigitta rubella*	DS
40	Pieridae	Common Grass Yellow	*Eurema hecabe hecabe*	DS
41	Pieridae	Tree Yellow	*Gandaca harina assamica*	DS

	Family	Common name	Scientific name	Source
42	Pieridae	Tibetan Brimstone	*Gonepteryx amintha thibetana*	DS
43	Pieridae	Tailed Sulphur	*Dercas verhuelli doubledayi*	DS
44	Pieridae	Common Emigrant	*Catopsilia pomona pomona* *	DS
45	Pieridae	Mottled Emigrant	*Catopsilia pyranthe pyranthe* *	DS
46	Pieridae	Dark Clouded Yellow	*Colias fieldii fieldii*	DS
47	Pieridae	Yellow Orange Tip	*Ixias pyrene familiaris*	DS
48	Pieridae	Pale Wanderer	*Pareronia avatar avatar*	DS
49	Pieridae	Chocolate Albatross	*Appias lyncida hippoides*	DS
50	Pieridae	Orange Albatross	*Appias nero galba*	DS
51	Pieridae	Common Albatross	*Appias albina darada*	DS
52	Pieridae	Spot Puffin	*Appias lalage lalage*	DS
53	Pieridae	Plain Puffin	*Appias indra indra*	DS
54	Pieridae	Large Cabbage White	*Pieris brassicae*	DS
55	Pieridae	Bhutan Blackvein	*Aporia harrietae*	DS
56	Pieridae	Green-veined White	*Pieris napi montana*	DS
57	Pieridae	Indian Cabbage White	*Pieris canidia indica*	DS
58	Pieridae	Lesser Gull	*Cepora nadina nadina*	DS
59	Pieridae	Common Gull	*Cepora nerissa*	DS
60	Pieridae	Spotted Sawtooth	*Prioneris thestylis thestylis*	DS
61	Pieridae	Redspot Sawtooth	*Prioneris clemanthe*	DS
62	Pieridae	Hill Jezebel	*Delias belladonna lugens*	DS
63	Pieridae	Dark Jezebel	*Delias berinda*	DS
64	Pieridae	Pale Jezebel	*Delias sanaca*	DS
65	Pieridae	Red-breast Jezebel	*Delias acalis pyramus*	DS
66	Pieridae	Yellow Jezebel	*Delias agostina agostina*	DS
67	Lycaenidae	Angled Sunbeam	*Curetis dentata dentata*	DS
68	Lycaenidae	Forest Pierrot	*Taraka hamada mendesia*	DS
69	Lycaenidae	Straight Pierrot	*Caleta roxus roxana*	DS
70	Lycaenidae	Elbowed Pierrot	*Caleta elna noliteia*	DS
71	Lycaenidae	Common Pierrot	*Castalius rosimon rosimon*	DS
72	Lycaenidae	Greater Spotted Blue	*Phengaris atroguttatus* !	Singh & Das (2016)
73	Lycaenidae	Pointed Pierrot	*Tarucus indica* *	DS
74	Lycaenidae	Silver Royal	*Ancema blanka*	DS
75	Lycaenidae	Bi-Spot Royal	*Ancema ctesia ctesia*	DS
76	Lycaenidae	Chocolate Royal	*Remelana jangala ravata*	DS
77	Lycaenidae	Centaur Oakblue	*Arhopala centaurus pirithous*	DS
78	Lycaenidae	Hooked Oakblue	*Arhopala paramuta*	DS
79	Lycaenidae	Variegated Plushblue	*Flos adriana*	DS
80	Lycaenidae	Spangled Plushblue	*Flos asoka*	DS
81	Lycaenidae	Common Acacia Blue	*Surendra vivarna*	DS
82	Lycaenidae	Silver Streaked Acacia Blue	*Zinaspa todara distorta*	DS
83	Lycaenidae	Yamfly	*Loxura atymnus continentalis*	DS
84	Lycaenidae	Branded Yamfly	*Yasoda tripunctata tripunctata*	DS
85	Lycaenidae	Common Imperial	*Cheritra freja freja*	DS
86	Lycaenidae	Blue Imperial	*Ticherra acte*	DS

	Family	Common name	Scientific name	Source
87	Lycaenidae	Common Tit	*Hypolycaena erylus himavantus*	DS
88	Lycaenidae	Blue Tit	*Chliaria kina cachara*	DS
89	Lycaenidae	Fluffy Tit	*Zeltus amasa*	DS
90	Lycaenidae	Common Flash	*Rapala nissa ratna*	DS
91	Lycaenidae	Slate Flash	*Rapala manea schistacea*	DS
92	Lycaenidae	Copper Flash	*Rapala pheritima*	DS
93	Lycaenidae	-	*Euaspa mikamii* !	Das et al. (2019)
94	Lycaenidae	-	Euaspa motokii !	Das et al. (2019)
95	Lycaenidae		*Ahlbergia sp.* !	G. N. Das (pers. comm)
96	Lycaenidae	Common Tinsel	*Catapoecilma elegans*	DS
97	Lycaenidae	Evans Silverline	*Spindasis evansii*	DS
98	Lycaenidae	Khaki Silverline	*Spindasis rukmini*	DS
99	Lycaenidae	Long-banded Silverline	*Spindasis lohita himalayanus*	DS
100	Lycaenidae	Chinese Silverline	*Spindasis zhengweilie*	DS
101	Lycaenidae	Purple Sapphire	*Heliophorus epicles*	DS
102	Lycaenidae	Green Sapphire	*Heliophorus moorei*	DS
103	Lycaenidae	Golden Sapphire	*Heliophorus brahma major*	DS
104	Lycaenidae	Common Ciliate Blue	*Anthene emolus emolus*	DS
105	Lycaenidae	Pointed Cilate Blue	*Anthene lycaenina lycaenina*	DS
106	Lycaenidae	Zebra Blue	*Leptotes plinius plinius* *	DS
107	Lycaenidae	Large-4-Lineblue	*Nacaduba pactolus continentalis*	DS
108	Lycaenidae	Pale-4-Lineblue	*Nacaduba hermus nabo*	DS
109	Lycaenidae	Transparent 6-Lineblue	*Nacaduba kurava euplea*	DS
110	Lycaenidae	Banded Lineblue	*Prosotas aluta coelestis*	DS
111	Lycaenidae	Common Lineblue	*Prosotas nora nora*	DS
112	Lycaenidae	Straight Winged Blue	*Orthomiella pontis*	Singh & Das (2016)
113	Lycaenidae	Pointed Lineblue	*Lonolyce helicon merguiana*	DS
114	Lycaenidae	Dingy Lineblue	*Petrelaea dana*	DS
115	Lycaenidae	Common Cerulean	*Jamides celeno celeno*	DS
116	Lycaenidae	Dark Cerulean	*Jamides bochus bochus*	DS
117	Lycaenidae	Glistening Cerulean	*Jamides elpis pseudelpis*	DS
118	Lycaenidae	Metallic Cerulean	*Jamides alecto eurysaces*	DS
119	Lycaenidae	Forget-me-not	*Catochrysops strabo srrabo*	DS
120	Lycaenidae	Peablue	*Lampides boeticus*	DS
121	Lycaenidae	Pale Spark	*Sinthusa virgo*	DS
122	Lycaenidae	Dark Grass Blue	*Zizeeria karsandra*	DS
123	Lycaenidae	Pale Grass Blue	*Pseudozizeeria maha maha*	DS
124	Lycaenidae	Eastern Grass Jewel	*Freyeria putli* *	DS
125	Lycaenidae	Grass Jewel	*Freyeria trochylus* *	DS
126	Lycaenidae	Lesser Grass Blue	*Zizina otis otis*	DS
127	Lycaenidae	Malayan	*Megisba malaya*	DS
128	Lycaenidae	Common Hedge Blue	*Acytolepis puspa gisca*	DS
129	Lycaenidae	Pale Hedge Blue	*Udara cardia dilecta*	DS
130	Lycaenidae	Albocerulean	*Udara albocaerulea*	DS
131	Lycaenidae	Plain Hedge Blue	*Celastrina lavendularis limbata*	DS
132	Lycaenidae	Hill Hedge Blue	*Celastrina argiolus sikkima*	DS

	Family	Common name	Scientific name	Source
133	Lycaenidae	White banded Hedgeblue	*Lycaenopsis transpectus*	DS
134	Lycaenidae	Margined Hedgeblue	*Celatoxia marginata*	DS
135	Lycaenidae	Large Hedge Blue	*Celastrina huegelii oreana*	DS
136	Lycaenidae	Moore's Cupid	*Shijimia moorei*	DS
137	Lycaenidae	False Tibetan Cupid	*Tongeia pseudozuthus*	DS
138	Lycaenidae	Lime Blue	*Chilades laius laius* *	DS
139	Lycaenidae	Blue Posy	*Drupadia scaeva* !	Das et al. (2018)
140	Riodinidae	Dark Judy	*Abisara fylla*	DS
141	Riodinidae	Punchinello	*Zemeros flegyas indicus*	DS
142	Riodinidae	Mixed Punch	*Dodona ouida*	DS
143	Riodinidae	Lesser Punch	*Dodona dipoea*	DS
144	Riodinidae	Tailed Punch	*Dodona eugens*	DS
145	Riodinidae	Striped Punch	*Dodonia adonira naga*	DS
146	Nymphalidae	Club Beak	*Libythea myrrha sanguinalis*	DS
147	Nymphalidae	Common Beak	*Libythea lepita lepita*	DS
148	Nymphalidae	Striped Tiger	*Danaus genutia*	DS
149	Nymphalidae	Blue Tiger	*Tirumala limniace mutina*	DS
150	Nymphalidae	Dark Blue Tiger	*Tirumala septentrionis*	DS
151	Nymphalidae	Glassy Tiger	*Parantica aglea melanoides*	DS
152	Nymphalidae	Chestnut Tiger	*Parantica sita*	DS
153	Nymphalidae	Chocolate Tiger	*Parantica melaneus*	DS
154	Nymphalidae	Striped Blue Crow	*Euploea mulciber mulciber*	DS
155	Nymphalidae	Long-branded Blue Crow	*Euploea algea deione*	DS
156	Nymphalidae	Magpie Crow	*Euploea radamanthus radamanthus*	DS
157	Nymphalidae	Common Nawab	*Polyura athamas athamas*	DS
158	Nymphalidae	Great Nawab	*Polyura eudamippus eudamippus*	DS
159	Nymphalidae	Pallid Nawab	*Polyura arja arja*	DS
160	Nymphalidae	Stately Nawab	*Polyura dolon*	Mekola, I (pers comm. 2018)
161	Nymphalidae	Tawny Rajah	*Charaxes bernardus hierax*	DS
162	Nymphalidae	Scarce Tawny Rajah	*Charaxes aristogiton*	DS
163	Nymphalidae	Variegated Rajah	*Charaxes kahruba*	DS
164	Nymphalidae	Yellow Rajah	*Charaxes marmax marmax*	DS
165	Nymphalidae	Jungle Glory	*Thaumantis diores diores*	DS
166	Nymphalidae	Common Faun	*Faunis canens*	DS
167	Nymphalidae	Common Duffer	*Discophora sondaica*	DS
168	Nymphalidae	Common Evening Brown	*Melanitis leda*	DS
169	Nymphalidae	Scarce Evening Brown	*Cyllogenes janetae* !	Singh & Das (2016)
170	Nymphalidae	Bamboo Treebrown	*Lethe europa niladana*	DS
171	Nymphalidae	Banded Treebrown	*Lethe confusa*	Singh & Das (2016)
172	Nymphalidae	Straight Banded Treebrown	*Lethe verma*	DS
173	Nymphalidae	Common Red Forester	*Lethe mekara zuchara*	DS
174	Nymphalidae	Angled Red Forester	*Lethe chandica flanona*	DS
175	Nymphalidae	Tailed Red Forester	*Lethe sinorix*	DS
176	Nymphalidae	Blue Forester	*Lethe scanda*	DS

	Family	Common name	Scientific name	Source
177	Nymphalidae	Common Forester	*Lethe insana*	DS
178	Nymphalidae	Dull Forester	*Lethe gulnihal*	DS
179	Nymphalidae	Brown Forester	*Lethe serbonis*	DS
180	Nymphalidae	Scarce Red Forester	*Lethe distans* !	Singh & Das (2016)
181	Nymphalidae	Common Woodbrown	*Lethe sidonis sidonis*	DS
182	Nymphalidae	Barred Woodbrown	*Lethe maitrya*	DS
183	Nymphalidae	Yellow Woodbrown	*Lethe nicetas*	DS
184	Nymphalidae	Moeller's Silverfork	*Lethe moelleri*	DS
185	Nymphalidae	Small Goldenfork	*Lethe atkinsonia*	DS
186	Nymphalidae	Large Goldenfork	*Lethe goalpara*	DS
187	Nymphalidae	Single Silverstripe	*Lethe ramadeva*	DS
188	Nymphalidae	Lilacfork	*Lethe sura*	DS
189	Nymphalidae	Scarce Labyrinth	*Neope pulahina*	DS
190	Nymphalidae	Dusky Labyrinth	*Neope yama*	DS
191	Nymphalidae	Veined Labyrinth	*Neope pulaha*	DS
192	Nymphalidae	Tailed Labyrinth	*Neope bhadara*	Singh & Das (2016)
193	Nymphalidae	Chumbi Wall	*Chonala masoni*	DS
194	Nymphalidae	Large Tawny Wall	*Rhapicera satricus*	DS
195	Nymphalidae	Small Tawny Wall	*Rhapicera moorei*	Singh & Das (2016)
196	Nymphalidae	Dusky Diadem	*Ethope himachala*	DS
197	Nymphalidae	Yellow Owl	*Neorina hilda*	DS
198	Nymphalidae	Yellow Kaiser	*Penthema lisarda lisarda*	DS
199	Nymphalidae	Empress	*Sasakia funebris* !	Singh & Das (2016)
200	Nymphalidae	Common Palmfly	*Elymnias hypermenestra undularis*	DS
201	Nymphalidae	Spotted Palmfly	*Elymnias malelas malelas*	DS
202	Nymphalidae	Whitebar Bushbrown	*Mycalesis anaxias*	DS
203	Nymphalidae	Watson's Bushbrown	*Mycalesis adamsoni*	DS
204	Nymphalidae	Plain Busbrown	*Mycalesis malsarida*	DS
205	Nymphalidae	Common Bushbrown	*Mycalesis perseus blasius*	DS
206	Nymphalidae	Dark-brand Bushbrown	*Mycalesis mineus mineus*	DS
207	Nymphalidae	Long-brand Bushbrown	*Mycalesis visala visala*	DS
208	Nymphalidae	Salmon-branded Bushbrown	*Mycalesis misenus misenus*	DS
209	Nymphalidae	Bright-eye Bushbrown	*Mycalesis nicotia*	DS
210	Nymphalidae	Nigger	*Orsotrioena medus medus*	DS
211	Nymphalidae	Striped Ringlet	*Ragadia crisilda crisilda*	DS
212	Nymphalidae	Dark Catseye	*Zipoetis scylax*	DS
213	Nymphalidae	Mottled Argus	*Hemadara narasingha*	DS
214	Nymphalidae	Himalayan Fivering	*Ypthima parasakra*	DS
215	Nymphalidae	Large Threering	*Ypthima newara*	DS
216	Nymphalidae	Common Fiverring	*Ypthima baldus baldus*	DS
217	Nymphalidae	Common Fourring	*Ypthima huebneri*	DS
218	Nymphalidae	Ring sp.	*Ypthima* sp.	DS
219	Nymphalidae	Roy's Argus	*Callerebia dibangensis*	DS
220	Nymphalidae	Pallid Argus	*Callerebia scanda*	DS
221	Nymphalidae	Argus species	*Callerebia* sp.	DS

	Family	Common name	Scientific name	Source
222	Nymphalidae	Doherty's Satyr	*Aulocera loha*	DS
223	Nymphalidae	Striated Satyr	*Aulocera saraswatti*	Singh & Das (2016)
224	Nymphalidae	Yellow Coster	*Acraea issoria issoria*	DS
225	Nymphalidae	Tawny Coster	*Acraea violae*	DS
226	Nymphalidae	Red Lacewing	*Cethosia biblis tisamena*	DS
227	Nymphalidae	Leopard Lacewing	*Cethosia cyane cyane*	DS
228	Nymphalidae	Indian Fritillary	*Argynnis hyperbius hyperbius*	DS
229	Nymphalidae	Yellow Dryad	*Aemona amathusia*	DS
230	Nymphalidae	Cruiser	*Vindula erota erota*	DS
231	Nymphalidae	Common Yeoman	*Cirrochroa tyche mithila*	DS
232	Nymphalidae	Large Yeoman	*Cirrochroa aoris aoris*	DS
233	Nymphalidae	Rustic	*Cupha erymanthis lotis*	DS
234	Nymphalidae	Vagrant	*Vagrans egista sinha*	DS
235	Nymphalidae	Common Leopard	*Phalanta phalantha phalantha*	DS
236	Nymphalidae	Large Silverstripe	*Argynnis childreni* !	Singh & Das (2016)
237	Nymphalidae	Green Commodore	*Sumalia daraxa daraxa*	DS
238	Nymphalidae	Commodore	*Auzakia danava danava*	DS
239	Nymphalidae	White Commodore	*Parasarpa dudu dudu*	DS
240	Nymphalidae	Scarce White Commodore	*Limenitis zulema*	DS
241	Nymphalidae	Grey Commodore	*Bhagadatta austenia*	DS
242	Nymphalidae	Bicolour Commodore	*Parasarpa zayla*	DS
243	Nymphalidae	Commander	*Moduza procris procris*	DS
244	Nymphalidae	Studded Sergent	*Athyma asura asura*	DS
245	Nymphalidae	Himalayan Sergent	*Athyma opalina orientalis*	DS
246	Nymphalidae	Blackvein Sergent	*Athyma ranga ranga*	DS
247	Nymphalidae	Staff Sergent	*Athyma selenophora selenophora*	DS
248	Nymphalidae	Small Staff Sergent	*Athyma zeroca zeroca*	DS
249	Nymphalidae	Orange Staff Sergent	*Athyma cama*	DS
250	Nymphalidae	Common Lascar	*Pantoporia hordonia hordonia*	DS
251	Nymphalidae	Perak Lascar	*Pantoporia peraka*	DS
252	Nymphalidae	Great Yellow Sailer	*Neptis radha radha*	DS
253	Nymphalidae	Yellow Sailer	*Neptis ananta ochracea*	DS
254	Nymphalidae	Small Yellow Sailer	*Neptis miah miah*	DS
255	Nymphalidae	Pale Hockeystick Sailer	*Neptis manasa manasa*	DS
256	Nymphalidae	Great Hockey Stick Sailer	*Phaedyma aspasia* !	Singh & Das (2016)
257	Nymphalidae	Common Sailer	*Neptis hylas astola*	DS
258	Nymphalidae	Creamy Sailer	*Neptis soma soma*	DS
259	Nymphalidae	Sullied Sailer	*Neptis clinia susruta*	DS
260	Nymphalidae	Pallas Sailer	*Neptis sappho*	DS
261	Nymphalidae	Broad-banded Sailer	*Neptis sankara amba*	DS
262	Nymphalidae	Dingy Sailer	*Neptis pseudovikasi*	DS
263	Nymphalidae	Plain Sailer	*Neptis cartica cartica*	DS
264	Nymphalidae	Pale Green Sailer	*Neptis zaida*	DS
265	Nymphalidae	Short-banded Sailer	*Phaedyma columella ophiana*	DS
266	Nymphalidae	Common Baron	*Euthalia aconthea*	DS

	Family	Common name	Scientific name	Source
267	Nymphalidae	Blue Baron	*Euthalia telchinia*	DS
268	Nymphalidae	Gaudy Baron	*Euthalia lubentina*	DS
269	Nymphalidae	French Duke	*Euthalia franciae*	DS
270	Nymphalidae	Grand Duchess	*Euthalia patala*	DS
271	Nymphalidae	White edge Blue Baron	*Euthalia phemius*	DS
272	Nymphalidae	Dark Archduke	*Lexias dirtea khasiana*	DS
273	Nymphalidae	Bronze Duke	*Euthalia nara* !	Singh & Das (2016)
274	Nymphalidae	Green Duke	*Euthalia sahadeva* !	Singh & Das (2016)
275	Nymphalidae	Blue Duke	*Bassarona durga* !	Singh & Das (2016)
276	Nymphalidae	Grey Count	*Tanaecia lepida* *	DS
277	Nymphalidae	Common Earl	*Tanaecia julii*	DS
278	Nymphalidae	Plain Earl	*Tanaecia jahnu*	DS
279	Nymphalidae		*Limenitis rileyi* !	Roy (2017)
280	Nymphalidae	Common Map	*Cyrestis thyodamas thyodamas*	DS
281	Nymphalidae	Common Maplet	*Chersonesia risa*	DS
282	Nymphalidae	Tabby	*Pseudergolis wedah*	DS
283	Nymphalidae	Constable	*Dichorrhagia nesimachus*	DS
284	Nymphalidae	Popinjay	*Stibochiona nicea*	DS
285	Nymphalidae	Angled Castor	*Ariadne ariadne pallidior* *	DS
286	Nymphalidae	Common Castor	*Ariadne merione tapestrina* *	DS
287	Nymphalidae	Sergeant Emperor	*Mimathyma chevana*	DS
288	Nymphalidae	Indian Purple Emperor	*Mimathyma ambica*	DS
289	Nymphalidae	Courtesan	*Euripus nyctelius*	DS
290	Nymphalidae	Circe	*Hestinalis nama*	DS
291	Nymphalidae	Eastern Courtier	*Sephisa chandra*	DS
292	Nymphalidae	Common Jester	*Symbrenthia lilaea khasiana*	DS
293	Nymphalidae	Spotted Jester	*Symbrenthia hypselis cotanda*	DS
294	Nymphalidae	Blue tailed Jester	*Symbrenthia niphanda*	Singh & Das (2016)
295	Nymphalidae	Indian Red Admiral	*Vanessa indica indica*	DS
296	Nymphalidae	Painted Lady	*Vanessa cardui*	DS
297	Nymphalidae	Blue Admiral	*Kaniska canace canace*	DS
298	Nymphalidae	Black Prince	*Rohana parisatis*	DS
299	Nymphalidae	Brown Prince	*Rohana parvata*	DS
300	Nymphalidae	Chocolate Pansy	*Junonia iphita iphita*	DS
301	Nymphalidae	Grey Pansy	*Junonia atlites*	DS
302	Nymphalidae	Peacock Pansy	*Junonia almana almana*	DS
303	Nymphalidae	Lemon Pansy	*Junonia lemonias lemonias*	DS
304	Nymphalidae	Great Eggfly	*Hypolimnas bolina*	DS
305	Nymphalidae	Orange Oakleaf	*Kallima inachus inachus*	DS
306	Nymphalidae	Scarce Blue Oakleaf	*Kallima knyvetti* !	Singh & Das (2016)
307	Nymphalidae	Autumn Leaf	*Doleschallia bisaltide indica*	DS
308	Nymphalidae	Panther	*Neurosigma doubledayi*	DS
309	Nymphalidae	Abor Freak	*Callinaga aborica* !	Mekola, I (pers comm. 2018)
310	Nymphalidae	Tiger Brown	*Orinoma damaris*	DS
311	Nymphalidae	Manipur Jungle Queen	*Stichophthalma sparta*	

	Family	Common name	Scientific name	Source
312	Nymphalidae	Northern Jungle Queen	*Stichophthalma camadeva* !	Singh & Das (2016)
313	Hesperiidae	Branded Orange Awlet	*Burara oedipodea aegina*	DS
314	Hesperiidae	Orange Awlet	*Burara jaina vasundhara*	DS
315	Hesperiidae	Small Green Awlet	*Burara amara*	DS
316	Hesperiidae	Green Awlet	*Burara vasutana*	DS
317	Hesperiidae	Pale Green Awlet	*Burara gomata gomata*	DS
318	Hesperiidae	Slate Awl	*Hasora anura danda*	DS
319	Hesperiidae	Common Awl	*Hasora badra badra*	DS
320	Hesperiidae	Plain Banded Awl	*Hasora vita indica*	DS
321	Hesperiidae	Common Banded Awl	*Hasora chromus*	DS
322	Hesperiidae	White-banded Awl	*Hasora taminatus bhavara*	DS
323	Hesperiidae	Brown Awl	*Badamia exclamationis*	DS
324	Hesperiidae	Orange-tail Awl	*Bibasis sena sena*	DS
325	Hesperiidae	Indian Awlking	*Choaspes benjaminii*	DS
326	Hesperiidae	Common Spotted Flat	*Celaenorrhinus leucocera chinensis*	DS
327	Hesperiidae	Dark Yellow-banded Flat	*Celaenorrhinus aurivittata aurivittata*	DS
328	Hesperiidae	Himalayan White Flat	*Seseria dohertyi*	DS
329	Hesperiidae	Fulvous Pied Flat	*Pseudocoladenia dan*	DS
330	Hesperiidae	Hairy Angle	*Darpa hanria*	DS
331	Hesperiidae	White Yellow-breast Flat	*Gerosis sinica indica*	DS
332	Hesperiidae	Water Snow Flat	*Tagiades litigiosa litigiosa*	DS
333	Hesperiidae	Yellow Flat	*Mooreana trichoneura pralaya*	DS
334	Hesperiidae	Chestnut Angle	*Odontoptilum angulata*	DS
335	Hesperiidae	Tawny Angle	*Ctenoptilum vasava vasava*	DS
336	Hesperiidae	Striped Dawnfly	*Capila jayadeva*	DS
337	Hesperiidae	Small Indian Palm Bob	*Suastus minuta aditia*	DS
338	Hesperiidae	Common Dartlet	*Oriens gola gola*	DS
339	Hesperiidae	Common Dart	*Potanthus pseudomaesa*	DS
340	Hesperiidae	Broad Bident Dart	*Potanthus trachala tytleri*	DS
341	Hesperiidae	Chinese Dart	*Potanthus confucius*	DS
342	Hesperiidae	Sikkim Dart	*Potanthus mara*	DS
343	Hesperiidae	Pale Palm Dart	*Telicota colon*	DS
344	Hesperiidae	Dark Palm Dart	*Telicota ancilla*	DS
345	Hesperiidae	Light Straw Ace	*Pithauria stramineipennis*	DS
346	Hesperiidae	Dark Straw Ace	*Pithauria murdava*	DS
347	Hesperiidae	Chequered Ace	*Thoressa hyrie*	DS
348	Hesperiidae	Ace sp.	*Thoressa* sp.	DS
349	Hesperiidae	Northern Spotted Ace	*Thoressa cerata*	DS
350	Hesperiidae	Banded Ace	*Halpe zema zema*	DS
351	Hesperiidae	Moore's Ace	*Halpe porus*	DS
352	Hesperiidae	Plain Ace	*Halpe kumara*	DS
353	Hesperiidae	Indian Ace	*Halpe homolea*	DS
354	Hesperiidae	Tufted Ace	*Sebastonyma dolopia*	DS
355	Hesperiidae	Brown Bush Bob	*Pedesta pandita*	DS
356	Hesperiidae	Bush Bob sp	*Pedesta* sp.	DS
357	Hesperiidae	Figure of 8 Swift	*Caltoris pagana*	DS

	Family	Common name	Scientific name	Source
358	Hesperiidae	Colon Swift	*Caltoris cahira cara*	DS
359	Hesperiidae	Paintbrush Swift	*Baoris farri*	DS
360	Hesperiidae	Contiguous Swift	*Polytremis lubricans*	DS
361	Hesperiidae	Yellow-Spot Swift	*Polytremis eltola*	DS
362	Hesperiidae	Himalayan Swift	*Polytremes discreta*	DS
363	Hesperiidae	Straight Swift	*Parnara bada*	DS
364	Hesperiidae	Bevan's Swift	*Pseudoborbo bevani*	DS
365	Hesperiidae	Tree Flitter	*Hyarotis adrastus praba*	DS
366	Hesperiidae	Purple and Gold Flitter	*Zographetus satwa*	DS
367	Hesperiidae	Black-veined Redeye	*Matapa sasivarna*	DS
368	Hesperiidae	Spotted Redeye	*Pudicita pholus*	Singh & Das (2016)
369	Hesperiidae	Hedge Hopper	*Baracus vittatus septentrionum*	DS
370	Hesperiidae	Large Forest Bob	*Scobura cephaloides cephaloides*	DS
371	Hesperiidae	Dark Velvet Bob	*Koruthaialos butleri butleri*	DS
372	Hesperiidae	Chocolate Demon	*Ancistroides nigrita*	DS
373	Hesperiidae	Common Banded Demon	*Notocrypta paralysos alysia*	DS
374	Hesperiidae	Spotted Demon	*Notocrypta feisthameli alysos*	DS
375	Hesperiidae	Grass Demon	*Udaspes folus*	DS
376	Hesperiidae	Forest Hopper	*Asticopterus jama kada*	DS
377	Hesperiidae	Veined Scrub Hopper	*Aeromachus stigmatus*	DS
378	Hesperiidae	Grey Scrub Hopper	*Aeromachus jhora creta*	DS
379	Hesperiidae	Hedge Hopper sp.	*Baracus* sp.	DS
380	Hesperiidae	Manipur Ace	*Sovia malta*	DS
381	Hesperiidae	Lucas' Ace	*Sovia magna*	DS

Appendix IV: Checklist of birds known from Dibang River basin. Abbreviations and symbols: *Evidence exclusively from Lower Dibang Valley District. ǂEvidence exclusively from Dibang Valley District. IUCN Red List categories: DD – Data deficient; CR – Critically Endangered; EN – Endangered; LC – Least concern; NT – Near threatened; VU – Vulnerable; WLPA – Indian Wild Life Protection Act, 1972; SoIB – State of India's Birds (2020). Source: eBird (2020).

	Family	Common name	Scientific name	SoIB concern status	IUCN Red List	WLPA schedule
1	Anatidae (Ducks, Geese, and Waterfowl)	Fulvous Whistling-Duck	*Dendrocygna bicolor* *	Low	LC	Schedule-I
2	Anatidae (Ducks, Geese, and Waterfowl)	Lesser Whistling-Duck	*Dendrocygna javanica* *	Low	LC	Schedule-IV
3	Anatidae (Ducks, Geese, and Waterfowl)	Graylag Goose	*Anser anser**	Low	LC	Schedule-IV
4	Anatidae (Ducks, Geese, and Waterfowl)	Ruddy Shelduck	*Tadorna ferruginea*	Low	LC	Schedule-IV
5	Anatidae (Ducks, Geese, and Waterfowl)	Gadwall	*Mareca strepera* *	Low	LC	Schedule-IV
6	Anatidae (Ducks, Geese, and Waterfowl)	Eurasian Wigeon	*Mareca Penelope*	Low	LC	Schedule-IV
7	Anatidae (Ducks, Geese, and Waterfowl)	Indian Spot-billed Duck	*Anas poecilorhyncha* *	Low	LC	Schedule-IV

	Family	Common name	Scientific name	SoIB concern status	IUCN Red List	WLPA schedule
8	Anatidae (Ducks, Geese, and Waterfowl)	Northern Pintail	*Anas acuta* *	Low	LC	Schedule-IV
9	Anatidae (Ducks, Geese, and Waterfowl)	Tufted Duck	*Aythya fuligula* *	Low	LC	Schedule-IV
10	Anatidae (Ducks, Geese, and Waterfowl)	Common Merganser	*Mergus merganser*	Low	LC	Schedule-IV
11	Phasianidae (Pheasants, Grouse, and Allies)	Hill Partridge	*Arborophila torqueola*	Low	LC	Schedule-IV
12	Phasianidae (Pheasants, Grouse, and Allies)	Chestnut-breasted Partridge	*Arborophila mandellii*	High	VU	Schedule-IV
13	Phasianidae (Pheasants, Grouse, and Allies)	Rufous-throated Partridge	*Arborophila rufogularis*	Moderate	LC	Schedule-IV
14	Phasianidae (Pheasants, Grouse, and Allies)	White-cheeked Partridge	*Arborophila atrogularis*	Moderate	NT	Schedule-IV
15	Phasianidae (Pheasants, Grouse, and Allies)	Gray Peacock-Pheasant	*Polyplectron bicalcaratum*	NA	LC	Schedule-I
16	Phasianidae (Pheasants, Grouse, and Allies)	Blue-breasted Quail	*Synoicus chinensis* *	NA	LC	Schedule-IV
17	Phasianidae (Pheasants, Grouse, and Allies)	Swamp Francolin	*Francolinus gularis* *	High	VU	Schedule-IV
18	Phasianidae (Pheasants, Grouse, and Allies)	Red Junglefowl	*Gallus gallus*	Low	LC	Schedule-IV
19	Phasianidae (Pheasants, Grouse, and Allies)	Blood Pheasant	*Ithaginis cruentus*	Moderate	LC	Schedule-I
20	Phasianidae (Pheasants, Grouse, and Allies)	Himalayan Monal	*Lophophorus impejanus*	Low	LC	Schedule-I
21	Phasianidae (Pheasants, Grouse, and Allies)	Sclater's Monal	*Lophophorus sclateri*	High	VU	Schedule-I
22	Phasianidae (Pheasants, Grouse, and Allies)	Blyth's Tragopan	*Tragopan blythii*	High	VU	Schedule-I
23	Phasianidae (Pheasants, Grouse, and Allies)	Temminck's Tragopan	*Tragopan temminckii*	NA	LC	Schedule-I
24	Phasianidae (Pheasants, Grouse, and Allies)	Kalij Pheasant	*Lophura leucomelanos*	Low	LC	Schedule-I
25	Columbidae (Pigeons and Doves)	Rock Pigeon	*Columba livia*	Low	LC	Schedule-IV
26	Columbidae (Pigeons and Doves)	Speckled Wood-Pigeon	*Columba hodgsonii*	Low	LC	Schedule-IV
27	Columbidae (Pigeons and Doves)	Ashy Wood-Pigeon	*Columba pulchricollis*	Moderate	LC	Schedule-IV
28	Columbidae (Pigeons and Doves)	Pale-capped Pigeon	*Columba punicea*	High	VU	Schedule-IV
29	Columbidae (Pigeons and Doves)	Oriental Turtle-Dove	*Streptopelia orientalis*	Low	LC	Schedule-IV
30	Columbidae (Pigeons and Doves)	Spotted Dove	*Streptopelia chinensis*	Low	LC	Schedule-IV
31	Columbidae (Pigeons and Doves)	Barred Cuckoo-Dove	*Macropygia unchall*	Low	LC	Schedule-IV
32	Columbidae (Pigeons and Doves)	Asian Emerald Dove	*Chalcophaps indica*	Low	LC	Schedule-IV
33	Columbidae (Pigeons and Doves)	Ashy-headed Green-Pigeon	*Treron phayrei*	NA	NT	Schedule-IV

	Family	Common name	Scientific name	SoIB concern status	IUCN Red List	WLPA schedule
34	Columbidae (Pigeons and Doves)	Thick-billed Green-Pigeon	*Treron curvirostra*	NA	LC	Schedule-IV
35	Columbidae (Pigeons and Doves)	Pin-tailed Green-Pigeon	*Treron apicauda*	Low	LC	Schedule-IV
36	Columbidae (Pigeons and Doves)	Wedge-tailed Green-Pigeon	*Treron sphenurus*	Low	LC	Schedule-IV
37	Columbidae (Pigeons and Doves)	Green Imperial-Pigeon	*Ducula aenea*	Low	LC	Schedule-IV
38	Columbidae (Pigeons and Doves)	Mountain Imperial-Pigeon	*Ducula badia*	Moderate	LC	Schedule-IV
39	Otididae (Bustards)	Bengal Florican	*Houbaropsis bengalensis* *	High	CR	Schedule-I
40	Cuculidae (Cuckoos)	Greater Coucal	*Centropus sinensis*	Low	LC	Schedule-IV
41	Cuculidae (Cuckoos)	Lesser Coucal	*Centropus bengalensis* *	Low	LC	Schedule-IV
42	Cuculidae (Cuckoos)	Green-billed Malkoha	*Phaenicophaeus tristis*	Low	LC	Schedule-IV
43	Cuculidae (Cuckoos)	Chestnut-winged Cuckoo	*Clamator coromandus*	NA	LC	Schedule-IV
44	Cuculidae (Cuckoos)	Asian Koel	*Eudynamys scolopaceus*	Low	LC	Schedule-IV
45	Cuculidae (Cuckoos)	Asian Emerald Cuckoo	*Chrysococcyx maculatus*	NA	LC	Schedule-IV
46	Cuculidae (Cuckoos)	Banded Bay Cuckoo	*Cacomantis sonneratii*	Moderate	LC	Schedule-IV
47	Cuculidae (Cuckoos)	Plaintive Cuckoo	*Cacomantis merulinus*	Moderate	LC	Schedule-IV
48	Cuculidae (Cuckoos)	Square-tailed Drongo-Cuckoo	*Surniculus lugubris*	Low	LC	Schedule-IV
49	Cuculidae (Cuckoos)	Large Hawk-Cuckoo	*Hierococcyx sparverioides*	Low	LC	Schedule-IV
50	Cuculidae (Cuckoos)	Hodgson's Hawk-Cuckoo	*Hierococcyx nisicolor*	NA	LC	Schedule-IV
51	Cuculidae (Cuckoos)	Lesser Cuckoo	*Cuculus poliocephalus*	Moderate	LC	Schedule-IV
52	Cuculidae (Cuckoos)	Indian Cuckoo	*Cuculus micropterus*	Moderate	LC	Schedule-IV
53	Cuculidae (Cuckoos)	Himalayan Cuckoo	*Cuculus saturatus*	Moderate	LC	Schedule-IV
54	Cuculidae (Cuckoos)	Common Cuckoo	*Cuculus canorus*	Moderate	LC	Schedule-IV
55	Podargidae (Frogmouths)	Hodgson's Frogmouth	*Batrachostomus hodgsoni*	NA	LC	Schedule-I
56	Caprimulgidae (Nightjars and Allies)	Great Eared-Nightjar	*Lyncornis macrotis* !	NA	LC	Schedule-IV
57	Caprimulgidae (Nightjars and Allies)	Gray Nightjar	*Caprimulgus jotaka*	NA	LC	Schedule-IV
58	Caprimulgidae (Nightjars and Allies)	Large-tailed Nightjar	*Caprimulgus macrurus*	NA	LC	Schedule-IV
59	Apodidae (Swifts)	White-throated Needletail	*Hirundapus caudacutus*	NA	LC	Schedule-IV
60	Apodidae (Swifts)	Himalayan Swiftlet	*Aerodramus brevirostris*	Moderate	LC	Schedule-IV
61	Apodidae (Swifts)	Blyth's Swift	*Apus leuconyx*	Moderate	LC	Schedule-IV
62	Apodidae (Swifts)	House Swift	*Apus nipalensis*	NA	LC	Schedule-IV
63	Apodidae (Swifts)	Asian Palm-Swift	*Cypsiurus balasiensis*	Low	LC	Schedule-IV

	Family	Common name	Scientific name	SoIB concern status	IUCN Red List	WLPA schedule
64	Rallidae (Rails, Gallinules, and Coots)	Eurasian Moorhen	*Gallinula chloropus* *	Low	LC	Schedule-IV
65	Rallidae (Rails, Gallinules, and Coots)	Eurasian Coot	*Fulica atra* *	Moderate	LC	Schedule-IV
66	Rallidae (Rails, Gallinules, and Coots)	Gray-headed Swamphen	*Porphyrio poliocephalus* *	Moderate	LC	Schedule-IV
67	Rallidae (Rails, Gallinules, and Coots)	Watercock	*Gallicrex cinerea* *	Moderate	LC	Schedule-IV
68	Rallidae (Rails, Gallinules, and Coots)	White-breasted Waterhen	*Amaurornis phoenicurus*	Low	LC	Schedule-IV
69	Ibidorhynchidae (Ibisbill)	Ibisbill	*Ibidorhyncha struthersii*	NA	LC	Schedule-IV
70	Charadriidae (Plovers and Lapwings)	Northern Lapwing	*Vanellus vanellus* *	Moderate	NT	Schedule-IV
71	Charadriidae (Plovers and Lapwings)	River Lapwing	*Vanellus duvaucelii*	Moderate	NT	Schedule-IV
72	Charadriidae (Plovers and Lapwings)	Red-wattled Lapwing	*Vanellus indicus*	Low	LC	Schedule-IV
73	Charadriidae (Plovers and Lapwings)	Kentish Plover	*Charadrius alexandrinus* *	Moderate	LC	Schedule-IV
74	Charadriidae (Plovers and Lapwings)	Little Ringed Plover	*Charadrius dubius*	Moderate	LC	Schedule-IV
75	Rostratulidae (Painted-Snipes)	Greater Painted-Snipe	*Rostratula benghalensis* *	Moderate	LC	Schedule-IV
76	Jacanidae (Jacanas)	Pheasant-tailed Jacana	*Hydrophasianus chirurgus* *	Moderate	LC	Schedule-IV
77	Scolopacidae (Sandpipers and Allies)	Temminck's Stint	*Calidris temminckii* *	Moderate	LC	Schedule-IV
78	Scolopacidae (Sandpipers and Allies)	Little Stint	*Calidris minuta* *	Moderate	LC	Schedule-IV
79	Scolopacidae (Sandpipers and Allies)	Eurasian Woodcock	*Scolopax rusticola*	NA	LC	Schedule-IV
80	Scolopacidae (Sandpipers and Allies)	Solitary Snipe	*Gallinago solitaria*	NA	LC	Schedule-IV
81	Scolopacidae (Sandpipers and Allies)	Wood Snipe	*Gallinago nemoricola*	NA	VU	Schedule-IV
82	Scolopacidae (Sandpipers and Allies)	Pin-tailed Snipe	*Gallinago stenura* *	Moderate	LC	Schedule-IV
83	Scolopacidae (Sandpipers and Allies)	Common Sandpiper	*Actitis hypoleucos*	Moderate	LC	Schedule-IV
84	Scolopacidae (Sandpipers and Allies)	Green Sandpiper	*Tringa ochropus*	Moderate	LC	Schedule-IV
85	Scolopacidae (Sandpipers and Allies)	Common Greenshank	*Tringa nebularia* *	High	LC	Schedule-IV
86	Scolopacidae (Sandpipers and Allies)	Wood Sandpiper	*Tringa glareola* *	Low	LC	Schedule-IV
87	Scolopacidae (Sandpipers and Allies)	Common Redshank	*Tringa totanus* *	Moderate	LC	Schedule-IV
88	Glareolidae (Pratincoles and Coursers)	Small Pratincole	*Glareola lactea* *	Moderate	LC	Schedule-IV
89	Laridae (Gulls, Terns, and Skimmers)	Pallas's Gull	*Ichthyaetus ichthyaetus*	Low	LC	Schedule-IV
90	Ciconiidae (Storks)	Asian Openbill	*Anastomus oscitans* *	Low	LC	Schedule-IV

	Family	Common name	Scientific name	SoIB concern status	IUCN Red List	WLPA schedule
91	Ciconiidae (Storks)	Black Stork	*Ciconia nigra*	Moderate	LC	Schedule-IV
92	Ciconiidae (Storks)	Woolly-necked Stork	*Ciconia episcopus* *	Low	VU	Schedule-IV
93	Ciconiidae (Storks)	Lesser Adjutant	*Leptoptilos javanicus* *	Moderate	VU	Schedule-IV
94	Phalacrocoracidae (Cormorants and Shags)	Little Cormorant	*Microcarbo niger*	Low	LC	Schedule-IV
95	Phalacrocoracidae (Cormorants and Shags)	Great Cormorant	*Phalacrocorax carbo*	Low	LC	Schedule-IV
96	Ardeidae (Herons, Egrets, and Bitterns)	Cinnamon Bittern	*Ixobrychus cinnamomeus* *	High	LC	Schedule-IV
97	Ardeidae (Herons, Egrets, and Bitterns)	Gray Heron	*Ardea cinerea* *	Low	LC	Schedule-IV
98	Ardeidae (Herons, Egrets, and Bitterns)	Purple Heron	*Ardea purpurea* *	Low	LC	Schedule-IV
99	Ardeidae (Herons, Egrets, and Bitterns)	Great Egret	*Ardea alba* *	Low	LC	Schedule-IV
100	Ardeidae (Herons, Egrets, and Bitterns)	Intermediate Egret	*Ardea intermedia* *	Low	LC	Schedule-IV
101	Ardeidae (Herons, Egrets, and Bitterns)	Little Egret	*Egretta garzetta* *	Low	LC	Schedule-IV
102	Ardeidae (Herons, Egrets, and Bitterns)	Cattle Egret	*Bubulcus ibis*	Low	LC	Schedule-IV
103	Ardeidae (Herons, Egrets, and Bitterns)	Indian Pond-Heron	*Ardeola grayii*	Low	LC	Schedule-IV
104	Ardeidae (Herons, Egrets, and Bitterns)	Chinese Pond-Heron	*Ardeola bacchus* *	NA	LC	Schedule-IV
105	Ardeidae (Herons, Egrets, and Bitterns)	Striated Heron	*Butorides striata*	Low	LC	Schedule-IV
106	Ardeidae (Herons, Egrets, and Bitterns)	Black-crowned Night-Heron	*Nycticorax nycticorax* *	Low	LC	Schedule-IV
107	Pandionidae (Osprey)	Osprey	*Pandion haliaetus*	Low	LC	Schedule-I
108	Accipitridae (Hawks, Eagles, and Kites)	Black-winged Kite	*Elanus caeruleus* *	Low	LC	Schedule-I
109	Accipitridae (Hawks, Eagles, and Kites)	Oriental Honey-buzzard	*Pernis ptilorhynchus*	Low	LC	Schedule-I
110	Accipitridae (Hawks, Eagles, and Kites)	Jerdon's Baza	*Aviceda jerdoni*	Moderate	LC	Schedule-I
111	Accipitridae (Hawks, Eagles, and Kites)	Red-headed Vulture	*Sarcogyps calvus* *	High	CR	Schedule-IV
112	Accipitridae (Hawks, Eagles, and Kites)	White-rumped Vulture	*Gyps bengalensis* *	High	CR	Schedule-I
113	Accipitridae (Hawks, Eagles, and Kites)	Slender-billed Vulture	*Gyps tenuirostris* *	High	CR	Schedule-I
114	Accipitridae (Hawks, Eagles, and Kites)	Himalayan Griffon	*Gyps himalayensis*	Moderate	NT	Schedule-IV
115	Accipitridae (Hawks, Eagles, and Kites)	Eurasian Griffon	*Gyps fulvus*	Moderate	LC	Schedule-IV
116	Accipitridae (Hawks, Eagles, and Kites)	Crested Serpent-Eagle	*Spilornis cheela*	Low	LC	Schedule-I
117	Accipitridae (Hawks, Eagles, and Kites)	Short-toed Snake-Eagle	*Circaetus gallicus*	High	LC	Schedule-I

	Family	Common name	Scientific name	SoIB concern status	IUCN Red List	WLPA schedule
118	Accipitridae (Hawks, Eagles, and Kites)	Changeable Hawk-Eagle	*Nisaetus cirrhatus*	Low	LC	Schedule-I
119	Accipitridae (Hawks, Eagles, and Kites)	Mountain Hawk-Eagle	*Nisaetus nipalensis*	Low	LC	Schedule-I
120	Accipitridae (Hawks, Eagles, and Kites)	Rufous-bellied Eagle	*Lophotriorchis kienerii*	Moderate	NT	Schedule-I
121	Accipitridae (Hawks, Eagles, and Kites)	Black Eagle	*Ictinaetus malaiensis*	Low	LC	Schedule-I
122	Accipitridae (Hawks, Eagles, and Kites)	Greater Spotted Eagle	*Clanga clanga*	Moderate	VU	Schedule-I
123	Accipitridae (Hawks, Eagles, and Kites)	Booted Eagle	*Hieraaetus pennatus*	Low	LC	Schedule-I
124	Accipitridae (Hawks, Eagles, and Kites)	Steppe Eagle	*Aquila nipalensis*	High	EN	Schedule-I
125	Accipitridae (Hawks, Eagles, and Kites)	Eurasian Marsh-Harrier	*Circus aeruginosus*	Low	LC	Schedule-I
126	Accipitridae (Hawks, Eagles, and Kites)	Hen Harrier	*Circus cyaneus*	NA	LC	Schedule-I
127	Accipitridae (Hawks, Eagles, and Kites)	Pallid Harrier	*Circus macrourus*	Moderate	NT	Schedule-I
128	Accipitridae (Hawks, Eagles, and Kites)	Pied Harrier	*Circus melanoleucos*	NA	LC	Schedule-I
129	Accipitridae (Hawks, Eagles, and Kites)	Crested Goshawk	*Accipiter trivirgatus*	Low	LC	Schedule-I
130	Accipitridae (Hawks, Eagles, and Kites)	Shikra	*Accipiter badius*	Low	LC	Schedule-I
131	Accipitridae (Hawks, Eagles, and Kites)	Besra	*Accipiter virgatus*	Moderate	LC	Schedule-I
132	Accipitridae (Hawks, Eagles, and Kites)	Eurasian Sparrowhawk	*Accipiter nisus*	Moderate	LC	Schedule-I
133	Accipitridae (Hawks, Eagles, and Kites)	Northern Goshawk	*Accipiter gentilis*	NA	LC	Schedule-I
134	Accipitridae (Hawks, Eagles, and Kites)	Black Kite	*Milvus migrans*	Low	LC	Schedule-I
135	Accipitridae (Hawks, Eagles, and Kites)	White-tailed Eagle	*Haliaeetus albicilla* [1]	NA	LC	Schedule-I
136	Accipitridae (Hawks, Eagles, and Kites)	Common Buzzard	*Buteo buteo*	Low	LC	Schedule-I
137	Accipitridae (Hawks, Eagles, and Kites)	Himalayan Buzzard	*Buteo refectus*	Low	LC	Schedule-I
138	Accipitridae (Hawks, Eagles, and Kites)	Long-legged Buzzard	*Buteo rufinus*	Low	LC	Schedule-I
139	Tytonidae (Barn-Owls)	Australasian Grass-Owl	*Tyto longimembris*	NA	LC	Schedule-IV
140	Tytonidae (Barn-Owls)	Barn Owl	*Tyto alba*	NA	LC	Schedule-IV
141	Strigidae (Owls)	Mountain Scops-Owl	*Otus spilocephalus*	NA	LC	Schedule-IV
142	Strigidae (Owls)	Collared Scops-Owl	*Otus lettia*	NA	LC	Schedule-IV
143	Strigidae (Owls)	Oriental Scops-Owl	*Otus sunia*	NA	LC	Schedule-IV
144	Strigidae (Owls)	Brown Fish-Owl	*Ketupa zeylonensis*	Low	LC	Schedule-IV
145	Strigidae (Owls)	Collared Owlet	*Glaucidium brodiei*	Low	LC	Schedule-IV

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146	Strigidae (Owls)	Asian Barred Owlet	*Glaucidium cuculoides*	Low	LC	Schedule-IV
147	Strigidae (Owls)	Spotted Owlet	*Athene brama* *	NA	LC	Schedule-IV
148	Strigidae (Owls)	Brown Wood-Owl	*Strix leptogrammica*	NA	LC	Schedule-IV
149	Strigidae (Owls)	Himalayan Owl	*Strix nivicolum*	NA	LC	Schedule-IV
150	Strigidae (Owls)	Long-eared Owl	*Asio otus*	NA	LC	Schedule-IV
151	Strigidae (Owls)	Brown Boobook	*Ninox scutulata*	NA	LC	Schedule-IV
152	Trogonidae (Trogons)	Red-headed Trogon	*Harpactes erythrocephalus*	Low	LC	Schedule-IV
153	Trogonidae (Trogons)	Ward's Trogon	*Harpactes wardi*	High	NT	Schedule-IV
154	Upupidae (Hoopoes)	Eurasian Hoopoe	*Upupa epops*	Moderate	LC	Schedule-IV
155	Bucerotidae (Hornbills)	Oriental Pied-Hornbill	*Anthracoceros albirostris*	Low	LC	Schedule-I
156	Bucerotidae (Hornbills)	Rufous-necked Hornbill	*Aceros nipalensis*	High	VU	Schedule-I
157	Bucerotidae (Hornbills)	Wreathed Hornbill	*Rhyticeros undulatus*	High	VU	Schedule-I
158	Alcedinidae (Kingfishers)	Common Kingfisher	*Alcedo atthis*	Low	LC	Schedule-IV
159	Alcedinidae (Kingfishers)	Blue-eared Kingfisher	*Alcedo meninting*	Low	LC	Schedule-IV
160	Alcedinidae (Kingfishers)	Stork-billed Kingfisher	*Pelargopsis capensis*	Low	LC	Schedule-IV
161	Alcedinidae (Kingfishers)	Ruddy Kingfisher	*Halcyon coromanda*	NA	LC	Schedule-IV
162	Alcedinidae (Kingfishers)	White-throated Kingfisher	*Halcyon smyrnensis*	Low	LC	Schedule-IV
163	Alcedinidae (Kingfishers)	Black-capped Kingfisher	*Halcyon pileata*	Moderate	LC	Schedule-IV
164	Alcedinidae (Kingfishers)	Crested Kingfisher	*Megaceryle lugubris*	Low	LC	Schedule-IV
165	Alcedinidae (Kingfishers)	Pied Kingfisher	*Ceryle rudis*	Moderate	LC	Schedule-IV
166	Meropidae (Bee-eaters)	Blue-bearded Bee-eater	*Nyctyornis athertoni*	Low	LC	Schedule-IV
167	Meropidae (Bee-eaters)	Green Bee-eater	*Merops orientalis*	Low	LC	Schedule-IV
168	Meropidae (Bee-eaters)	Chestnut-headed Bee-eater	*Merops leschenaulti*	Low	LC	Schedule-IV
169	Coraciidae (Rollers)	Indochinese Roller	*Coracias affinis*	NA	NA	NA
170	Megalaimidae (Asian Barbets)	Coppersmith Barbet	*Psilopogon haemacephalus*	Low	LC	Schedule-IV
171	Megalaimidae (Asian Barbets)	Blue-eared Barbet	*Psilopogon duvaucelii*	Low	LC	Schedule-IV
172	Megalaimidae (Asian Barbets)	Great Barbet	*Psilopogon virens*	Low	LC	Schedule-IV
173	Megalaimidae (Asian Barbets)	Lineated Barbet	*Psilopogon lineatus*	Low	LC	Schedule-IV
174	Megalaimidae (Asian Barbets)	Golden-throated Barbet	*Psilopogon franklinii*	Moderate	LC	Schedule-IV
175	Megalaimidae (Asian Barbets)	Blue-throated Barbet	*Psilopogon asiaticus*	Low	LC	Schedule-IV
176	Indicatoridae (Honeyguides)	Yellow-rumped Honeyguide	*Indicator xanthonotus*	Moderate	NT	Schedule-IV
177	Picidae (Woodpeckers)	Eurasian Wryneck	*Jynx torquilla*	Low	LC	Schedule-IV
178	Picidae (Woodpeckers)	Speckled Piculet	*Picumnus innominatus*	Low	LC	Schedule-IV

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179	Picidae (Woodpeckers)	White-browed Piculet	*Sasia ochracea*	Low	LC	Schedule-IV
180	Picidae (Woodpeckers)	Gray-capped Woodpecker	*Yungipicus canicapillus*	Moderate	LC	Schedule-IV
181	Picidae (Woodpeckers)	Rufous-bellied Woodpecker	*Dendrocopos hyperythrus*	Low	LC	Schedule-IV
182	Picidae (Woodpeckers)	Fulvous-breasted Woodpecker	*Dendrocopos macei*	Low	LC	Schedule-IV
183	Picidae (Woodpeckers)	Darjeeling Woodpecker	*Dendrocopos darjellensis*	Moderate	LC	Schedule-IV
184	Picidae (Woodpeckers)	Crimson-breasted Woodpecker	*Dryobates cathpharius*	NA	LC	Schedule-IV
185	Picidae (Woodpeckers)	Bay Woodpecker	*Blythipicus pyrrhotis*	Low	LC	Schedule-IV
186	Picidae (Woodpeckers)	Greater Flameback	*Chrysocolaptes guttacristatus*	Low	LC	Schedule-IV
187	Picidae (Woodpeckers)	Rufous Woodpecker	*Micropternus brachyurus*	Low	LC	Schedule-IV
188	Picidae (Woodpeckers)	Pale-headed Woodpecker	*Gecinulus grantia*	Moderate	LC	Schedule-IV
189	Picidae (Woodpeckers)	Black-rumped Flameback	*Dinopium benghalense*	Low	LC	Schedule-IV
190	Picidae (Woodpeckers)	Lesser Yellownape	*Picus chlorolophus*	Low	LC	Schedule-IV
191	Picidae (Woodpeckers)	Gray-headed Woodpecker	*Picus canus*	Low	LC	Schedule-IV
192	Picidae (Woodpeckers)	Greater Yellownape	*Chrysophlegma flavinucha*	Low	LC	Schedule-IV
193	Picidae (Woodpeckers)	Great Slaty Woodpecker	*Mulleripicus pulverulentus*	High	VU	Schedule-IV
194	Falconidae (Falcons and Caracaras)	Pied Falconet	*Microhierax melanoleucos*	NA	LC	Schedule-IV
195	Falconidae (Falcons and Caracaras)	Eurasian Kestrel	*Falco tinnunculus*	Moderate	LC	Schedule-IV
196	Falconidae (Falcons and Caracaras)	Amur Falcon	*Falco amurensis*	Low	LC	Schedule-IV
197	Falconidae (Falcons and Caracaras)	Eurasian Hobby	*Falco subbuteo*	Low	LC	Schedule-IV
198	Falconidae (Falcons and Caracaras)	Oriental Hobby	*Falco severus*	NA	LC	Schedule-IV
199	Falconidae (Falcons and Caracaras)	Peregrine Falcon	*Falco peregrinus*	Low	LC	Schedule-I
200	Psittaculidae (Old World Parrots)	Rose-ringed Parakeet	*Psittacula krameri*	Low	LC	Schedule-IV
201	Psittaculidae (Old World Parrots)	Gray-headed Parakeet	*Psittacula finschii*	NA	NT	Schedule-IV
202	Psittaculidae (Old World Parrots)	Blossom-headed Parakeet	*Psittacula roseata*	NA	NT	Schedule-IV
203	Psittaculidae (Old World Parrots)	Red-breasted Parakeet	*Psittacula alexandri*	Moderate	NT	Schedule-IV
204	Psittaculidae (Old World Parrots)	Vernal Hanging-Parrot	*Loriculus vernalis*	Low	LC	Schedule-IV
205	Eurylaimidae (Asian and Grauer's Broadbills)	Long-tailed Broadbill	*Psarisomus dalhousiae*	Low	LC	Schedule-IV

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206	Eurylaimidae (Asian and Grauer's Broadbills)	Silver-breasted Broadbill	*Serilophus lunatus*	NA	LC	Schedule-IV
207	Pittidae (Pittas)	Blue-naped Pitta	*Hydrornis nipalensis*	Moderate	LC	Schedule-IV
208	Pittidae (Pittas)	Hooded Pitta	*Pitta sordida*	NA	LC	Schedule-IV
209	Campephagidae (Cuckooshrikes)	Small Minivet	*Pericrocotus cinnamomeus*	High	LC	Schedule-IV
210	Campephagidae (Cuckooshrikes)	Gray-chinned Minivet	*Pericrocotus solaris*	NA	LC	Schedule-IV
211	Campephagidae (Cuckooshrikes)	Short-billed Minivet	*Pericrocotus brevirostris*	Low	LC	Schedule-IV
212	Campephagidae (Cuckooshrikes)	Long-tailed Minivet	*Pericrocotus ethologus*	Moderate	LC	Schedule-IV
213	Campephagidae (Cuckooshrikes)	Scarlet Minivet	*Pericrocotus speciosus*	Low	LC	Schedule-IV
214	Campephagidae (Cuckooshrikes)	Rosy Minivet	*Pericrocotus roseus*	NA	LC	Schedule-IV
215	Campephagidae (Cuckooshrikes)	Large Cuckooshrike	*Coracina macei*	High	LC	Schedule-IV
216	Campephagidae (Cuckooshrikes)	Black-winged Cuckooshrike	*Lalage melaschistos*	Low	LC	Schedule-IV
217	Vireonidae (Vireos, Shrike-Babblers, and Erpornis)	Black-headed Shrike-Babbler	*Pteruthius rufiventer*	Moderate	LC	Schedule-IV
218	Vireonidae (Vireos, Shrike-Babblers, and Erpornis)	Blyth's Shrike-Babbler	*Pteruthius aeralatus*	NA	LC	Schedule-IV
219	Vireonidae (Vireos, Shrike-Babblers, and Erpornis)	Green Shrike-Babbler	*Pteruthius xanthochlorus*	Low	LC	Schedule-IV
220	Vireonidae (Vireos, Shrike-Babblers, and Erpornis)	Black-eared Shrike-Babbler	*Pteruthius melanotis*	NA	LC	Schedule-IV
221	Vireonidae (Vireos, Shrike-Babblers, and Erpornis)	White-bellied Erpornis	*Erpornis zantholeuca*	Low	LC	Schedule-IV
222	Oriolidae (Old World Orioles)	Black-hooded Oriole	*Oriolus xanthornus*	Low	LC	Schedule-IV
223	Oriolidae (Old World Orioles)	Maroon Oriole	*Oriolus traillii*	Low	LC	Schedule-IV
224	Artamidae (Woodswallows, Bellmagpies, and Allies)	Ashy Woodswallow	*Artamus fuscus* *	Moderate	LC	Schedule-IV
225	Vangidae (Vangas, Helmetshrikes, and Allies)	Large Woodshrike	*Tephrodornis virgatus*	Low	LC	Schedule-IV
226	Vangidae (Vangas, Helmetshrikes, and Allies)	Bar-winged Flycatcher-shrike	*Hemipus picatus*	Moderate	LC	Schedule-IV
227	Aegithinidae (Ioras)	Common Iora	*Aegithina tiphia*	Moderate	LC	Schedule-IV
228	Rhipiduridae (Fantails)	White-throated Fantail	*Rhipidura albicollis*	Low	LC	Schedule-IV
229	Dicruridae (Drongos)	Black Drongo	*Dicrurus macrocercus*	Low	LC	Schedule-IV
230	Dicruridae (Drongos)	Ashy Drongo	*Dicrurus leucophaeus*	Low	LC	Schedule-IV
231	Dicruridae (Drongos)	Bronzed Drongo	*Dicrurus aeneus*	Low	LC	Schedule-IV
232	Dicruridae (Drongos)	Lesser Racket-tailed Drongo	*Dicrurus remifer*	Low	LC	Schedule-IV
233	Dicruridae (Drongos)	Hair-crested Drongo	*Dicrurus hottentottus*	Low	LC	Schedule-IV
234	Dicruridae (Drongos)	Greater Racket-tailed Drongo	*Dicrurus paradiseus*	Moderate	LC	Schedule-IV

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235	Monarchidae (Monarch Flycatchers)	Black-naped Monarch	*Hypothymis azurea*	Moderate	LC	Schedule-IV
236	Monarchidae (Monarch Flycatchers)	Blyth's Paradise-Flycatcher	*Terpsiphone affinis*	NA	LC	Schedule-IV
237	Laniidae (Shrikes)	Brown Shrike	*Lanius cristatus*	Low	LC	Schedule-IV
238	Laniidae (Shrikes)	Burmese Shrike	*Lanius collurioides* *	NA	LC	Schedule-IV
239	Laniidae (Shrikes)	Long-tailed Shrike	*Lanius schach*	Moderate	LC	Schedule-IV
240	Laniidae (Shrikes)	Gray-backed Shrike	*Lanius tephronotus*	Low	LC	Schedule-IV
241	Corvidae (Crows, Jays, and Magpies)	Eurasian Jay	*Garrulus glandarius*	Low	LC	Schedule-IV
242	Corvidae (Crows, Jays, and Magpies)	Yellow-billed Blue-Magpie	*Urocissa flavirostris*	Low	LC	Schedule-IV
243	Corvidae (Crows, Jays, and Magpies)	Red-billed Blue-Magpie	*Urocissa erythroryncha*	Low	LC	Schedule-IV
244	Corvidae (Crows, Jays, and Magpies)	Common Green-Magpie	*Cissa chinensis*	Low	LC	Schedule-IV
245	Corvidae (Crows, Jays, and Magpies)	Rufous Treepie	*Dendrocitta vagabunda* *	Low	LC	Schedule-IV
246	Corvidae (Crows, Jays, and Magpies)	Gray Treepie	*Dendrocitta formosae*	Low	LC	Schedule-IV
247	Corvidae (Crows, Jays, and Magpies)	Collared Treepie	*Dendrocitta frontalis*	Moderate	LC	Schedule-IV
248	Corvidae (Crows, Jays, and Magpies)	Eurasian Nutcracker	*Nucifraga caryocatactes*	NA	LC	Schedule-IV
249	Corvidae (Crows, Jays, and Magpies)	House Crow	*Corvus splendens*	Low	LC	Schedule-V
250	Corvidae (Crows, Jays, and Magpies)	Large-billed Crow	*Corvus macrorhynchos*	Low	LC	Schedule-IV
251	Stenostiridae (Fairy Flycatchers)	Yellow-bellied Fairy-Fantail	*Chelidorhynx hypoxanthus*	Low	LC	Schedule-IV
252	Stenostiridae (Fairy Flycatchers)	Gray-headed Canary-Flycatcher	*Culicicapa ceylonensis*	Moderate	LC	Schedule-IV
253	Paridae (Tits, Chickadees, and Titmice)	Yellow-browed Tit	*Sylviparus modestus*	Moderate	LC	Schedule-IV
254	Paridae (Tits, Chickadees, and Titmice)	Sultan Tit	*Melanochlora sultanea*	Low	LC	Schedule-IV
255	Paridae (Tits, Chickadees, and Titmice)	Coal Tit	*Periparus ater*	Low	LC	Schedule-IV
256	Paridae (Tits, Chickadees, and Titmice)	Rufous-vented Tit	*Periparus rubidiventris*	Low	LC	Schedule-IV
257	Paridae (Tits, Chickadees, and Titmice)	Gray-crested Tit	*Lophophanes dichrous*	Low	LC	Schedule-IV
258	Paridae (Tits, Chickadees, and Titmice)	Green-backed Tit	*Parus monticolus*	Low	LC	Schedule-IV
259	Paridae (Tits, Chickadees, and Titmice)	Cinereous Tit	*Parus cinereus*	Low	LC	Schedule-IV
260	Paridae (Tits, Chickadees, and Titmice)	Yellow-cheeked Tit	*Machlolophus spilonotus*	Low	LC	Schedule-IV
261	Alaudidae (Larks)	Bengal Bushlark	*Mirafra assamica* *	Low	LC	Schedule-IV
262	Alaudidae (Larks)	Oriental Skylark	*Alauda gulgula*	Moderate	LC	Schedule-IV

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263	Cisticolidae (Cisticolas and Allies)	Common Tailorbird	*Orthotomus sutorius*	Low	LC	Schedule-IV
264	Cisticolidae (Cisticolas and Allies)	Dark-necked Tailorbird	*Orthotomus atrogularis*	NA	LC	Schedule-IV
265	Cisticolidae (Cisticolas and Allies)	Striated Prinia	*Prinia crinigera*	Low	LC	Schedule-IV
266	Cisticolidae (Cisticolas and Allies)	Black-throated Prinia	*Prinia atrogularis*	Moderate	LC	Schedule-IV
267	Cisticolidae (Cisticolas and Allies)	Rufescent Prinia	*Prinia rufescens*	NA	LC	Schedule-IV
268	Cisticolidae (Cisticolas and Allies)	Gray-breasted Prinia	*Prinia hodgsonii*	Low	LC	Schedule-IV
269	Cisticolidae (Cisticolas and Allies)	Graceful Prinia	*Prinia gracilis*	Low	LC	Schedule-IV
270	Cisticolidae (Cisticolas and Allies)	Yellow-bellied Prinia	*Prinia flaviventris*	Low	LC	Schedule-IV
271	Cisticolidae (Cisticolas and Allies)	Ashy Prinia	*Prinia socialis*	Low	LC	Schedule-IV
272	Cisticolidae (Cisticolas and Allies)	Plain Prinia	*Prinia inornata*	Low	LC	Schedule-IV
273	Cisticolidae (Cisticolas and Allies)	Zitting Cisticola	*Cisticola juncidis* *	Low	LC	Schedule-IV
274	Cisticolidae (Cisticolas and Allies)	Golden-headed Cisticola	*Cisticola exilis* *	Moderate	LC	Schedule-IV
275	Acrocephalidae (Reed Warblers and Allies)	Thick-billed Warbler	*Arundinax aedon*	Low	LC	Schedule-IV
276	Acrocephalidae (Reed Warblers and Allies)	Paddyfield Warbler	*Acrocephalus agricola* *	Low	LC	Schedule-IV
277	Acrocephalidae (Reed Warblers and Allies)	Blunt-winged Warbler	*Acrocephalus concinens*	NA	LC	Schedule-IV
278	Acrocephalidae (Reed Warblers and Allies)	Blyth's Reed Warbler	*Acrocephalus dumetorum*	Low	LC	Schedule-IV
279	Acrocephalidae (Reed Warblers and Allies)	Clamorous Reed Warbler	*Acrocephalus stentoreus*	Low	LC	Schedule-IV
280	Locustellidae (Grassbirds and Allies)	Striated Grassbird	*Megalurus palustris* *	Low	LC	Schedule-IV
281	Locustellidae (Grassbirds and Allies)	Pallas's Grasshopper-Warbler	*Locustella certhiola* *	NA	LC	Schedule-IV
282	Locustellidae (Grassbirds and Allies)	Baikal Bush Warbler	*Locustella davidi* *	NA	LC	Schedule-IV
283	Locustellidae (Grassbirds and Allies)	Spotted Bush Warbler	*Locustella thoracica* *	Moderate	LC	Schedule-IV
284	Pnoepygidae (Cupwings)	Scaly-breasted Cupwing	*Pnoepyga albiventer*	Low	LC	Schedule-IV
285	Pnoepygidae (Cupwings)	Pygmy Cupwing	*Pnoepyga pusilla*	Low	LC	Schedule-IV
286	Hirundinidae (Swallows)	Gray-throated Martin	*Riparia chinensis*	Low	LC	Schedule-IV
287	Hirundinidae (Swallows)	Bank Swallow	*Riparia riparia*	NA	LC	Schedule-IV
288	Hirundinidae (Swallows)	Barn Swallow	*Hirundo rustica*	Low	LC	Schedule-IV
289	Hirundinidae (Swallows)	Red-rumped Swallow	*Cecropis daurica*	Low	LC	Schedule-IV

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290	Hirundinidae (Swallows)	Striated Swallow	*Cecropis striolata*	NA	LC	Schedule-IV
291	Hirundinidae (Swallows)	Asian House-Martin	*Delichon dasypus*	NA	LC	Schedule-IV
292	Hirundinidae (Swallows)	Nepal House-Martin	*Delichon nipalense*	Moderate	LC	Schedule-IV
293	Pycnonotidae (Bulbuls)	Black-crested Bulbul	*Rubigula flaviventris*	Low	LC	Schedule-IV
294	Pycnonotidae (Bulbuls)	Striated Bulbul	*Pycnonotus striatus*	Low	LC	Schedule-IV
295	Pycnonotidae (Bulbuls)	Red-vented Bulbul	*Pycnonotus cafer*	Low	LC	Schedule-IV
296	Pycnonotidae (Bulbuls)	Red-whiskered Bulbul	*Pycnonotus jocosus*	Low	LC	Schedule-IV
297	Pycnonotidae (Bulbuls)	White-throated Bulbul	*Alophoixus flaveolus*	Low	LC	Schedule-IV
298	Pycnonotidae (Bulbuls)	Black Bulbul	*Hypsipetes leucocephalus*	Low	LC	Schedule-IV
299	Pycnonotidae (Bulbuls)	Ashy Bulbul	*Hemixos flavala*	Low	LC	Schedule-IV
300	Pycnonotidae (Bulbuls)	Mountain Bulbul	*Ixos mcclellandii*	Low	LC	Schedule-IV
301	Phylloscopidae (Leaf Warblers)	Ashy-throated Warbler	*Phylloscopus maculipennis*	Low	LC	Schedule-IV
302	Phylloscopidae (Leaf Warblers)	Buff-barred Warbler	*Phylloscopus pulcher*	Low	LC	Schedule-IV
303	Phylloscopidae (Leaf Warblers)	Yellow-browed Warbler	*Phylloscopus inornatus*	Moderate	LC	Schedule-IV
304	Phylloscopidae (Leaf Warblers)	Lemon-rumped Warbler	*Phylloscopus chloronotus*	Moderate	LC	Schedule-IV
305	Phylloscopidae (Leaf Warblers)	Tickell's Leaf Warbler	*Phylloscopus affinis*	Low	LC	Schedule-IV
306	Phylloscopidae (Leaf Warblers)	Dusky Warbler	*Phylloscopus fuscatus*	Low	LC	Schedule-IV
307	Phylloscopidae (Leaf Warblers)	Smoky Warbler	*Phylloscopus fuligiventer*	Moderate	LC	Schedule-IV
308	Phylloscopidae (Leaf Warblers)	Common Chiffchaff	*Phylloscopus collybita*	Low	LC	Schedule-IV
309	Phylloscopidae (Leaf Warblers)	White-spectacled Warbler	*Phylloscopus intermedius*	Low	LC	Schedule-IV
310	Phylloscopidae (Leaf Warblers)	Gray-cheeked Warbler	*Phylloscopus poliogenys*	Low	LC	Schedule-IV
311	Phylloscopidae (Leaf Warblers)	Green-crowned Warbler	*Phylloscopus burkii*	Moderate	LC	Schedule-IV
312	Phylloscopidae (Leaf Warblers)	Gray-crowned Warbler	*Phylloscopus tephrocephalus*	NA	LC	Schedule-IV
313	Phylloscopidae (Leaf Warblers)	Whistler's Warbler	*Phylloscopus whistleri*	Low	LC	Schedule-IV
314	Phylloscopidae (Leaf Warblers)	Greenish Warbler	*Phylloscopus trochiloides*	Moderate	LC	Schedule-IV
315	Phylloscopidae (Leaf Warblers)	Large-billed Leaf Warbler	*Phylloscopus magnirostris*	Moderate	LC	Schedule-IV
316	Phylloscopidae (Leaf Warblers)	Chestnut-crowned Warbler	*Phylloscopus castaniceps*	Low	LC	Schedule-IV
317	Phylloscopidae (Leaf Warblers)	Yellow-vented Warbler	*Phylloscopus cantator*	Moderate	LC	Schedule-IV
318	Phylloscopidae (Leaf Warblers)	Blyth's Leaf Warbler	*Phylloscopus reguloides*	Low	LC	Schedule-IV

	Family	Common name	Scientific name	SoIB concern status	IUCN Red List	WLPA schedule
319	Phylloscopidae (Leaf Warblers)	Gray-hooded Warbler	*Phylloscopus xanthoschistos*	Low	LC	Schedule-IV
320	Scotocercidae (Bush Warblers and Allies)	Gray-bellied Tesia	*Tesia cyaniventer*	Low	LC	Schedule-IV
321	Scotocercidae (Bush Warblers and Allies)	Slaty-bellied Tesia	*Tesia olivea*	Low	LC	Schedule-IV
322	Scotocercidae (Bush Warblers and Allies)	Chestnut-crowned Bush Warbler	*Cettia major*	NA	LC	Schedule-IV
323	Scotocercidae (Bush Warblers and Allies)	Gray-sided Bush Warbler	*Cettia brunnifrons*	Low	LC	Schedule-IV
324	Scotocercidae (Bush Warblers and Allies)	Chestnut-headed Tesia	*Cettia castaneocoronata*	Low	LC	Schedule-IV
325	Scotocercidae (Bush Warblers and Allies)	Yellow-bellied Warbler	*Abroscopus superciliaris*	Low	LC	Schedule-IV
326	Scotocercidae (Bush Warblers and Allies)	Rufous-faced Warbler	*Abroscopus albogularis*	NA	LC	Schedule-IV
327	Scotocercidae (Bush Warblers and Allies)	Black-faced Warbler	*Abroscopus schisticeps*	Low	LC	Schedule-IV
328	Scotocercidae (Bush Warblers and Allies)	Mountain Tailorbird	*Phyllergates cucullatus*	Low	LC	Schedule-IV
329	Scotocercidae (Bush Warblers and Allies)	Broad-billed Warbler	*Tickellia hodgsoni*	Moderate	LC	Schedule-IV
330	Scotocercidae (Bush Warblers and Allies)	Brownish-flanked Bush Warbler	*Horornis fortipes*	Low	LC	Schedule-IV
331	Scotocercidae (Bush Warblers and Allies)	Hume's Bush Warbler	*Horornis brunnescens*	Moderate	LC	Schedule-IV
332	Scotocercidae (Bush Warblers and Allies)	Aberrant Bush Warbler	*Horornis flavolivaceus*	Low	LC	Schedule-IV
333	Aegithalidae (Long-tailed Tits)	Black-throated Tit	*Aegithalos concinnus*	Low	LC	Schedule-IV
334	Aegithalidae (Long-tailed Tits)	Black-browed Tit	*Aegithalos iouschistos*	Moderate	LC	Schedule-IV
335	Sylviidae (Sylviid Warblers, Parrotbills, and Allies)	Fire-tailed Myzornis	*Myzornis pyrrhoura*	Moderate	LC	Schedule-IV
336	Sylviidae (Sylviid Warblers, Parrotbills, and Allies)	Golden-breasted Fulvetta	*Lioparus chrysotis*	NA	LC	Schedule-IV
337	Sylviidae (Sylviid Warblers, Parrotbills, and Allies)	Jerdon's Babbler	*Chrysomma altirostre* *	High	VU	Schedule-IV
338	Sylviidae (Sylviid Warblers, Parrotbills, and Allies)	Ludlow's Fulvetta	*Fulvetta ludlowi*	Moderate	LC	Schedule-IV
339	Sylviidae (Sylviid Warblers, Parrotbills, and Allies)	Streak-throated Fulvetta	*Fulvetta manipurensis*	NA	LC	Schedule-IV
340	Sylviidae (Sylviid Warblers, Parrotbills, and Allies)	Brown Parrotbill	*Cholornis unicolor*	NA	LC	Schedule-IV
341	Sylviidae (Sylviid Warblers, Parrotbills, and Allies)	Gray-headed Parrotbill	*Psittiparus gularis*	NA	LC	Schedule-IV
342	Sylviidae (Sylviid Warblers, Parrotbills, and Allies)	Rufous-headed Parrotbill	*Psittiparus bakeri*	NA	LC	Schedule-IV
343	Sylviidae (Sylviid Warblers, Parrotbills, and Allies)	Black-breasted Parrotbill	*Paradoxornis flavirostris* *	High	VU	Schedule-IV
344	Sylviidae (Sylviid Warblers, Parrotbills, and Allies)	Spot-breasted Parrotbill	*Paradoxornis guttaticollis*	NA	LC	Schedule-IV

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345	Sylviidae (Sylviid Warblers, Parrotbills, and Allies)	Pale-billed Parrotbill	*Chleuasicus atrosuperciliaris*	Moderate	LC	Schedule-IV
346	Sylviidae (Sylviid Warblers, Parrotbills, and Allies)	Fulvous Parrotbill	*Suthora fulvifrons*	NA	LC	Schedule-IV
347	Sylviidae (Sylviid Warblers, Parrotbills, and Allies)	Black-throated Parrotbill	*Suthora nipalensis*	Moderate	LC	Schedule-IV
348	Zosteropidae (White-eyes, Yuhinas, and Allies)	Striated Yuhina	*Yuhina castaniceps*	Moderate	LC	Schedule-IV
349	Zosteropidae (White-eyes, Yuhinas, and Allies)	White-naped Yuhina	*Yuhina bakeri*	Moderate	LC	Schedule-IV
350	Zosteropidae (White-eyes, Yuhinas, and Allies)	Whiskered Yuhina	*Yuhina flavicollis*	Low	LC	Schedule-IV
351	Zosteropidae (White-eyes, Yuhinas, and Allies)	Stripe-throated Yuhina	*Yuhina gularis*	Low	LC	Schedule-IV
352	Zosteropidae (White-eyes, Yuhinas, and Allies)	Rufous-vented Yuhina	*Yuhina occipitalis*	Moderate	LC	Schedule-IV
353	Zosteropidae (White-eyes, Yuhinas, and Allies)	Black-chinned Yuhina	*Yuhina nigrimenta*	Low	LC	Schedule-IV
354	Zosteropidae (White-eyes, Yuhinas, and Allies)	Chestnut-flanked White-eye	*Zosterops erythropleurus*	NA	LC	Schedule-IV
355	Zosteropidae (White-eyes, Yuhinas, and Allies)	Indian White-eye	*Zosterops palpebrosus*	Low	LC	Schedule-IV
356	Timaliidae (Tree-Babblers, Scimitar-Babblers, and Allies)	Chestnut-capped Babbler	*Timalia pileata*[*]	Low	LC	Schedule-IV
357	Timaliidae (Tree-Babblers, Scimitar-Babblers, and Allies)	Pin-striped Tit-Babbler	*Mixornis gularis*	Low	LC	Schedule-IV
358	Timaliidae (Tree-Babblers, Scimitar-Babblers, and Allies)	Golden Babbler	*Cyanoderma chrysaeum*	Low	LC	Schedule-IV
359	Timaliidae (Tree-Babblers, Scimitar-Babblers, and Allies)	Rufous-capped Babbler	*Cyanoderma ruficeps*	Low	LC	Schedule-IV
360	Timaliidae (Tree-Babblers, Scimitar-Babblers, and Allies)	Buff-chested Babbler	*Cyanoderma ambiguum*	Moderate	LC	Schedule-IV
361	Timaliidae (Tree-Babblers, Scimitar-Babblers, and Allies)	Rusty-throated Wren-Babbler	*Spelaeornis badeigularis*	High	VU	Schedule-IV
362	Timaliidae (Tree-Babblers, Scimitar-Babblers, and Allies)	Bar-winged Wren-Babbler	*Spelaeornis troglodytoides*	High	LC	Schedule-IV
363	Timaliidae (Tree-Babblers, Scimitar-Babblers, and Allies)	Red-billed Scimitar-Babbler	*Pomatorhinus ochraceiceps*	NA	LC	Schedule-IV
364	Timaliidae (Tree-Babblers, Scimitar-Babblers, and Allies)	Coral-billed Scimitar-Babbler	*Pomatorhinus ferruginosus*	NA	LC	Schedule-IV
365	Timaliidae (Tree-Babblers, Scimitar-Babblers, and Allies)	Slender-billed Scimitar-Babbler	*Pomatorhinus superciliaris*	Moderate	LC	Schedule-IV

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366	Timaliidae (Tree-Babblers, Scimitar-Babblers, and Allies)	Streak-breasted Scimitar-Babbler	*Pomatorhinus ruficollis*	Low	LC	Schedule-IV
367	Timaliidae (Tree-Babblers, Scimitar-Babblers, and Allies)	White-browed Scimitar-Babbler	*Pomatorhinus schisticeps*	Low	LC	Schedule-IV
368	Timaliidae (Tree-Babblers, Scimitar-Babblers, and Allies)	Spot-breasted Scimitar-Babbler	*Megapomatorhinus mcclellandi* *	Moderate	LC	Schedule-IV
369	Timaliidae (Tree-Babblers, Scimitar-Babblers, and Allies)	Gray-throated Babbler	*Stachyris nigriceps*	NA	LC	Schedule-IV
370	Timaliidae (Tree-Babblers, Scimitar-Babblers, and Allies)	Chevron-breasted Babbler	*Stachyris roberti*	Moderate	NT	Schedule-IV
371	Pellorneidae (Ground Babblers and Allies)	White-hooded Babbler	*Gampsorhynchus rufulus*	Moderate	LC	Schedule-IV
372	Pellorneidae (Ground Babblers and Allies)	Yellow-throated Fulvetta	*Schoeniparus cinereus*	Moderate	LC	Schedule-IV
373	Pellorneidae (Ground Babblers and Allies)	Rufous-winged Fulvetta	*Schoeniparus castaneceps*	NA	LC	Schedule-IV
374	Pellorneidae (Ground Babblers and Allies)	Rufous-throated Fulvetta	*Schoeniparus rufogularis*	Moderate	LC	Schedule-IV
375	Pellorneidae (Ground Babblers and Allies)	Rusty-capped Fulvetta	*Schoeniparus dubius* !	NA	LC	Schedule-IV
376	Pellorneidae (Ground Babblers and Allies)	Swamp Grass Babbler	*Laticilla cinerascens* *	High	EN	Schedule-IV
377	Pellorneidae (Ground Babblers and Allies)	Puff-throated Babbler	*Pellorneum ruficeps*	Moderate	LC	Schedule-IV
378	Pellorneidae (Ground Babblers and Allies)	Marsh Babbler	*Pellorneum palustre* *	High	VU	Schedule-IV
379	Pellorneidae (Ground Babblers and Allies)	Spot-throated Babbler	*Pellorneum albiventre*	NA	LC	Schedule-IV
380	Pellorneidae (Ground Babblers and Allies)	Buff-breasted Babbler	*Pellorneum tickelli*	NA	LC	Schedule-IV
381	Pellorneidae (Ground Babblers and Allies)	Eyebrowed Wren-Babbler	*Napothera epilepidota*	NA	LC	Schedule-IV
382	Pellorneidae (Ground Babblers and Allies)	Long-billed Wren-Babbler	*Napothera malacoptila*	Moderate	LC	Schedule-IV
383	Leiothrichidae (Laughingthrushes and Allies)	Brown-cheeked Fulvetta	*Alcippe poioicephala*	Moderate	LC	Schedule-IV
384	Leiothrichidae (Laughingthrushes and Allies)	Nepal Fulvetta	*Alcippe nipalensis*	Low	LC	Schedule-IV
385	Leiothrichidae (Laughingthrushes and Allies)	Striated Laughingthrush	*Grammatoptila striata*	Low	LC	Schedule-IV
386	Leiothrichidae (Laughingthrushes and Allies)	Himalayan Cutia	*Cutia nipalensis*	Moderate	LC	Schedule-IV
387	Leiothrichidae (Laughingthrushes and Allies)	Striated Babbler	*Turdoides earlei*	Low	LC	Schedule-IV

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388	Leiothrichidae (Laughingthrushes and Allies)	White-crested Laughingthrush	*Garrulax leucolophus*	Low	LC	Schedule-IV
389	Leiothrichidae (Laughingthrushes and Allies)	Lesser Necklaced Laughingthrush	*Garrulax monileger*	Low	LC	Schedule-IV
390	Leiothrichidae (Laughingthrushes and Allies)	Rufous-chinned Laughingthrush	*Ianthocincla rufogularis*	Low	LC	Schedule-IV
391	Leiothrichidae (Laughingthrushes and Allies)	Spotted Laughingthrush	*Ianthocincla ocellata*	NA	LC	Schedule-IV
392	Leiothrichidae (Laughingthrushes and Allies)	Greater Necklaced Laughingthrush	*Ianthocincla pectoralis*	Low	LC	Schedule-IV
393	Leiothrichidae (Laughingthrushes and Allies)	Rufous-necked Laughingthrush	*Ianthocincla ruficollis*	Low	LC	Schedule-IV
394	Leiothrichidae (Laughingthrushes and Allies)	Gray-sided Laughingthrush	*Ianthocincla caerulata*	High	LC	Schedule-IV
395	Leiothrichidae (Laughingthrushes and Allies)	Scaly Laughingthrush	*Trochalopteron subunicolor*	Moderate	LC	Schedule-IV
396	Leiothrichidae (Laughingthrushes and Allies)	Blue-winged Laughingthrush	*Trochalopteron squamatum*	Moderate	LC	Schedule-IV
397	Leiothrichidae (Laughingthrushes and Allies)	Elliot's Laughingthrush	*Trochalopteron elliotii* [1]	NA	LC	Schedule-IV
398	Leiothrichidae (Laughingthrushes and Allies)	Black-faced Laughingthrush	*Trochalopteron affine*	NA	LC	Schedule-IV
399	Leiothrichidae (Laughingthrushes and Allies)	Chestnut-crowned Laughingthrush	*Trochalopteron erythrocephalum*	Low	LC	Schedule-IV
400	Leiothrichidae (Laughingthrushes and Allies)	Gray Sibia	*Heterophasia gracilis* *	Moderate	LC	Schedule-IV
401	Leiothrichidae (Laughingthrushes and Allies)	Beautiful Sibia	*Heterophasia pulchella*	Moderate	LC	Schedule-IV
402	Leiothrichidae (Laughingthrushes and Allies)	Long-tailed Sibia	*Heterophasia picaoides*	NA	LC	Schedule-IV
403	Leiothrichidae (Laughingthrushes and Allies)	Silver-eared Mesia	*Leiothrix argentauris*	Low	LC	Schedule-IV
404	Leiothrichidae (Laughingthrushes and Allies)	Red-billed Leiothrix	*Leiothrix lutea*	Low	LC	Schedule-IV
405	Leiothrichidae (Laughingthrushes and Allies)	Red-tailed Minla	*Minla ignotincta*	Moderate	LC	Schedule-IV

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406	Leiothrichidae (Laughingthrushes and Allies)	Rufous-backed Sibia	*Minla annectens*	Moderate	LC	Schedule-IV
407	Leiothrichidae (Laughingthrushes and Allies)	Red-faced Liocichla	*Liocichla phoenicea*	Low	LC	Schedule-IV
408	Leiothrichidae (Laughingthrushes and Allies)	Streak-throated Barwing	*Actinodura waldeni*	Moderate	LC	Schedule-IV
409	Leiothrichidae (Laughingthrushes and Allies)	Rusty-fronted Barwing	*Actinodura egertoni*	Low	LC	Schedule-IV
410	Leiothrichidae (Laughingthrushes and Allies)	Blue-winged Minla	*Actinodura cyanouroptera*	Low	LC	Schedule-IV
411	Leiothrichidae (Laughingthrushes and Allies)	Chestnut-tailed Minla	*Actinodura strigula*	Low	LC	Schedule-IV
412	Regulidae (Kinglets)	Goldcrest	*Regulus regulus* !	NA	LC	Schedule-IV
413	Tichodromidae (Wallcreeper)	Wallcreeper	*Tichodroma muraria*	Low	LC	Schedule-IV
414	Sittidae (Nuthatches)	Chestnut-bellied Nuthatch	*Sitta cinnamoventris*	Low	LC	Schedule-IV
415	Sittidae (Nuthatches)	White-tailed Nuthatch	*Sitta himalayensis*	Low	LC	Schedule-IV
416	Sittidae (Nuthatches)	Velvet-fronted Nuthatch	*Sitta frontalis*	Moderate	LC	Schedule-IV
417	Sittidae (Nuthatches)	Beautiful Nuthatch	*Sitta formosa*	High	VU	Schedule-IV
418	Certhiidae (Treecreepers)	Hodgson's Treecreeper	*Certhia hodgsoni*	Moderate	LC	Schedule-IV
419	Certhiidae (Treecreepers)	Rusty-flanked Treecreeper	*Certhia nipalensis*	Moderate	LC	Schedule-IV
420	Certhiidae (Treecreepers)	Sikkim Treecreeper	*Certhia discolor*	Moderate	LC	Schedule-IV
421	Troglodytidae (Wrens)	Eurasian Wren	*Troglodytes troglodytes*	Low	LC	Schedule-IV
422	Elachuridae (Spotted Elachura)	Spotted Elachura	*Elachura formosa*	NA	LC	Schedule-IV
423	Cinclidae (Dippers)	Brown Dipper	*Cinclus pallasii*	Low	LC	Schedule-IV
424	Sturnidae (Starlings)	Common Hill Myna	*Gracula religiosa*	Low	LC	Schedule-I
425	Sturnidae (Starlings)	European Starling	*Sturnus vulgaris* !	Moderate	LC	Schedule-IV
426	Sturnidae (Starlings)	Asian Pied Starling	*Gracupica contra*	Low	LC	Schedule-IV
427	Sturnidae (Starlings)	Chestnut-tailed Starling	*Sturnia malabarica*	Low	LC	Schedule-IV
428	Sturnidae (Starlings)	Common Myna	*Acridotheres tristis*	Low	LC	Schedule-IV
429	Sturnidae (Starlings)	Jungle Myna	*Acridotheres fuscus*	Moderate	LC	Schedule-IV
430	Sturnidae (Starlings)	Great Myna	*Acridotheres grandis* *	Low	LC	Schedule-IV
431	Sturnidae (Starlings)	Spot-winged Starling	*Saroglossa spilopterus*	Moderate	LC	Schedule-IV
432	Turdidae (Thrushes and Allies)	Long-tailed Thrush	*Zoothera dixoni*	Moderate	LC	Schedule-IV
433	Turdidae (Thrushes and Allies)	Dark-sided Thrush	*Zoothera marginata*	Moderate	LC	Schedule-IV

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434	Turdidae (Thrushes and Allies)	Long-billed Thrush	*Zoothera monticola*	Low	LC	Schedule-IV
435	Turdidae (Thrushes and Allies)	Scaly Thrush	*Zoothera dauma*	Low	LC	Schedule-IV
436	Turdidae (Thrushes and Allies)	Purple Cochoa	*Cochoa purpurea*	Moderate	LC	Schedule-IV
437	Turdidae (Thrushes and Allies)	Green Cochoa	*Cochoa viridis*	NA	LC	Schedule-IV
438	Turdidae (Thrushes and Allies)	Orange-headed Thrush	*Geokichla citrina*	Moderate	LC	Schedule-IV
439	Turdidae (Thrushes and Allies)	Gray-winged Blackbird	*Turdus boulboul*	Low	LC	Schedule-IV
440	Turdidae (Thrushes and Allies)	Black-breasted Thrush	*Turdus dissimilis*	NA	LC	Schedule-IV
441	Turdidae (Thrushes and Allies)	Gray-sided Thrush	*Turdus feae*	NA	VU	Schedule-IV
442	Turdidae (Thrushes and Allies)	Eyebrowed Thrush	*Turdus obscurus*	NA	LC	Schedule-IV
443	Turdidae (Thrushes and Allies)	White-collared Blackbird	*Turdus albocinctus*	Low	LC	Schedule-IV
444	Turdidae (Thrushes and Allies)	Chestnut Thrush	*Turdus rubrocanus*	NA	LC	Schedule-IV
445	Turdidae (Thrushes and Allies)	Black-throated Thrush	*Turdus atrogularis*	NA	LC	Schedule-IV
446	Turdidae (Thrushes and Allies)	Red-throated Thrush	*Turdus ruficollis*	NA	LC	Schedule-IV
447	Turdidae (Thrushes and Allies)	Dusky Thrush	*Turdus eunomus*	NA	LC	Schedule-IV
448	Turdidae (Thrushes and Allies)	Naumann's Thrush	*Turdus naumanni*	NA	LC	Schedule-IV
449	Muscicapidae (Old World Flycatchers)	Dark-sided Flycatcher	*Muscicapa sibirica*	Low	LC	Schedule-IV
450	Muscicapidae (Old World Flycatchers)	Ferruginous Flycatcher	*Muscicapa ferruginea*	NA	LC	Schedule-IV
451	Muscicapidae (Old World Flycatchers)	Oriental Magpie-Robin	*Copsychus saularis*	Low	LC	Schedule-IV
452	Muscicapidae (Old World Flycatchers)	White-rumped Shama	*Copsychus malabaricus*	Low	LC	Schedule-IV
453	Muscicapidae (Old World Flycatchers)	White-gorgeted Flycatcher	*Anthipes monileger*	Moderate	LC	Schedule-IV
454	Muscicapidae (Old World Flycatchers)	Pale-chinned Blue Flycatcher	*Cyornis poliogenys*	Low	LC	Schedule-IV
455	Muscicapidae (Old World Flycatchers)	Pale Blue Flycatcher	*Cyornis unicolor*	NA	LC	Schedule-IV
456	Muscicapidae (Old World Flycatchers)	Blue-throated Flycatcher	*Cyornis rubeculoides*	Low	LC	Schedule-IV
457	Muscicapidae (Old World Flycatchers)	Large Blue Flycatcher	*Cyornis magnirostris*	High	LC	Schedule-IV
458	Muscicapidae (Old World Flycatchers)	Hill Blue Flycatcher	*Cyornis banyumas*	NA	LC	Schedule-IV
459	Muscicapidae (Old World Flycatchers)	Large Niltava	*Niltava grandis*	Low	LC	Schedule-IV

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460	Muscicapidae (Old World Flycatchers)	Small Niltava	*Niltava macgrigoriae*	Low	LC	Schedule-IV
461	Muscicapidae (Old World Flycatchers)	Rufous-bellied Niltava	*Niltava sundara*	Moderate	LC	Schedule-IV
462	Muscicapidae (Old World Flycatchers)	Vivid Niltava	*Niltava vivida*	NA	LC	Schedule-IV
463	Muscicapidae (Old World Flycatchers)	Verditer Flycatcher	*Eumyias thalassinus*	Low	LC	Schedule-IV
464	Muscicapidae (Old World Flycatchers)	Rusty-bellied Shortwing	*Brachypteryx hyperythra*	Moderate	NT	Schedule-IV
465	Muscicapidae (Old World Flycatchers)	Gould's Shortwing	*Brachypteryx stellata*	Moderate	LC	Schedule-IV
466	Muscicapidae (Old World Flycatchers)	Lesser Shortwing	*Brachypteryx leucophris*	Low	LC	Schedule-IV
467	Muscicapidae (Old World Flycatchers)	Himalayan Shortwing	*Brachypteryx cruralis*	NA	NA	NA
468	Muscicapidae (Old World Flycatchers)	Indian Blue Robin	*Larvivora brunnea*	Low	LC	Schedule-IV
469	Muscicapidae (Old World Flycatchers)	Bluethroat	*Luscinia svecica*	Low	LC	Schedule-IV
470	Muscicapidae (Old World Flycatchers)	Blue Whistling-Thrush	*Myophonus caeruleus*	Low	LC	Schedule-IV
471	Muscicapidae (Old World Flycatchers)	Little Forktail	*Enicurus scouleri*	Low	LC	Schedule-IV
472	Muscicapidae (Old World Flycatchers)	White-crowned Forktail	*Enicurus leschenaulti*	NA	LC	Schedule-IV
473	Muscicapidae (Old World Flycatchers)	Spotted Forktail	*Enicurus maculatus*	Low	LC	Schedule-IV
474	Muscicapidae (Old World Flycatchers)	Black-backed Forktail	*Enicurus immaculatus*	Low	LC	Schedule-IV
475	Muscicapidae (Old World Flycatchers)	Slaty-backed Forktail	*Enicurus schistaceus*	Low	LC	Schedule-IV
476	Muscicapidae (Old World Flycatchers)	Siberian Rubythroat	*Calliope calliope*	Moderate	LC	Schedule-IV
477	Muscicapidae (Old World Flycatchers)	Chinese Rubythroat	*Calliope tschebaiewi* *	High	LC	Schedule-IV
478	Muscicapidae (Old World Flycatchers)	White-tailed Robin	*Myiomela leucura*	Moderate	LC	Schedule-IV
479	Muscicapidae (Old World Flycatchers)	Blue-fronted Robin	*Cinclidium frontale*	Moderate	LC	Schedule-IV
480	Muscicapidae (Old World Flycatchers)	Himalayan Bluetail	*Tarsiger rufilatus*	Low	LC	Schedule-IV
481	Muscicapidae (Old World Flycatchers)	Rufous-breasted Bush-Robin	*Tarsiger hyperythrus*	Moderate	LC	Schedule-IV
482	Muscicapidae (Old World Flycatchers)	White-browed Bush-Robin	*Tarsiger indicus*	NA	LC	Schedule-IV
483	Muscicapidae (Old World Flycatchers)	Golden Bush-Robin	*Tarsiger chrysaeus*	Low	LC	Schedule-IV
484	Muscicapidae (Old World Flycatchers)	Slaty-backed Flycatcher	*Ficedula erithacus*	NA	LC	Schedule-IV
485	Muscicapidae (Old World Flycatchers)	Slaty-blue Flycatcher	*Ficedula tricolor*	Low	LC	Schedule-IV

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486	Muscicapidae (Old World Flycatchers)	Snowy-browed Flycatcher	*Ficedula hyperythra*	Low	LC	Schedule-IV
487	Muscicapidae (Old World Flycatchers)	Pygmy Flycatcher	*Ficedula hodgsoni*	Moderate	LC	Schedule-IV
488	Muscicapidae (Old World Flycatchers)	Rufous-gorgeted Flycatcher	*Ficedula strophiata*	Low	LC	Schedule-IV
489	Muscicapidae (Old World Flycatchers)	Sapphire Flycatcher	*Ficedula sapphira*	Moderate	LC	Schedule-IV
490	Muscicapidae (Old World Flycatchers)	Little Pied Flycatcher	*Ficedula westermanni*	Low	LC	Schedule-IV
491	Muscicapidae (Old World Flycatchers)	Ultramarine Flycatcher	*Ficedula superciliaris*	Low	LC	Schedule-IV
492	Muscicapidae (Old World Flycatchers)	Taiga Flycatcher	*Ficedula albicilla*	NA	LC	Schedule-IV
493	Muscicapidae (Old World Flycatchers)	Blue-fronted Redstart	*Phoenicurus frontalis*	Low	LC	Schedule-IV
494	Muscicapidae (Old World Flycatchers)	Plumbeous Redstart	*Phoenicurus fuliginosus*	Moderate	LC	Schedule-IV
495	Muscicapidae (Old World Flycatchers)	White-capped Redstart	*Phoenicurus leucocephalus*	Low	LC	Schedule-IV
496	Muscicapidae (Old World Flycatchers)	Hodgson's Redstart	*Phoenicurus hodgsoni*	NA	LC	Schedule-IV
497	Muscicapidae (Old World Flycatchers)	White-throated Redstart	*Phoenicurus schisticeps*	NA	LC	Schedule-IV
498	Muscicapidae (Old World Flycatchers)	Black Redstart	*Phoenicurus ochruros*	Moderate	LC	Schedule-IV
499	Muscicapidae (Old World Flycatchers)	Daurian Redstart	*Phoenicurus auroreus*	NA	LC	Schedule-IV
500	Muscicapidae (Old World Flycatchers)	Chestnut-bellied Rock-Thrush	*Monticola rufiventris*	Low	LC	Schedule-IV
501	Muscicapidae (Old World Flycatchers)	Blue Rock-Thrush	*Monticola solitarius*	Moderate	LC	Schedule-IV
502	Muscicapidae (Old World Flycatchers)	Siberian Stonechat	*Saxicola maurus*	Low	LC	Schedule-IV
503	Muscicapidae (Old World Flycatchers)	Pied Bushchat	*Saxicola caprata*	Low	LC	Schedule-IV
504	Muscicapidae (Old World Flycatchers)	Gray Bushchat	*Saxicola ferreus*	Low	LC	Schedule-IV
505	Muscicapidae (Old World Flycatchers)	Isabelline Wheatear	*Oenanthe isabellina*	Low	LC	Schedule-IV
506	Dicaeidae (Flowerpeckers)	Yellow-bellied Flowerpecker	*Dicaeum melanozanthum*	NA	LC	Schedule-IV
507	Dicaeidae (Flowerpeckers)	Plain Flowerpecker	*Dicaeum minullum*	Low	LC	Schedule-IV
508	Dicaeidae (Flowerpeckers)	Fire-breasted Flowerpecker	*Dicaeum ignipectus*	Low	LC	Schedule-IV
509	Dicaeidae (Flowerpeckers)	Scarlet-backed Flowerpecker	*Dicaeum cruentatum*	Moderate	LC	Schedule-IV
510	Nectariniidae (Sunbirds and Spiderhunters)	Ruby-cheeked Sunbird	*Chalcoparia singalensis*	Low	LC	Schedule-IV
511	Nectariniidae (Sunbirds and Spiderhunters)	Purple Sunbird	*Cinnyris asiaticus*	Low	LC	Schedule-IV

	Family	Common name	Scientific name	SoIB concern status	IUCN Red List	WLPA schedule
512	Nectariniidae (Sunbirds and Spiderhunters)	Fire-tailed Sunbird	*Aethopyga ignicauda*	Low	LC	Schedule-IV
513	Nectariniidae (Sunbirds and Spiderhunters)	Black-throated Sunbird	*Aethopyga saturata*	Low	LC	Schedule-IV
514	Nectariniidae (Sunbirds and Spiderhunters)	Mrs. Gould's Sunbird	*Aethopyga gouldiae*	Low	LC	Schedule-IV
515	Nectariniidae (Sunbirds and Spiderhunters)	Green-tailed Sunbird	*Aethopyga nipalensis*	Low	LC	Schedule-IV
516	Nectariniidae (Sunbirds and Spiderhunters)	Crimson Sunbird	*Aethopyga siparaja*	Low	LC	Schedule-IV
517	Nectariniidae (Sunbirds and Spiderhunters)	Little Spiderhunter	*Arachnothera longirostra*	Moderate	LC	Schedule-IV
518	Nectariniidae (Sunbirds and Spiderhunters)	Streaked Spiderhunter	*Arachnothera magna*	Low	LC	Schedule-IV
519	Chloropseidae (Leafbirds)	Blue-winged Leafbird	*Chloropsis cochinchinensis*	NA	LC	Schedule-IV
520	Chloropseidae (Leafbirds)	Golden-fronted Leafbird	*Chloropsis aurifrons*	Low	LC	Schedule-IV
521	Chloropseidae (Leafbirds)	Orange-bellied Leafbird	*Chloropsis hardwickii*	Low	LC	Schedule-IV
522	Ploceidae (Weavers and Allies)	Streaked Weaver	*Ploceus manyar* *	Moderate	LC	Schedule-IV
523	Ploceidae (Weavers and Allies)	Baya Weaver	*Ploceus philippinus* *	Low	LC	Schedule-IV
524	Estrildidae (Waxbills and Allies)	Red Avadavat	*Amandava amandava* *	Low	LC	Schedule-IV
525	Estrildidae (Waxbills and Allies)	White-rumped Munia	*Lonchura striata*	Moderate	LC	Schedule-IV
526	Estrildidae (Waxbills and Allies)	Scaly-breasted Munia	*Lonchura punctulata*	Low	LC	Schedule-IV
527	Estrildidae (Waxbills and Allies)	Chestnut Munia	*Lonchura atricapilla*	NA	LC	Schedule-IV
528	Prunellidae (Accentors)	Alpine Accentor	*Prunella collaris*	Low	LC	Schedule-IV
529	Prunellidae (Accentors)	Rufous-breasted Accentor	*Prunella strophiata*	Low	LC	Schedule-IV
530	Prunellidae (Accentors)	Maroon-backed Accentor	*Prunella immaculata*	Moderate	LC	Schedule-IV
531	Passeridae (Old World Sparrows)	House Sparrow	*Passer domesticus*	Low	LC	Schedule-IV
532	Passeridae (Old World Sparrows)	Russet Sparrow	*Passer cinnamomeus* !	Low	LC	Schedule-IV
533	Passeridae (Old World Sparrows)	Eurasian Tree Sparrow	*Passer montanus*	Low	LC	Schedule-IV
534	Motacillidae (Wagtails and Pipits)	Gray Wagtail	*Motacilla cinerea*	Low	LC	Schedule-IV
535	Motacillidae (Wagtails and Pipits)	Western Yellow Wagtail	*Motacilla flava*	Low	LC	Schedule-IV
536	Motacillidae (Wagtails and Pipits)	Citrine Wagtail	*Motacilla citreola*	Low	LC	Schedule-IV
537	Motacillidae (Wagtails and Pipits)	White-browed Wagtail	*Motacilla maderaspatensis*	Moderate	LC	Schedule-IV

	Family	Common name	Scientific name	SoIB concern status	IUCN Red List	WLPA schedule
538	Motacillidae (Wagtails and Pipits)	White Wagtail	*Motacilla alba*	Moderate	LC	Schedule-IV
539	Motacillidae (Wagtails and Pipits)	Richard's Pipit	*Anthus richardi*	Moderate	LC	Schedule-IV
540	Motacillidae (Wagtails and Pipits)	Paddyfield Pipit	*Anthus rufulus*	Low	LC	Schedule-IV
541	Motacillidae (Wagtails and Pipits)	Blyth's Pipit	*Anthus godlewskii*	Low	LC	Schedule-IV
542	Motacillidae (Wagtails and Pipits)	Rosy Pipit	*Anthus roseatus*	Low	LC	Schedule-IV
543	Motacillidae (Wagtails and Pipits)	Olive-backed Pipit	*Anthus hodgsoni*	Moderate	LC	Schedule-IV
544	Fringillidae (Finches, Euphonias, and Allies)	Collared Grosbeak	*Mycerobas affinis*	Moderate	LC	Schedule-IV
545	Fringillidae (Finches, Euphonias, and Allies)	Common Rosefinch	*Carpodacus erythrinus*	Low	LC	Schedule-IV
546	Fringillidae (Finches, Euphonias, and Allies)	Scarlet Finch	*Carpodacus sipahi*	Low	LC	Schedule-IV
547	Fringillidae (Finches, Euphonias, and Allies)	Dark-rumped Rosefinch	*Carpodacus edwardsii*	NA	LC	Schedule-IV
548	Fringillidae (Finches, Euphonias, and Allies)	Crimson-browed Finch	*Carpodacus subhimachalus*	Moderate	LC	Schedule-IV
549	Fringillidae (Finches, Euphonias, and Allies)	Chinese White-browed Rosefinch	*Carpodacus dubius*	NA	LC	Schedule-IV
550	Fringillidae (Finches, Euphonias, and Allies)	Brown Bullfinch	*Pyrrhula nipalensis*	Moderate	LC	Schedule-IV
551	Fringillidae (Finches, Euphonias, and Allies)	Gray-headed Bullfinch	*Pyrrhula erythaca*	NA	LC	Schedule-IV
552	Fringillidae (Finches, Euphonias, and Allies)	Gold-naped Finch	*Pyrrhoplectes epauletta*	Moderate	LC	Schedule-IV
553	Fringillidae (Finches, Euphonias, and Allies)	Dark-breasted Rosefinch	*Procarduelis nipalensis*	Low	LC	Schedule-IV
554	Fringillidae (Finches, Euphonias, and Allies)	Plain Mountain-Finch	*Leucosticte nemoricola*	Low	LC	Schedule-IV
555	Fringillidae (Finches, Euphonias, and Allies)	Black-headed Greenfinch	*Chloris ambigua*	NA	LC	Schedule-IV
556	Emberizidae (Old World Buntings)	Crested Bunting	*Emberiza lathami*	Moderate	LC	Schedule-IV
557	Emberizidae (Old World Buntings)	Chestnut-eared Bunting	*Emberiza fucata*	NA	LC	Schedule-IV
558	Emberizidae (Old World Buntings)	Yellow-breasted Bunting	*Emberiza aureola* *	High	CR	Schedule-IV
559	Emberizidae (Old World Buntings)	Little Bunting	*Emberiza pusilla*	NA	LC	Schedule-IV
560	Emberizidae (Old World Buntings)	Rustic Bunting	*Emberiza rustica*	NA	NA	NA
561	Emberizidae (Old World Buntings)	Black-faced Bunting	*Emberiza spodocephala*	NA	LC	Schedule-IV
562	Emberizidae (Old World Buntings)	Chestnut Bunting	*Emberiza rutila*	NA	LC	Schedule-IV
563	Emberizidae (Old World Buntings)	Tristram's Bunting	*Emberiza tristrami*	NA	LC	Schedule-IV

Appendix V: Checklist of mammals of the Dibang River basin. Sources: CT – Camera trap record collected by Nijhawan (2018) and Nijhawan and Mitapo [*unpublished data*]); DS – Direct sighting by Nijhawan (2018); HS – Hunted specimen collected by Nijhawan (2018) and Nijhawan and Mitapo [*unpublished data*]; *Evidence exclusively from Lower Dibang Valley district; ^Evidence from Dihang and Dibang Biosphere Reserve in Dibang Valley district (Alfred 2006a); IUCN Red List categories: DD – Data deficient; EN – Endangered; LC – Least concern; NT – Near threatened; VU – Vulnerable; WLPA – Indian Wild Life Life Protection Act, 1972.

	Family	Common name	Scientific name	WLPA 1972	IUCN	Source
1	Ailuridae	Red panda	*Ailurus fulgens*	Schedule I	EN	CT
2	Bovidae	Mithun	*Bos frontalis*	Status undetermined	LC	CT
3	Bovidae	Mishmi takin	*Budorcas taxicolor taxicolor*	Schedule I	EN	CT/DS
4	Bovidae	Himalayan serow	*Capricornis sumatraensis*	Schedule I	NT	CT/DS
5	Bovidae	Red goral	*Naemorhedus baileyi*	Schedule III	VU	CT/DS
6	Canidae	Golden jackal *	*Canis aureus*	Schedule II	LC	CT
7	Canidae	Asiatic wild dog	*Cuon alpinus*	Schedule II	EN	CT
8	Cercopithecidae	Assamese macaque	*Macaca assamensis*	Schedule II	NT	CT
9	Cercopithecidae	Rhesus macaque *	*Macaca mulatta*	Schedule II	LC	DS
10	Cercopithecidae	Arunachal macaque	*Macaca munzala*	Status undetermined	EN	CT
11	Cervidae	Gongshan muntjac	*Muntiacus gongshanensis*	Status undetermined	DD	CT/DS
12	Cervidae	Indian muntjac	*Muntiacus muntjak*	Schedule III	LC	CT/DS
13	Cervidae	Indian sambar *	*Rusa unicolor*	Schedule III	VU	CT
14	Cricetidae	Pere David's vole ^	*Eothenomys melanogaster libonotus*	Schedule IV	LC	Alfred (2006a)
15	Felidae	Asiatic golden cat	*Catopuma temminckii*	Schedule I	NT	CT/DS
16	Felidae	Clouded leopard	*Neofelis nebulosa*	Schedule I	VU	CT
17	Felidae	Tiger	*Panthera tigris*	Schedule I	EN	CT
18	Felidae	Marbled cat	*Pardofelis marmorata*	Schedule I	NT	CT
19	Felidae	Leopard Cat	*Prionailurus bengalensis*	Schedule I	LC	CT/DS
20	Herpestidae	Small Indian mongoose	*Herpestes auropunctatus*	Schedule II	LC	WII (2019)
21	Hipposideridae	Leaf-nosed bat^	*Hipposideros larvatus leptophyllus*	-	LC	Alfred (2006a)
22	Hylobatidae	Eastern hoolock gibbon (Mishmi Hills subspecies) *	*Hoolock leuconedys mishmiensis*	Schedule I	VU	DS
23	Hystricidae	Asiatic brush tailed porcupine *	*Atherurus macrourus*	Schedule II	LC	CT
24	Hystricidae	Malayan porcupine *	*Hystrix brachyura*	Schedule II	LC	CT
25	Manidae	Chinese pangolin	*Manis pentadactyla*	Schedule I	CR	CT (WII 2019)
26	Moschidae	Alpine musk deer	*Moschus chrysogaster*	Schedule I	EN	HS; WII (2019)
27	Muridae	South China field mouse ^	*Apodemus draco*	Schedule V	LC	Alfred (2006a)
28	Muridae	Millard's rat ^	*Dacnomys millardi wroughtoni*	Schedule V	DD	Alfred (2006a)
29	Muridae	Ryley's spiny mouse ^	*Mus cookii nagarum*	Schedule V	LC	Alfred (2006a)
30	Muridae	Brahma white-bellied rat ^	*Niviventer brahma*	Schedule V	LC	Alfred (2006a)

	Family	Common name	Scientific name	WLPA 1972	IUCN	Source
31	Muridae	Himalayan white-bellied rat ^	*Niviventer niviventer*	Schedule V	LC	Alfred (2006a)
32	Muridae	Himalayan jungle rat	*Rattus nitidus*	Schedule VI	LC	CT
33	Mustellidae	Eurasian otter	*Lutra lutra*	Schedule II	NT	WII (2019)
34	Mustellidae	Smooth-coated otter	*Lutrogale perspicillata*	Schedule II	VU	CT
35	Mustellidae	Yellow-throated marten	*Martes flavigula*	Schedule II	LC	CT/DS
36	Mustellidae	Yellow-bellied weasel	*Mustela kathiah*	Schedule II	LC	CT
37	Mustellidae	Siberian weasel	*Mustela sibirica*	Schedule II	LC	CT
38	Prionodontidae	Spotted linsang	*Prionodon pardicolor*	Schedule I	LC	CT/DS
39	Rhinolophidae	Greater horseshoe bat^	*Rhinolophus ferrumequinum tragatus*	-	LC	Alfred (2006a)
40	Sciuridae	Pallas' squirrel	*Callosciurus erythraeus*	Schedule IV	LC	DS; (WII 2019)
41	Sciuridae	Hoary-bellied Himalayan squirrel	*Callosciurus pygerythrus*	Schedule II	LC	CT
42	Sciuridae	Orange-bellied squirrel	*Dremomys lokriah*	Status undetermined	LC	WII (2019)
43	Sciuridae	Particolored gliding squirrel	*Hylopetes alboniger*	Schedule II	LC	Krishna et al. (2016)
44	Sciuridae	Himalayan pika	*Ochotona himalayana*	Status undetermined	LC	CT
45	Sciuridae	Grey headed gliding squirrel *	*Petaurista caniceps*	Schedule II	LC	Krishna et al. (2016)
46	Sciuridae	Hodgson's giant gliding squirrel *	*Petaurista magnificus*	Schedule II	LC	Krishna et al. (2016)
47	Sciuridae	Mishmi hill giant gliding squirrel	*Petaurista mishmiensis*	Schedule II	LC	Krishna et al. (2016)
48	Sciuridae	Bhutan giant gliding squirrel *	*Petaurista nobilis*	Schedule II	LC	Krishna et al. (2016)
49	Sciuridae	Red giant gliding squirrel *	*Petaurista petaurista*	Schedule II	LC	Krishna et al. (2016)
50	Sciuridae	Yunnan giant gliding squirrel	*Petaurista yunanensis*	Schedule II	LC	Choudhury (2013a)
51	Sciuridae	Malayan Giant Squirrel	*Ratufa bicolor*	Schedule II	NT	WII (2019)
52	Sciuridae	Himalayan stripped squirrel	*Tamiops mcclellandii*	Schedule IV	LC	CT
53	Soricidae	Asian Grey Shrew	*Crocidura attenuata*	Status undetermined	LC	WII (2019)
54	Soricidae	Himalayan large-clawed shrew	*Soriculus nigriscens*	Status undetermined	LC	WII (2019)
55	Suidae	Wild pig	*Sus scrofa cristatus*	Schedule III	LC	CT/DS
56	Talpidae	White-tailed mole	*Parascaptor leucura*	Schedule IV	LC	WII (2019)
57	Ursidae	Malayan sun bear *	*Helarctos malayanus*	Schedule I	VU	CT
58	Ursidae	Himalayan black bear	*Ursus thibetanus*	Schedule II	VU	CT
59	Viverridae	Masked palm civet	*Paguma larvata*	Schedule II	LC	CT
60	Viverridae	Common palm civet *	*Paradoxurus hermaphroditus*	Schedule II	LC	CT

Appendix VI: Checklist of amphibians known from Dibang River basin. Abbreviations and symbols: DS - Direct sighting by Roy and Ahmed (*unpublished data*); IUCN Red List categories: DD – Data deficient; EN – Endangered;; LC – Least concern; NT – Near threatened; VU – Vulnerable; *Evidence exclusively from Lower Dibang Valley district; ^Evidence from Dihang and Dibang Biosphere Reserve (Dibang Valley district), but likelihood of presence in Lower Dibang Valley district.

	Family	English common name	Species name	IUCN status	Source
1	Bufonidae	-	*Bufo* sp.	-	Roy et al. (2018)
2	Bufonidae	-	*Bufo* sp. ^		Borah & Bordoloi (2003)
3	Bufonidae	Common Asian Toad	*Duttaphrynus melanostictus*	LC	Roy et al. (2018)
4	Bufonidae	Stuart's Toad	*Duttaphrynus stuarti*	DD	Roy et al. (2018)
5	Ceratobatrachidae	Medog Eastern Frog	*Liurana medogensis*	DD	Roy et al. (2018)
6	Ceratobatrachidae	-	*Liurana* sp.	-	Roy et al. (2018)
7	Dicroglossidae	Indian Skittering Frog	*Euphlyctis cyanophlyctis*	LC	Roy et al. (2018)
8	Dicroglossidae	Jerdon's Bull Frog	*Hoplobatrachus crassus*	LC	Roy et al. (2018)
9	Dicroglossidae	Indian Bull Frog	*Hoplobatrachus tigerinus*	LC	Roy et al. (2018)
10	Dicroglossidae	Northern trickle frog	*Ingerana borealis* ^	VU	Borah & Bordoloi (2003)
11	Dicroglossidae	Nepal Cricket Frog	*Minervarya nepalensis*	LC	Roy et al. (2018)
12	Dicroglossidae	Pierre's Cricket Frog	*Minervarya pierrei*	LC	Roy et al. (2018)
13	Dicroglossidae	Small Cricket Frog	*Minervarya syhadrensis* *	LC	Roy et al. (2018)
14	Dicroglossidae	Terai Cricket Frog	*Minervarya teraiensis* *	LC	Roy et al. (2018)
15	Dicroglossidae	Chayu Paa Frog	*Nanorana chayuensis*	-	Roy et al. (2018)
16	Dicroglossidae	-	*Nanorana* sp.	-	DS
17	Megophryidae	-	*Oreolalax* sp.	-	Roy et al. (2018)
18	Megophryidae	Mountain Horn Frog	*Xenophrys robusta*	DD	Roy et al. (2018)
19	Megophryidae	-	*Xenophrys* sp. 1	-	Roy et al. (2018)
20	Megophryidae	-	*Xenophrys* sp. 2	-	Roy et al. (2018)
21	Megophryidae	-	*Xenophrys* sp. 3	-	Roy et al. (2018)
22	Megophryidae	Bompu Litter frog	*Leptobrachium bompu* *	-	Roy et al. (2018)
23	Ranidae	Chungan Torrent Frog	*Amolops chunganensis*	LC	Roy et al. (2018)
24	Ranidae	Himalaya Cascade Frog	*Amolops marmoratus*	LC	Borah & Bordoloi (2003); Roy et al. (2018)
25	Ranidae	-	*Amolops* sp.	-	Roy et al. (2018)
26	Ranidae	Green-spotted Torrent Frog	*Amolops viridimaculatus*	NT	Roy et al. (2018)
27	Ranidae	Assam Hills Frog	*Clinotarsus alticola* ^		Borah & Bordoloi (2003)
28	Ranidae	Bhamo Frog	*Humerana humeralis* *	LC	Roy et al. (2018)
29	Ranidae	Assam Forest Frog	*Hydrophylax leptoglossa* *	LC	Roy et al. (2018)
30	Ranidae	Copper-cheeked Frog	*Odorrana chloronota*	LC	Roy et al. (2018)
31	Rhacophoridae	-	*Kurixalus cf. naso*	DD	Roy et al. (2018); Ohler et al. (2018
32	Rhacophoridae	Boulenger's Bushfrog	*Kurixalus verrucosus*	LC	Ohler et al. (2018)
33	Rhacophoridae	Jerdon's Bush Frog	*Nasutixalus cf. jerdonii*	-	DS
34	Rhacophoridae	-	*Philautus* sp. 1 *	-	Roy et al. (2018)
35	Rhacophoridae	-	*Philautus* sp. 2	-	Roy et al. (2018)
36	Rhacophoridae	-	*Philautus* sp. 3	-	Roy et al. (2018)

	Family	English common name	Species name	IUCN status	Source
37	Rhacophoridae	-	*Philautus* sp. 4	-	Roy et al. (2018)
38	Rhacophoridae	Common Indian Tree Frog	*Polypedates himalayensis*	-	DS
39	Rhacophoridae	Himalaya Bubble-nest Frog	*Raorchestes annandalii* ^	LC	Borah & Bordoloi (2003)
40	Rhacophoridae	Himalaya Flying Frog	*Rhacophorus bipunctatus*	LC	Roy et al. (2018)
41	Rhacophoridae	-	*Rhacophorus* sp.^	-	Borah & Bordoloi (2003)
42	Rhacophoridae	Suffry Red-webbed Treefrog	*Rhacophorus suffry* *	-	DS
43	Rhacophoridae	Medog Tree Frog	*Rhacophorus translineatus*	DD	Borah & Bordoloi (2003); Athreya & Sheth (2016); Roy et al. (2018); Ohler et al. (2018)
44	Rhacophoridae	Tuberculate Tree Frog	*Rhacophorus tuberculatus* *	DD	Roy et al. (2018)
45	Rhacophoridae	Pied Warted Tree Frog	*Theloderma asperum* *	LC	Roy et al. (2018)
46	Rhacophoridae	Eerie Warted Tree Frog	*Theloderma moloch* *	VU	Roy et al. (2018)
47	Rhacophoridae	Gongshan Treefrog	*Zhangixalus burmanus*	NT	Roy et al. (2018)
48	Rhacophoridae	Large Tree Frog	*Zhangixalus smaragdinus*	LC	Roy et al. (2018)

Appendix VII: Checklist of turtles, lizards and snakes known from Dibang River basin. Abbreviations and symbols: DS – Direct sighting from Roy & Ahmed (*unpublished data*); IUCN Red List categories: DD – Data deficient; EN – Endangered; LC –Least concern; NT – Near threatened; VU – Vulnerable; *Evidence exclusively from Lower Dibang Valley.

	Order	Family	Common Name	Species	IUCN Status	Source
1	Testudines	Geoemydidae	Keeled box turtle	*Cuora mouhotii*	EN	Ahmed & Roy (2016)
2	Squamata	Agamidae	Jerdon's forest lizard	*Calotes jerdoni*	-	DS
3	Squamata	Agamidae	Indian garden lizard	*Calotes versicolor*	-	DS
4	Squamata	Agamidae	Burmese japalura	*Japalura sagittifera*	-	DS; Kunte & Manthey (2009)
5	Squamata	Agamidae	Blue throated lizard	*Ptyctolaemus gularis*	-	DS
6	Squamata	Gekkonidae	Bent-toad gecko	*Cyrtodactylus* sp.	-	DS
7	Squamata	Gekkonidae	Tokay gecko	*Gekko gecko*	LC	DS
8	Squamata	Scincidae	-	*Asymblepharus* sp.	-	WII (2019)
9	Squamata	Scincidae	Many-lined Grass Skink	*Eutropis multifasciata*	LC	WII (2019)
10	Squamata	Scincidae	Himalayan Litter Skink	*Sphenomorphus indicus*	-	WII (2019)
11	Squamata	Varanidae	Bengal Monitor	*Varanus bengalensis*	LC	WII (2019)
12	Squamata	Scincidae	Spotted Litter Skink	*Sphenomorphus maculatus*	-	WII (2019)
13	Squamata	Pythonidae	Burmese python	*Python bivittatus*	VU	DS
14	Squamata	Colubridae	Short nosed vine snake	*Ahaetulla prasina* *	-	DS

	Order	Family	Common Name	Species	IUCN Status	Source
15	Squamata	Colubridae	Green Cat Snake	*Boiga cyanea*	-	WII (2019)
16	Squamata	Colubridae	Eastern Cat Snake	*Boiga gokool*	-	WII (2019)
17	Squamata	Colubridae	Siamese cat snake	*Boiga siamensis*	-	WII (2019)
18	Squamata	Colubridae	Painted bronzeback	*Dendrelaphis pictus*	-	WII (2019)
19	Squamata	Colubridae	Green trinket snake	*Gonyosoma prasinum*	LC	DS
20	Squamata	Colubridae	Common wolf snake	*Lycodon aulicus*	-	WII (2019)
21	Squamata	Colubridae	Laotian Wolf Snake	*Lycodon laoensis*	-	WII (2019)
22	Squamata	Colubridae	Striped trinket snake	*Orthriophis taeniurus*	-	DS
23	Squamata	Colubridae	Assam Snail Eater	*Pareas monticola*	-	WII (2019)
24	Squamata	Colubridae	Large-eyed false Cobra	*Pseudoxenodon macrops*	-	WII (2019)
25	Squamata	Colubridae	Indo-Chinese Rat snake	*Ptyas korros*	-	WII (2019)
26	Squamata	Colubridae	Brown Trapezoid Snake	*Smithophis bicolor*	-	WII (2019)
27	Squamata	Colubridae	Checkered keelback	*Xenochrophis piscator*	-	DS
28	Squamata	Colubridae	Copper headed trinket snake	*Coelognathus radiatus* *	-	DS
29	Squamata	Colubridae	White-barred ukri snake	*Oligodon albocinctus*	-	DS
30	Squamata	Colubridae	Mock viper	*Psammodynastes pulverulentus*	-	DS
31	Squamata	Colubridae	Green Rat Snake	*Ptyas nigromarginata*	LC	DS; WII (2019)
32	Squamata	Colubridae	Himalayan keelback	*Rhabdophis himalayanus*	-	DS
33	Squamata	Colubridae	Hubei keelback	*Rhabdophis nuchalis* *	-	Athreya & Sheth (2016)
34	Squamata	Elapidae	Banded krait	*Bungarus fasciatus* *	LC	DS
35	Squamata	Elapidae	Black krait	*Bungarus niger*	-	DS
36	Squamata	Elapidae	Unidentified krait species	*Bungarus* sp.	-	DS
37	Squamata	Elapidae	King cobra	*Ophiophagus hannah*	VU	DS
38	Squamata	Elapidae	MacClelland's coral snake	*Sinomicrurus macclellandi* *	-	DS
39	Squamata	Typhlopidae	Diard's blindsnake	*Typhlops diardii*	LC	DS
40	Squamata	Viperidae	Mountain pitviper	*Ovophis monticola*	LC	DS
41	Squamata	Viperidae	Jerdon's pitviper group of species	*Protobothrops aff. jerdonii*	LC	DS
42	Squamata	Viperidae	Medog pitviper	*Trimeresurus cf. medoensis* *	DD	DS

Appendix VIII: Checklist of fish species known from Dibang River basin. Abbreviations and symbols: IUCN Red List categories: DD – Data deficient; EN – Endangered; LC – Least concern; NT – Near threatened; VU – Vulnerable; *Evidence exclusively from Lower Dibang Valley District; !Evidence exclusively from Dibang Valley District.

	Family	Species	IUCN	Source
1	Amblycipitidae	*Amblyceps laticeps* *	LC	Darshan et al. (2019)
2	Anguillidae	*Anguilla bengalensis* *	NT	Darshan et al. (2019)
3	Badidae	*Badis assamensis* *	DD	Darshan et al. (2019)
4	Bagridae	*Batasio batasio* *	LC	Darshan et al. (2019)
5	Bagridae	*Mystus dibrugarensis* *	LC	Darshan et al. (2019)
6	Bagridae	*Mystus prabini* *	Status undetermined	Darshan et al. (2019b)
7	Balitoridae	*Schistura devdevi* *	NT	Darshan et al. (2019)
8	Balitoridae	*Schistura savona* *	LC	Darshan et al. (2019)
9	Balitoridae	*Schistura zonata* *	DD	Darshan et al. (2019)
10	Belonidae	*Xenentodon cancila* *	LC	Darshan et al. (2019)
11	Channidae	*Channa stewartii* *	LC	Darshan et al. (2019)
12	Cobitidae	*Botia rostrata* *	VU	Darshan et al. (2019)
13	Cobitidae	*Lepidocephalichthys arunachalensis* *	Status undetermined	Darshan et al. (2019)
14	Cyprinidae	*Cyprinion semiplotum* *	VU	Darshan et al. (2019)
15	Cyprinidae	*Garra arunachalensis* *	Status undetermined	Darshan et al. (2019)
16	Cyprinidae	*Garra arupi* *	Status undetermined	Darshan et al. (2019)
17	Cyprinidae	*Garra kempi*	LC	WII (2019)
18	Cyprinidae	*Garra magnidiscus*	Status undetermined	WII (2019)
19	Cyprinidae	*Neolissochilus hexastichus* *	NT	Darshan et al. (2019)
20	Cyprinidae	*Salmostoma phulo* *	Status undetermined	Darshan et al. (2019)
21	Cyprinidae	*Schizothorax progastus* !	LC	WII (2019); Darshan et al. (2019)
22	Cyprinidae	*Schizothorax richardsonii*	VU	WII (2019)
23	Cyprinidae	*Systomus immaculatus* *	Status undetermined	Darshan et al. (2019)
24	Cyprinidae	*Systomus sarana* *	LC	Darshan et al. (2019)
25	Erethistidae	*Pseudolaguvia jiyaensis* *	Status undetermined	Darshan et al. (2019)
26	Erethistidae	*Pseudolaguvia magna* *	Status undetermined	Darshan et al. (2019)
27	Mastacembelidae	*Macrognathus pancalus* *	LC	Darshan et al. (2019)
28	Nandidae	*Nandus nandus* *	LC	Darshan et al. (2019)
29	Nemacheilidae	*Aborichthys elongatus* *	LC	Darshan et al. (2019)
30	Nemacheilidae	*Aborichthys iphipaniensis* *	Status undetermined	Kosygin et al. (2019)
31	Nemacheilidae	*Aborichthys waikhomi* *	Status undetermined	Darshan et al. (2019)
32	Nemacheilidae	*Physoschistura harkishorei* *	Status undetermined	Darshan et al. (2019)
33	Psilorhynchidae	*Psilorhynchus arunachalensis*	Status undetermined	WII (2019)
34	Siluridae	*Ompok pabda* *	NT	Darshan et al. (2019)
35	Sisoridae	*Creteuchiloglanis arunachalensis*	Status undetermined	WII (2019)

	Family	Species	IUCN	Source
36	Sisoridae	*Exostoma labiatum* [!]	LC	WII (2019); Darshan et al. (2019)
37	Sisoridae	*Glyptothorax cavia* [*]	LC	Darshan et al. (2019)
38	Sisoridae	*Parachiloglanis bhutanensis*	Status undetermined	WII (2019)
39	Sisoridae	*Pseudecheneis sirenica* [*]	VU	Darshan et al. (2019)
40	Sisoridae	*Pseudecheneis sulcata*	LC	WII (2019)
41	Syngnathidae	*Microphis deocata* [*]	NT	Darshan et al. (2019)
42	Tetraodontidae	*Leiodon cutcutia* [*]	Status undetermined	Darshan et al. (2019)

bats **did not*** directly infect humans with **COVID-19**

***as per current scientific consensus**

Collage of the awareness posters on Covid19 not being caused or transmitted by bats in twelve (12) languages of South Asia released by Chiroptera Conservation and Information Network of South Asia (CCINSA)

Lesser Mouse-tailed Bat
Rhinopoma hardwickii

Bat Conservation Awareness Campaign

CCINSA

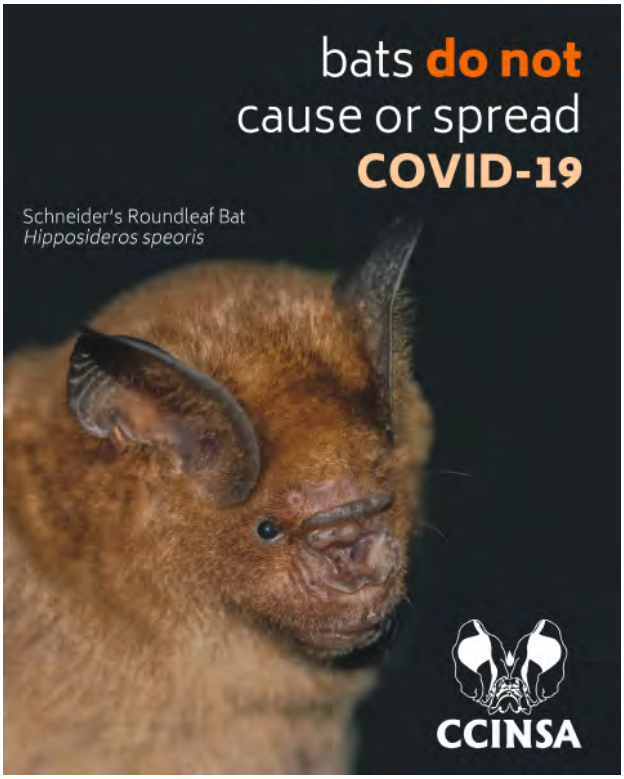
Thanks to Chelmala Srinivasulu, Sanjay Molur, Bhargavi Srinivasulu, Aditya Srinivasulu, Sanjeev Baniya, Pushpa Raj Acharya, Subrat Debata, Harpreet Kaur, Sayantani Nath, Akaanksha Venkataraman, Baheerathan, S., Harshada Yadkikar, Tijo K Joy, Nagarathna, and Vijaya for the text and translations.

Thanks to Aditya Srinivasulu for designing and typesetting.

Chiroptera Conservation and Information Network of South Asia

Bats do not cause or spread COVID-19

There is NO evidence suggesting that SARS-CoV-2 is found in bats, and as far as we know, bats do not cause or spread COVID-19, as they do not carry the virus that causes the disease.



Due to the recent discovery of bat coronaviruses in two species of fruit bats in India, people have been worried about bats living in the vicinity of human habitation, leading to unnecessary fear and superstition. Bats DO NOT cause COVID-19, and there is NO reason to harm them or fear them.

Bats are very important to the ecosystem, as they pollinate flowering plants, disperse seeds, and eat pest insects, which damage crops and spread diseases. Harming or exterminating bats will cause irreparable harm to the balance of the ecosystem, and will not slow the spread of COVID-19 in any way.

COVID-19 is caused by SARS-CoV-2, which is only transmitted from humans to other humans, and according to current scientific knowledge, bats did not infect humans with the virus.

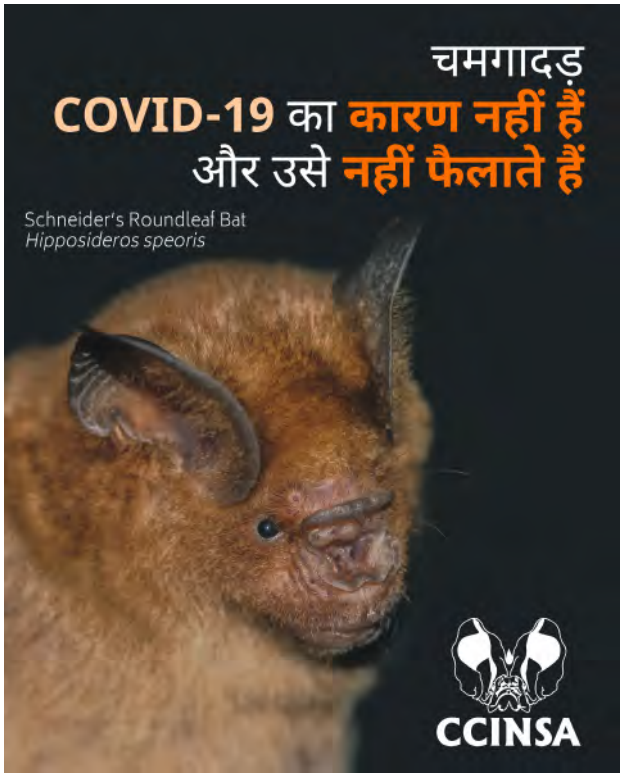
If you have any questions, please feel free to contact me, or:
Dr. Sanjay Molur, Co-Chair, CCINSA: sanjay@zooreach.org
Dr. Chelmala Srinivasulu, Co-Chair, CCINSA: srini.chelmala@gmail.com

For more information please visit:
https://bit.ly/2yH2dvk - Global Union of Bat Diversity Networks (GBatNet)
https://bit.ly/2S0h1Mq - Chiroptera Conservation Information Network of South Asia's Statement on COVID-19 and Bats
https://bit.ly/2VrqEWq - WHO technical guidance for COVID-19
https://bit.ly/2yynUh2 - Checklist to the Bats of South Asia

PC: Aditya Srinivasulu (@sleepybats)

Hindi

चमगादड़ COVID-19 का कारण नहीं हैं और उसे नहीं फैलाते हैं



चमगादड़ में COVID-19 और उसकी संबंधित वायरस (SARS-CoV-2) की मौजूदगी का कोई सबूत नहीं है, और इस वजह से वे कोविद-19 का कारण नहीं है, और उसे फैलाते नहीं है।

हाल ही में, भारतीय चमगादड़ों में "बैट कोरोनावायरस" खोजे गए हैं, और इस वजह से लोग अपने घरों के आस-पास चमगादड़ों की मौजूदगी को अशुभ मान रहे हैं, और उन से डर रहे हैं। चमगादड़ COVID-19 का कारण नहीं हैं, और उनसे डरने की और उन्हे नुकसान पहुंचाने की कोई जरूरत नहीं है।

पर्यावरण के लिए चमगादड़ बहुत महत्वपूर्ण हैं। वे पौधों के परागण और बीजों के वितरण मे मदद करते हैं, और कीट-पतंगों को खाते हैं जिन से फ़सलों को नुकसान होता हैं और बीमारियाँ फैलते हैं। उन्हे मारने या नुकसान पहुंचाने से न केवल पर्यावरण को अपूर्णीय क्षति होगी साथ ही मे इस से COVID-19 कि फैलने की क्षमता मे कमी नहीं आयेगी।

COVID-199 का कारक (SARS-CoV-2) वायरस है, जो केवल मनुष्यों से दूसरे मनुष्यों में फैलता है। वर्तमान वैज्ञानिक तथ्यों के अनुसार मनुष्यों में यह वायरस चमगादड़ों से प्रेषित नहीं हुआ।

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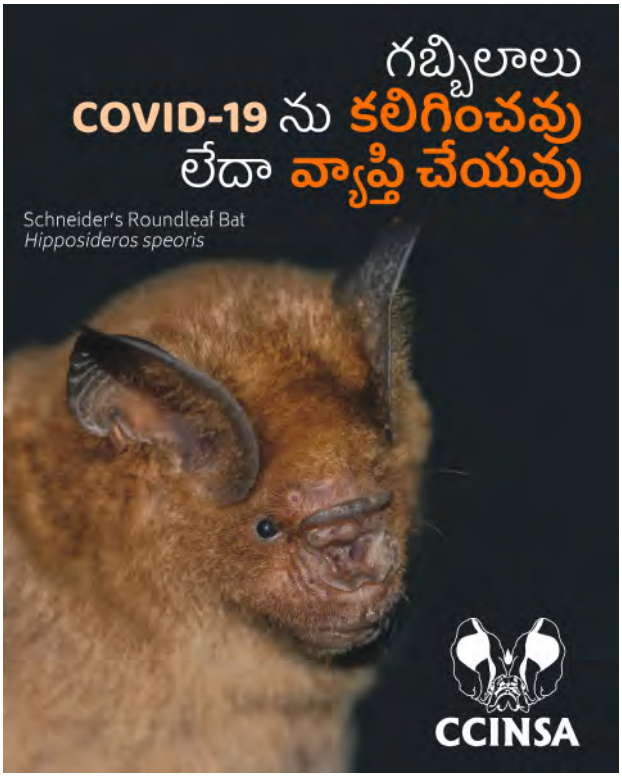
https://bit.ly/2yH2dvk - Global Union of Bat Diversity Networks (GBatNet)
https://bit.ly/2S0h1Mq - Chiroptera Conservation Information Network of South Asia's Statement on COVID-19 and Bats
https://bit.ly/2VrqEWq - WHO technical guidance for COVID-19
https://bit.ly/2yynUh2 - Checklist to the Bats of South Asia

फोटो: आदित्य श्रीनिवासुलू (@sleepybats)
अनुवाद: आदित्य श्रीनिवासुलू

Telugu

COVID-19 ను గబ్బిలాలు కలిగించవు లేదా వ్యాప్తి చెయ్యవు



SARS-CoV-2 గబ్బిలాలలో ఉంటుందని సూచించే ఆధారాలు లేవు. మనకు తెలిసినంత వరకు గబ్బిలాలు కోవిడ్ 19 ను కలిగించవు లేదా వ్యాప్తి చెయ్యవు ఎందుకంటే అవి ఈ వ్యాధి కి కారణమైన వైరస్ ను కలిగి ఉండవు.

భారత దేశములో ఇటీవల రెండు జాతుల ఫలభక్షి గబ్బిలాలలో బాట్ కొరవనవీరుస ను కనుగున్న కారణముగా మానవ నివాస పరిసరాలలో నివసించే గబ్బిలాల గురించి ప్రజలు ఆందోళన చెందుతు ఆనవసరమైన భయాలకు మరియు మూఢనమ్మకాలకు గురఅవుతున్నారు. గబ్బిలాలు కోవిడ్ 19 కి కారణము కావు, వాటికి హాని కలిగించదము మరియు వాటి వలన భయ పడడము అవసరము లేదు.

గబ్బిలాలు పరియవరణ వ్యవస్థకు చల్లా ముఖ్యమైనవి. ఆవి పుష్పించే మొక్కల పరాగ సంపర్కము, విత్తనాలవ్యాప్తి తో సహా తెగులు కీటకాలను తిని అవిటి సంఖ్య ను నియంత్రణ లో ఉంచుతాయి. గబ్బిలాలకు హాని కలిగించడము లేదా నిర్మూలించడం వలన పర్యావరణ వ్యవస్థ యొక్క సమతుల్యతకు కోలుకో లేని నష్టము కలుగును, మరియు కోవిడ్ 19 యొక్క వ్యాప్తిని ఏవిధంగాను మందగించదు.

కోవిడ్ 19 SARS-CoV-2 వైరస్ వల్ల కల్గుతుంది, ఇది మానవులనుండి ఇతర మానవులకు మాత్రమే సంక్రమిస్తుంది. ప్రస్తుత శాస్త్రీయ జ్ఞానం ప్రకారం గబ్బిలాలనుండి మానవులకు ఈ వైరస్ సోకలేదు.

మరిన్ని వివరములకు ఈ నిపుణులను సంప్రదించండి:
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Dr. చెమల శ్రీనివాసులు, Co-Chair, CCINSA: srini.chelmala@gmail.com

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ఫోటో: ఆదిత్య శ్రీనివాసులు (@sleepybats)
అనువాదం: Dr భార్గవి శ్రీనివాసులు

Kannada

ಬಾವಲಿಗಳು COVID-19 ಕಾಯಿಲೆ ಯನ್ನು ಹರಡುವುದಿಲ್ಲ ಅಥವಾ ಬಾವಲಿಗಳಿಂದ ಈ ಕಾಯಿಲೆ ಬರುವುದಿಲ್ಲ

ಬಾವಲಿಗಳು ಕೊರೋನಾ ರೋಗವನ್ನು ಹರಡುವುದಿಲ್ಲ. ಬಾವಲಿಗಳಲ್ಲಿ SARS-ಕೊರೋನಾವೈರಸ್-2 ಕಂಡು ಬರುತ್ತದೆ ಎಂಬುದಕ್ಕೆ ಆಧಾರವಿಲ್ಲ. ತೆಳಿದಿರುವ ಹಾಗೆ ಬಾವಲಿಗಳಿಂದ ಕೋರೋನಾ ಹರಡುವುದಿಲ್ಲ. ಇದಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ವೈರಸ್ ಬಾವಲಿಗಳಲ್ಲಿ ಕಂಡು ಬಂದಿಲ್ಲ.

ಇತ್ತೀಚಿನ ಸಂಶೋಧನೆ ಪ್ರಕಾರ ಎರಡು ಜಾತಿಯ ಹಣ್ಣು ತಿನ್ನುವ ಬಾವಲಿಗಳಲ್ಲಿ "ಬ್ಯಾಟ್ ಕೋರೋನಾವೈರಸ್" ಕಂಡುಹಿಡಿಯಲಾಯಿತು, ಈ ಕಾರಣದಿಂದಾಗಿ ಜನರಿಗೆ ಆತಂಕ ಉಂಟಾಗಿದೆ.

ಮೂಢನಂಬಿಕೆ ಮತ್ತು ಭಯ ಗಳಿಂದ ಈ ಬಾವಲಿಗಳಿಗೆ ಹಾನಿ ಮಾಡುತ್ತಾರೆ. ಆದರೆ ಈ ಬಾವಲಿಗಳಿಂದ ಕೊರೋನಾ ಹರಡುವುದಿಲ್ಲ. ಹಾಗಾಗಿ ಯಾವ ರೀತಿಯ ಭಯವೂ ಬೇಡ. ಅವುಗಳನ್ನು ಹಿಂಸಿಸುವದರಲ್ಲಿ ಅರ್ಥವಿಲ್ಲ.

ಪರಿಸರಕ್ಕೆ ಬಾವಲಿಗಳು ಅತ್ಯಗತ್ಯ ವಾಗಿ ಬೇಕು. ಇವು ಹೂವಿನ ಗಿಡಗಳಿಗೆ ಬೆಳವಣಿಗೆಗೆ ಸಹಾಯಕೆ. ಸಸ್ಯಗಳ ಬೀಜಗಳನ್ನು ಪ್ರಸಾರ ಮಾಡುತ್ತವೆ, ಕ್ರಿಮಿ ಕೀಟಗಳನ್ನು ಕೊಲ್ಲುತ್ತವೆ. ಬೆಳೆಯನ್ನು ನಾಶ ಪಡಿಸುವ ರೋಗ ರೂಜಿನಗಳನ್ನು ಹರಡುವ ಕ್ರಿಮಿ ಕೀಟಗಳನ್ನು ಕೊಲ್ಲುತ್ತವೆ. ಆದ್ದರಿಂದ ಬಾವಳಿಗಳನ್ನು ಹಿಂಸಿಸುವುದು ಪರಿಸರಕ್ಕೆ ಅಪಾಯಕಾರಿ. ಬಾವಲಿಗಳಿಗೆ ಹಾನಿ ಮಾಡುವುದರಿಂದ COVID-19 ಹರಡುವುದನ್ನು ನಿಧಾನಗೊಳಿಸುವುದಿಲ್ಲ.

COVID-19 ಕಾಯಿಲೆ mattu SARS-ಕೊರೋನಾವೈರಸ್-2 ಹರಡುವುದು ಮನುಷ್ಯನಿಂದ ಮನುಷ್ಯನಿಗೆ ಮಾತ್ರ. ಇತ್ತೇಜಿನ ವೈಜ್ಞಾನಿಕ ಸಂಶೋಧನೆಯ ಪ್ರಕಾರ ಬಾವಲಿಗಳಿಂದ ಈ ಕೊರೋನಾ ಕಾಯಿಲೆ ಹರಡುವುದಿಲ್ಲ.

ನಾವು ಯಾವುದಾದರೂ ಪ್ರಶನಗಳನ್ನು ಕೆಳೆ ಬೇಕೆಂದಿದ್ದರೆ ನನ್ನನ್ನು ಸಂಕೋಚವಿಲ್ಲದೆ ಈ ಕೆಳಗಿನ ವಿಲಸವನ್ನು ಸಂಪರ್ಕಿಸಿ:
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ಫೋಟೋ: ಆದಿತ್ಯ ಶ್ರೀನಿವಾಸೂಲು (@sleepybats)
ಅನುವಾದ: ನಾಗರತ್ನ ಮತ್ತು ವಿಜಯ

Malayalam

വവ്വാലുകൾ COVID-19 ഉണ്ടാക്കുകയോ വ്യാപിപ്പിക്കുകയോ ചെയ്യുന്നില്ല

SARS-CoV-2 വവ്വാലുകളിൽ കാണപ്പെടുന്നു എന്നതിന് തെളിവുകളൊന്നുമില്ല, നമുക്കറിയാവുന്നിടത്തോളം, വവ്വാലുകൾ COVID-19 ഉണ്ടാക്കുകയോ വ്യാപിക്കുകയോ ചെയ്യുന്നില്ല, കാരണം അവ രോഗത്തിന് കാരണമാകുന്ന വൈറസ് വഹിക്കുന്നില്ല.

ഇന്ത്യയിൽ അടുത്തിടെ രണ്ട് ഇനം ഫ്രൂട്ട വവ്വാലുകളിൽ ബാറ്റ് കൊറോണ വൈറസുകൾ കണ്ടെത്തിയതിനാൽ, മനുഷ്യവാസ കേന്ദ്രത്തിന് സമീപം വവ്വാലുകളെക്കുറിച്ച ആളുകൾ ആശങ്കാകുലരാണ്, ഇത് അനാവശ്യ ഭയത്തിനും അന്ധവിശ്വാസത്തിനും കാരണമാകുന്നു. വവ്വാലുകൾ COVID-19 ന് കാരണമാകുന്നില്ലാത്തതുകൊണ്ട് അവരെ ഉപദ്രവിക്കാനോ ഭയപ്പെടുത്തുന്നത് കൊണ്ട് യാതൊരുഗുണവും ഇല്ലാ.

പൂച്ചെടികളെ പരാഗണം നടത്തുകയും വിത്തുകൾ ചിതറിക്കുകയും കീടങ്ങളെ തിന്നുകയും വിളകളെ നശിപ്പിക്കാതെയും രോഗങ്ങൾ പടർത്താതെയും ചെയ്യുന്നതിനാൽ വവ്വാലുകൾ ആവാസവ്യവസ്ഥയ്ക്ക് വളരെ പ്രധാനമാണ്. വവ്വാലുകളെ ഉപദ്രവിക്കുകയോ നശിപ്പിക്കുകയോ ചെയ്യുന്നത് ആവാസവ്യവസ്ഥയുടെ സന്തുലിതാവസ്ഥയ്ക്ക് പരിഹരിക്കാനാകാത്ത ദോഷം വരുത്തും, കൂടാതെ ഇത്തരത്തിലുള്ള പ്രവർത്തനംമൂലം COVID-19 ന്റെ വ്യാപനത്തെ ഒരു തരത്തിലും മന്ദഗതിയിലാകുന്നില്ല.

മനുഷ്യരിൽ നിന്ന മറ്റ് മനുഷ്യരിലേക്ക മാത്രം പകരുന്ന SARS-CoV-2 മൂലമാണ് COVID-19 ഉണ്ടാകുന്നത്, നിലവിലെ ശാസ്ത്രീയ അറിവനുസരിച്ച, വവ്വാലുകളിൽനിന്നും മനുഷ്യരിലേക്കു വൈറസ് ബാധിച്ചിട്ടില്ല.

നിങ്ങൾക്ക എന്തെങ്കിലും ചോദ്യങ്ങളുണ്ടെങ്കിൽ, എന്നെ ബന്ധപ്പെടാൻ മടിക്കേണ്ടതില്ല, അല്ലെങ്കിൽ:
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കൂടുതൽ വിവരങ്ങൾക്ക
https://bit.ly/2yH2dvk - Global Union of Bat Diversity Networks (GBatNet)
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https://bit.ly/2yynUh2 - Checklist to the Bats of South Asia
PC: Aditya Srinivasulu (@sleepybats)
Translation: Tijo K. Joy

Bangla

বাদুড় Covid-19 জীবাণুর সংক্রমণ বা উৎসের কারণ নয়

এখন অবধি বাদুড়ের দেহে SARS-CoV-2 এর উপস্থিতির কোনো পোক্ত প্রমান পাওয়া যায়নি, এবং যতদূর গবেষণায় জানা গেছে বাদুড় COVID-19 এর উৎস বা সংক্রমণ ঘটাতে পারে না, কারন তারা এই রোগ সৃষ্টিকারী ভাইরাসটি বহন করে না।

সাম্প্রতিক গবেষণায় ভারতের দুই প্রজাতির ফলাহারি বাদুড়ের শরীরে করোনা জীবানু আবিষ্কৃত হওয়ার কারণে, মানুষ জনজীবনের নিকটে বসবাসকারী বাদুড় সম্বন্ধে উদ্বেগ প্রকাশ করছে, যা কিনা অযাচিত ভয় আর কুসংস্কারের জন্ম দিচ্ছে। কিন্তু বাদুড় COVID-19 রোগ সৃষ্টি করে না, তাই তাদের ভয় পাওয়ার বা ক্ষতি করার কোনো প্রয়োজন নেই।

বাদুড় আমাদের বাস্তুতন্ত্রের অপরিহার্য অংশ, তারা সপুষ্পক গাছের পড়াগযোগ ঘটায়, বীজবিস্তরনে সাহায্য করে এবং শস্য বিনষ্টকরি ও রোগ সৃষ্টিকারী কীটপতঙ্গ খেয়ে তাদের সংখা নিয়ন্ত্রণ করে আমাদের অনেক ক্ষয়ক্ষতির থেকে প্রতিরক্ষা করে। বাদুড়কে হানি বা নির্মূল করার চেষ্টা করলে আমাদের বাস্ততন্ত্রের ভারসাম্যর অসংশোধনীয় ক্ষতি অনিবার্য যা কোনোভাবেই Covid-19 এর বিস্তারকে নিয়ন্ত্রণ করবে না।

COVID-19 রোগের সৃষ্টিকারী ভাইরাস হলো SARS-CoV-2, যা শুধুমাত্র মানুষ থেকে মানুষে সংক্রমণ ছড়ায়, এবং উপস্থিত কোনো বিজ্ঞানসম্মত তথ্য নেই যা প্রমাণ করে যে এই ভাইরাসটি বাদুড় থেকে মানুষের দেহে প্রবেশ করেছে।

এই বিষয়ে আর কোনো প্রশ্ন থাকলে নির্দ্বিধায় যোগাযোগ করুন:
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For more information please visit:

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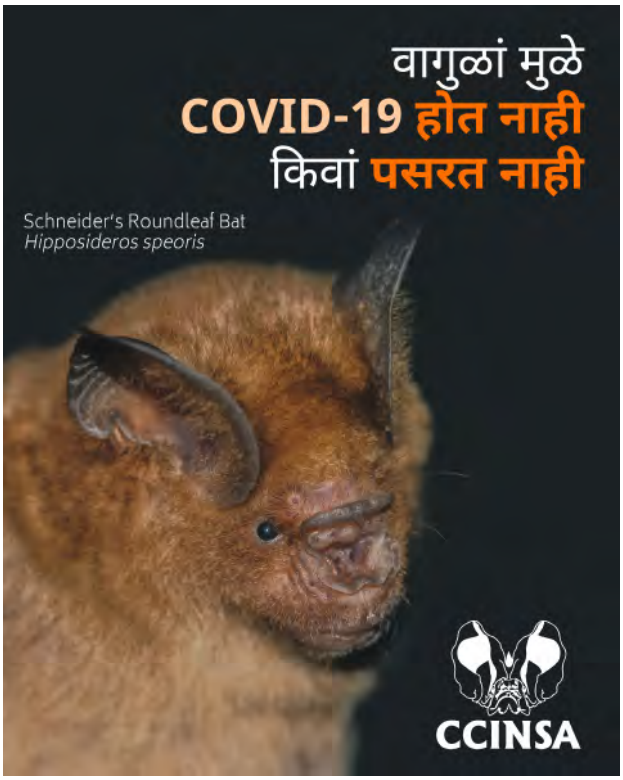
PC: Aditya Srinivasulu (ig: sleepybats)

Translation: Sayantani Nath

Marathi

वटवाघुळ covid-१९ चे कारण नाहीत किंवा त्यांचा प्रसारही करत नाहीत

सार्स-CoV-२ वटवाघुळमध्ये आढळतात त्याचा कोणताही पुरावा नाही आणि आपल्या माहितीनुसार Covid-१९ चे कारण किंवा त्यांचा प्रसार वटवाघुळ करत नाहीत कारण ते कोणतेही विषाणू आपल्यासोबत घेऊन फिरत नाहीत. नुकत्याच भारतात वटवाघुळच्या दोन प्रजातींमध्ये कोरोना विषाणू आढळल्यामुळे मानवी वस्तीच्या सभोवती राहणाऱ्या वटवाघुळ यांबद्दल भीती व अंधश्रद्धा निर्माण होत आहे. वटवाघुळ मुळे Covid-१९ होऊ शकत नाही आणि त्यांना इजा करण्याची किंवा घाबरायचे कोणतेही कारण नाही. वटवाघुळ परीसंस्थेसाठी अत्यंत महत्त्वपूर्ण असतात कारण ते फुलांची झाडे परागकण करतात, बियाणे पसरवतात आणि कीटकांचे सेवन करतात त्यामुळे पिकांचे नुकसान होण्यापासून वाचते आणि रोगही पसरत नाही.



वटवाघुळ मारणे परिसंस्थेचे संतुलनास अपूर्णनिय हानी पोचवू शकते आणि असे करून देखील Covid-१९ चा प्रसार कमी होणार नाही.

Covid-१९ सार्स-CoV-२ मुळे होतो जो केवळ एका मानवाकडून दुसरा मानवाकडे संक्रमित केला जातो आणि सध्याच्या वैज्ञानिक ज्ञानाच्या अनुसार वटवाघुळ यांमुळे मानवालाही लागवड केलेली नाही.

आपल्याकडे काही प्रश्न असल्यास कृपया माझ्याशी संपर्क साधा, किंवा:
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https://bit.ly/2yH2dvk - Global Union of Bat Diversity Networks (GBatNet)
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https://bit.ly/2yynUh2 - Checklist to the Bats of South Asia

PC: Aditya Srinivasulu (ig: sleepybats)
भाषांतर: Harshada Yadkikar

Tamil

வௌவால்களிடம் இருந்து COVID-19 தோன்றியதும் இல்லை மற்றும் பரவுவதும் இல்லை

SARS-CoV-2 வௌவால்களில் காணப்படுவதற்கான எந்த ஆதாரமும் இல்லை. நமக்குத் தெரிந்தவரை, இவைகளில் இந்த வைரஸ் தோன்றவில்லை, மட்டும் இவைகளால் பரவுவதில்லை.

இரண்டு வகையான வௌவால்களில் (Bat - Coronavirus) கொரோனா வைரஸ்கள் சமீபத்தில் கண்டுபிடிக்கப்பட்டது. இது பயத்தையும் மூடநம்பிக்கையையும் ஏற்படுத்துகிறது. மக்கள் வௌவால்களுக்கு அருகில் வாழ பயப்பட்டு அவைகளுக்கு தீங்கு செய்கிறார்கள். வௌவால்கள் COVID-19ஐ ஏற்படுத்தாது, மேலும் பயப்படத் தேவையில்லை.

வௌவால்கள் பூக்களின் மகரந்தச் சேர்க்கை மற்றும் விதைகளை பரவச் செய்கின்றன. அவர்கள் பயிர்களை அழித்து நோய்களை பரப்பும் பூச்சிகளையும் சாப்பிடுகின்றனர். இதனால் வௌவால்கள் இயற்கைக்கு முக்கியம். வௌவால்களைக் கொல்வது அல்லது அகற்றுவது இயற்கைக்கு ஈடுசெய்ய முடியாத தீங்கு விளைவிக்கும். இது COVID-19இன் பரவலை மெதுவாக்காது.

SARS-CoV-2ஆல் ஏற்படுகின்ற நோய் தான் COVID-19. இது மனிதர்களிடமிருந்து மற்ற மனிதர்களுக்கு மட்டுமே பரவும் நோய். தற்போதைய விஞ்ஞான அறிவின் படி, வௌவால்கள் மனிதர்களுக்கு COVID-19ஐ பரப்ப முடியாது.

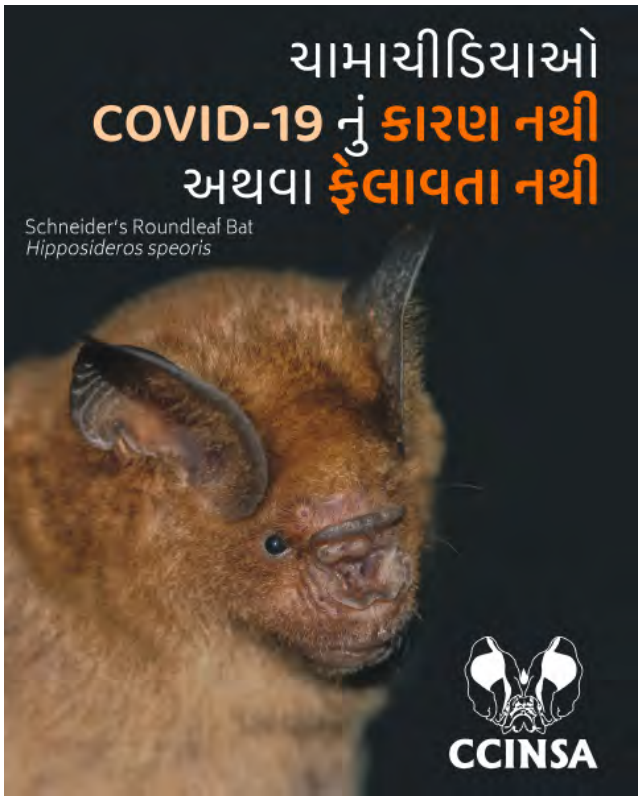
உங்களிடம் ஏதேனும் கேள்விகள் இருந்தால், என்னை தொடர்பு கொள்ளவும் அல்லது:
Dr. Sanjay Molur, Co-Chair, CCINSA: sanjay@zooreach.org
Dr. Chelmala Srinivasulu, Co-Chair, CCINSA: srini.chelmala@gmail.com

மேலும் தகவலுக்கு கீழ்க்கண்ட இணையதள முகவரிகளில் செல்க:
https://bit.ly/2yH2dvk - Global Union of Bat Diversity Networks (GBatNet)
https://bit.ly/2S0h1Mq - Chiroptera Conservation Information Network of South Asia's Statement on COVID-19 and Bats
https://bit.ly/2VrqEWq - WHO technical guidance for COVID-19
https://bit.ly/2yynUh2 - Checklist to the Bats of South Asia

PC: Aditya Srinivasulu (ig: sleepybats)
Translation: Akaanksha Venkatramanan & Aditya Srinivasulu

Gujarati

ચામાચીડિયાઓ COVID-19 નું કારણ નથી અથવા ફેલાવતા નથી



તૂયાં કોઈ પુરાવા નથી જે સૂચવે છે કે સારસ-કોરોનવાઈરસ-2 (SARS-CoV-2) બેટમાંથી જોવા મળે છે, અને જ્યાં સુધી આપણે જાણીએ છીએ, બેટ COVID -19 નું કારણ આપતા નથી અથવા ફેલાવતા નથી, કારણ કે તેઓ રોગનું કારણ બનેલા વાયરસને લઈ જતા નથી.

ભારતમાં તાજેતરમાં બે પરજાતિના ફળની બેટ પર બેટ કોરોનાવાયરસની શોધને લીધે, લોકો માનવ વસવાટની આજુબાજુમાં રહેતા બેટ વિશે ચિંતામાં મુકાયા છે, જેના કારણે બિનજરૂરી ભય અને અંધશરદ્ધા થઈ છે. ચામાચીડિયાઓ COVID -19 નું કારણ આપતા નથી, અને તેમને નુકસાન પહોંચાડવાનું કે તેમને ડરવાનું કોઈ કારણ નથી.
બટ ઈકોસિસ્ટમ માટે ખૂબ મહત્વનું છે, કારણ કે તે ફૂલોના છોડને પરાગાધાન કરે છે, બીજ ફેલાવે છે અને જંતુના જંતુઓ ખાય છે, જે પાકને નુકસાન કરે છે અને રોગો ફેલાવે છે. બટ્સને નુકસાન પહોંચાડવું અથવા સંહાર કરવો ઈકોસિસ્ટમના સંતુલનને ન ભરવાપાતર્ નુકસાન પહોંચાડશે, અને કોઈ પણ રીતે COVID-19 ના ફેલાવાને ધીમું કરશે નહીં.

COVID-19 એ SARS-CoV-2 દ્વારા થાય છે, જે ફક્ત અન્ય માણસોમાં મનુષ્યથી સંક્રમિત થાય છે, અને વૈજ્ઞિનકજ્ન મુજબ, બેટ મનુષ્યને વાયરસથી સંક્રમિત કરતું નથી.

જો તમને કોઈ પરશ્નો હોય, તો કૃપા કરીને મને સંપકર્ મફત લાગે, અથવા:

Dr. Sanjay Molur, Co-Chair, CCINSA: sanjay@zooreach.org
Dr. Chelmala Srinivasulu, Co-Chair, CCINSA: chelmala.srinivasulu@osmania.ac.in

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Translation: Akaanksha Venkatramanan

Punjabi

ਬੈਟ੍ਸ (ਚਮਗਿੱਦੜ) ਕੋਵਿਡ-19 (COVID-19) ਬਿਮਾਰੀ ਨੂੰ ਫੈਲਾਉਣ ਦਾ ਕਾਰਣ ਨਹੀ ਹਨ।

ਕੋਈ ਪੱਕਾ ਸਬੂਤ ਇਹ ਨਹੀ ਦਰਸ਼ਾਉਦਾ ਹੈ ਕਿ COVID-19 ਦੇ ਫੈਲਣ ਦਾ ਕਾਰਣ ਚਮਗਿੱਦੜ ਹਨ ਕਿਉਂਕਿ ਜਿੱਥੋ ਤੱਕ ਅਸੀ ਜਾਣਦੇ ਹਾਂ, ਇਸ ਬਿਮਾਰੀ ਨੂੰ ਫੈਲਾਉਣ ਵਾਲਾ ਵਾਇਰਸ, ਸਾਰਸ-ਕੋਵ -2 (SARS-CoV-2), ਚਮਗਿੱਦੜਾਂ ਵਿੱਚ **ਨਹੀ** ਪਾਇਆ ਜਾਂਦਾ ਹੈ। ਹਾਲ ਹੀ ਵਿੱਚ ਭਾਰਤ ਵਿੱਚ ਚਮਗਿੱਦੜਾਂ ਦੀਆਂ ਦੋ (ਫਲ਼ ਖਾਣ ਵਾਲੀਆਂ) ਕਿਸਮਾਂ ਵਿੱਚ ਬੈਟ ਕੋਰੋਨਾਵਾਇਰਸ ਦੀ ਹੋਈ ਖੋਜ ਦੇ ਕਾਰਣ ਲੋਕਾਂ ਦੇ ਆਸ ਪਾਸ ਰਹਿਣ ਵਾਲ਼ੀਆਂ ਚਮਗਿੱਦੜਾਂ ਚਿੰਤਾ ਦਾ ਕਾਰਣ ਬਣ ਗਈਆਂ ਹਨ, ਜਿਸ ਕਰਕੇ ਚਮਗਿੱਦੜਾਂ ਦੇ ਪਰਤੀ ਬੇਲੋੜਾ ਡਰ ਅਤੇ ਅੰਧਵਿਸ਼ਵਾਸ ਪੈਦਾ ਹੋਇਆ ਹੈ। ਚਮਗਿੱਦੜ ਕੋਵੀਡ -19 ਫੈਲਾਉਣ ਦਾ ਕਾਰਣ ਨਹੀ ਹਨ, ਅਤੇ ਉਨਹਾਂ ਨੂੰ ਨੁਕਸਾਨ ਪਹੁੰਚਾਉਣ ਜਾਂ ਉਨਹਾਂ ਤੋ **ਡਰਨ ਦੀ ਕੋਈ ਲੋੜ ਨਹੀ ਹੈ**।

ਚਮਗਿੱਦੜ ਪਰਿਸਥਿਤਿਕ ਪਰਬੰਧ (ਈਕੋਸਿਸਟਮ) ਲਈ ਬਹੁਤ **ਮਹੱਤਵਪੂਰਣ** ਹਨ, ਕਿਉਂਕਿ ਇਹ ਫੁੱਲਦਾਰ ਪੌਦਿਆਂ ਦੀ ਪਰਾਗਣ ਕੀਰਿਆ ਵਿੱਚ ਸਹਾਇਤਾ ਕਰਦੇ ਹਨ, ਬੀਜ ਫੈਲਾਉਦੇ ਹਨ, ਅਤੇ ਕਈ ਬਿਮਾਰੀ ਫੈਲਾਉਣ ਵਾਲੇ ਤੇ ਫ਼ਸਲਾਂ ਦਾ ਨੁਕਸਾਨ ਕਰਨ ਵਾਲੇ ਕੀੜੇ-ਮਕੌੜਿਆਂ ਨੂੰ ਖਾਂਦੇ ਹਨ। ਚਮਗਿੱਦੜਾਂ ਨੂੰ ਨੁਕਸਾਨ ਪਹੁੰਚਾਉਣਾ ਜਾਂ ਉਹਨਾ ਦਾ ਵਿਨਾਸ਼ ਕਰਨਾ ਵਾਤਾਵਰਣ ਦੇ ਸੰਤੁਲਨ ਨੂੰ ਨਾ ਪੂਰਾ ਹੋਣ ਵਾਲਾ ਨੁਕਸਾਨ ਕਰੇਗਾ, ਅਤੇ ਇਹ ਕਰਨਾ COVID-19 ਦੇ ਫੈਲਣ ਦੀ ਪਰਿਕਰ੍ਰੀਆ ਤੇ ਰੋਕ ਨਹੀ ਲਗਾ ਸਕਦਾ।

ਕੋਵਿਡ -19 ਬਿਮਾਰੀ ਸਾਰਸ-ਕੋਵ -2 ਨਾਮਕ ਵਾਇਰਸ ਦੇ ਕਾਰਣ ਹੁੰਦੀ ਹੈ, ਜੋ ਸਿਰਫ ਇੱਕ ਸੰਕਰ੍ਰਮਿਤ ਵਿਅਕਤੀ ਤੋ ਹੀ ਦੂਜੇ ਵਿਅਕਤੀਆਂ ਵਿੱਚ ਸੰਚਾਰਿਤ ਹੁੰਦੀ ਹੈ। ਮੌਜੂਦਾ ਵਿਗਿਆਨਕ ਗਿਆਨ ਦੇ ਅਨੁਸਾਰ, ਚਮਗਿੱਦੜਾਂ ਮਨੁੱਖਾਂ ਨੂੰ ਵਾਇਰਸ ਨਾਲ ਸੰਕਰਮਿਤ ਨਹੀ ਕਰਦੀਆਂ ਹਨ।
ਇਸ ਵਿਸ਼ੇ ਤੇ ਜੇ ਤੁਹਾਡੇ ਕੋਈ ਪਰ੍ਸ਼ਨ ਹਨ, ਤਾਂ ਕਿਰਪਾ ਕਰਕੇ ਨੀਚੇ ਲਿਖੇ ਵਿਅਕਤੀ ਜਾਂ ਸੰਸਥਾਨ ਨਾਲ ਸੰਪਰਕ ਕਰੋ,

Dr. Sanjay Molur, Co-Chair, CCINSA: sanjay@zooreach.org
Dr. Chelmala Srinivasulu, Co-Chair, CCINSA: srini.chelmala@gmail.com

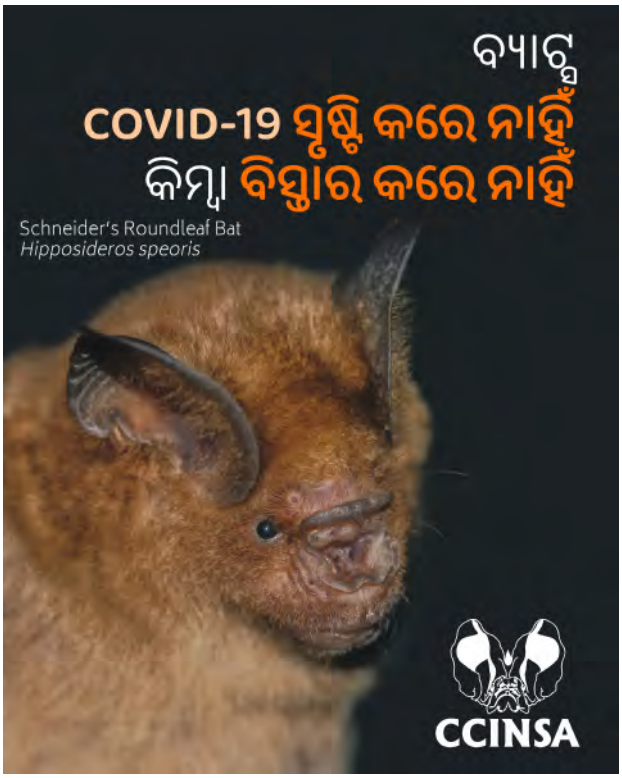
ਵਧੇਰੇ ਜਾਣਕਾਰੀ ਲਈ ਕਿਰਪਾ ਕਰਕੇ ਵੇਖੋ:
https://bit.ly/2yH2dvk - Global Union of Bat Diversity Networks (GBatNet)
https://bit.ly/2S0h1Mq - Chiroptera Conservation Information Network of South Asia's Statement on COVID-19 and Bats
https://bit.ly/2VrqEWq - WHO technical guidance for COVID-19
https://bit.ly/2yynUh2 - Checklist to the Bats of South Asia

ਅਨੁਵਾਦਕ: ਡਾ ਹਰਪਰ੍ਰੀਤ ਕੌਰ ਵੜੈਚ
PC: Aditya Srinivasulu

Odiya

ବ୍ୟାଟ୍ସ COVID-19 ସୃଷ୍ଟି କରେ ନାହିଁ କିମ୍ବା ବିସ୍ତାର କରେ ନାହିଁ।

କ S ଣସି ପ୍ରମାଣ ନାହିଁ ଯେ SARS-CoV-2 ବ୍ୟାଟ୍ସରେ ମିଳିଥାଏ, ଏବଂ ଆମେ ଯେତେ ଜାଣୁ, ବ୍ୟାଟ୍ସମାନେ COVID-19 ସୃଷ୍ଟି କରନ୍ତି ନାହିଁ କିମ୍ବା ବିସ୍ତାର କରନ୍ତି ନାହିଁ, କାରଣ ସେମାନେ ଏହି ରୋଗ ସୃଷ୍ଟି କରୁଥିବା ବହନ କରନ୍ତି ନାହିଁ।



ନିକଟରେ ଭାରତରେ ଦୁଇ ପ୍ରଜାତିର ଫଳ ବ୍ୟାଟରେ ବ୍ୟାଟ୍ କରୋନାଭାଇରସ୍ ଆବିଷ୍କାର ହେତୁ ଲୋକମାନେ ମାନବ ବାସସ୍ଥାନରେ ରହୁଥିବା ବ୍ୟାଟ୍ସ୍ୟାନଙ୍କ ପାଇଁ ଚିନ୍ତିତ ହୋଇ ଅନାବଶ୍ୟକ ଭୟ ଏବଂ ଅନ୍ଧବିଶ୍ୱାସର କାରଣ ହୋଇଥିଲେ। ବ୍ୟାଟ୍ସ COVID-19 ସୃଷ୍ଟି କରେ ନାହିଁ, ଏବଂ ସେମାନଙ୍କୁ କ୍ଷତି ପହଞ୍ଚାଇବା କିମ୍ବା ଭୟ କରିବାର କ ଣସି କାରଣ ନାହିଁ।

ବ୍ୟାଟ୍ ଇକୋସିଷ୍ଟମ୍ ପାଇଁ ଅତ୍ୟନ୍ତ ଗୁରୁତ୍ୱପୂର୍ଣ୍ଣ, କାରଣ ସେମାନେ ଫୁଲ ଗଛକୁ ପ୍ରଦୂଷିତ କରନ୍ତି, ମ ମଞ୍ଜି ବିସ୍ତାର କରନ୍ତି, ଏବଂ କୀଟ ଖାଏ, ଯାହା ଫସଲକୁ କ୍ଷତି ପହ ଏବଂ ରୋଗ ବ୍ୟାପିଥାଏ | ବ୍ୟାଟ୍ସକୁ କ୍ଷତି ପହଞ୍ଚାଇବା କିମ୍ବା ବିନାଶ କରିବା ଇକୋସିଷ୍ଟମର ସନ୍ତୁଳନରେ ଅପୂରଣୀୟ କ୍ଷତି ଘଟାଇବ ଏବଂ COVID-19 ର ବିସ୍ତାରକୁ କ ଣିମେଇ ଜାଅ ଣସି ପ୍ରକାରେ ମନ୍ଥର କରିବ ନାହିଁ।

COVID-19 SARS-CoV-2 ଦ୍ କାରଣରୁ ଘଟିଥାଏ, ଯାହା କେବଳ ମଣିଷଠାରୁ ଅନ୍ୟ ମଣିଷକୁ ସଂକ୍ରମିତ ହୋଇଥାଏ ଏବଂ ବର୍ତ୍ତମାନର ବ ଜ୍ଞାନିକ ଜ୍ଞାନ ଅନୁଯାୟୀ ବ୍ୟାଟ୍ସ ମଣିଷମାନଙ୍କୁ ସଂକ୍ରମିତ କରିନଥିଲେ।

ଯଦି ଆପଣଙ୍କର କିଛି ପ୍ରଶ୍ନ ଅଛି, ଦୟାକରି ମୋ ସହିତ ଯୋଗାଯୋଗ କରିବାକୁ ଦୟାକରି ଅନୁଭବ କରନ୍ତୁ, କିମ୍ବା:

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ଅଧିକ ସୂଚନା ପାଇଁ ଦୟାକରି ପରିଦର୍ଶନ କରନ୍ତୁ:

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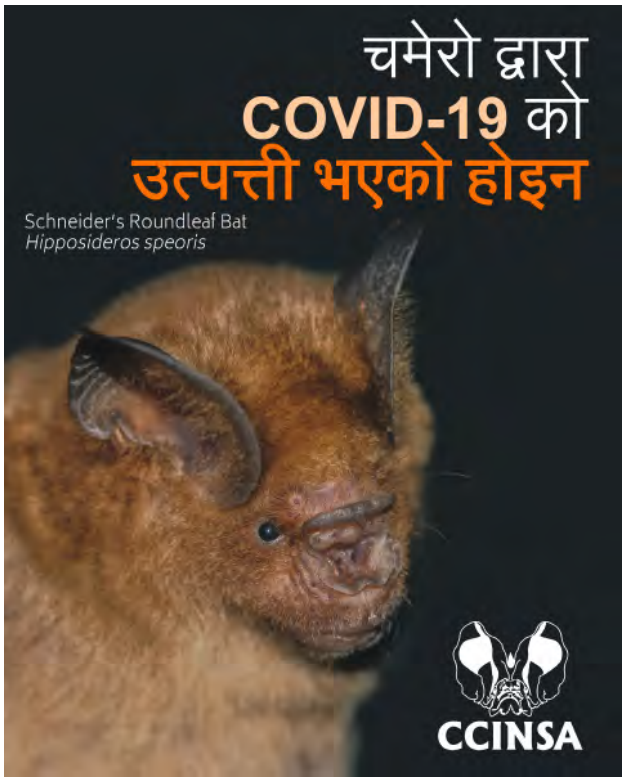
PC: Aditya Srinivasulu
ଅନୁବାଦକ: ଶ୍ରୀ ସୁବ୍ରତ ଦେବତା

Nepali

चमेराद्वारा कोभिड–१९ COVID-19 को उत्पत्ती भएको होइन



हालसम्म SARS-Coronavirus-2 कोरोना भाइरस चमेरामा भेटिएको कुनै आधारभूत प्रमाण छैन। जहाँ सम्म हामीलाई थाहा छ, चमेरामा न त COVID-19 रोग निम्त्याउने SARS-CoV-2 भाइरसको उत्पत्ति भएको हो, न यिनीहरुले यस्ता भाइरस बोकेका हुन्छन्।

हालसालै भारतमा दुई प्रजातिका फलफुल खाने चमेरामा कोरोना भाइरस देखिएको थियो, तर त्यस्ता भाइरसहरु हाल माहामारी फैलाउने (SARS-CoV-2) हैनन, अन्य सामान्य भाइरस हुन् । तसर्थ चमेराका वासस्थान आसपासमा वस्ने मानव समुदायहरु चमेराले कुनै हानी, नोक्सानी पुरुयाइहाल्छन् कि भन्ने अन्धविश्वासमा डराउने या आत्तिनुपर्ने कारण छैन।

तपाँइको स्थानीय वातावरणमा सदियौदखि वस्दै आएका यि चमेराहरु पर्यावरणका लागि एकदमै महत्वपूर्ण जीव हुन् । यिनीहरुले कतिपय फूल फुल्ने बोटहरुको परागसेचक (pollination) को काम गरिरहेका हुन्छन्, अन्य थुपैं वनस्पतीका विउविजन विस्तृतीकरण (dispersal) गरी प्राकृतिक वक्षारोपण गरिरहेका छन् । त्यस्तै वहूसंख्यक किराखाने चमेराहरुले हाम्रा खेतवारीमा वनस्पतिलाई नोक्सान पुर्याउने कीराहरु खाइदिने, हामीलाई रोगसार्ने लामखुट्टे, भुसुना जस्ता किराहरुको नियन्त्रण (pest control) गरीरहेका छन् ।

रातीमा मात्र सक्रिय हुने यि चमेराहरुले प्रकृतिको रात्रीकालीन पर्यावरण सन्तुलनमा अतुलनीय भुमिका रहेकाले हामीले चमेरा जोगाउन आवश्यक छ । हामीले यिनीहरुको वासस्थानमा कुनै पनि क्षती पुर्याउनु हुदैन । यिनीहरुको विनाश भयो भने हाम्रो वातावरणमा अर्को अपुरणीय क्षति हुन्छ । चमेरा विनाशले हाल मानवजातीलाई सताइरहेको कोरोना भाइरस (SARS-CoV-2) को माहामारीमा सामान्य सुधार पनि आउदैन । यसकारण चमेराको वासस्थानमा कुनै नकारात्मक क्रियाकलाप नगर्न हून ध्यानाकर्षण गरिएको छ।

SARS-CoV-2 कोरोनाभाइरस मानिसबाट मानिसमा सर्ने गर्दछ । अहिले सम्मको वैज्ञानिक अनुसन्धान अनुसार यो भाइरस चमेराबाट मानिसमा संक्रमित भएको होइन भन्ने तथ्य रहेको छ ।

इदि तपाईंसँग कुनै प्रश्नहरु छन् भने कृपया तल दिइएका ईमेलहरुमा सम्पर्क गर्नु होला ।
Dr. Sanjay Molur, Co-Chair, CCINSA: sanjay@zooreach.org
Dr. Chelmala Srinivasulu, Co-Chair, CCINSA: chelmala.srinivasulu@osmania.ac.in

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Translation: Sanjeev Baniya & Dr Pushpa Raj Acharya

Poem on Corona

Hey Corona, why are you here?
spreading fast across the sphere
You bring us cold, cough, sneeze and fever
Being so small, you are a mighty warrior

We have to wear masks wherever we go
and wash our hands for 20 seconds, you know?
Schools,classes, markets are all closed
Always at home, I sometimes get bored

But I have thought of activities to do
reading,dancing and drawing are a few
I also watch movies and write poems
play games and take online lessons

On the news I have been hearing
that the World's economy is falling
Why isn't there a medicine to bring you down?
Oh Corona, how long more will you hang around?

Arpitha, B.R.
Grade 4, Bengaluru

Video on Corona

Are bats really bad? Do they really give us diseases or are humans to blame? Akshaya Pradeep our Wild Detective does an investigative interview and finds out some amazing facts. **Do watch.**

Credits
Interviewer: Akshaya Pradeep
Script: Akshaya Pradeep and Rani Pradeep
Camera: Pradeep Kumar

Sundarvan - An urban green space and its role in supporting wildlife diversity

Introduction

Urban growth is occurring at an extraordinary scale. In 2008, for the first time, more than 50% of the global human population lived in urban environments. Much of this urbanization is occurring in developing countries, which are predicted to harbour 80% of the urban population of the world by 2030 (UNFPA 2007). Although urban areas remain a relatively small fraction of the terrestrial surface (about 4% globally), the urban ecological footprint extends beyond city boundaries and drives environmental change at local to global scales (Grimm et al. 2008).

Rapid urban expansion is impacting heavily on ecological processes (Goddard et al. 2009). People living in species-poor cities are increasingly disconnected from the natural world (Miller 2005). Here, we highlight the valuable role of urban green spaces in mitigating the detrimental impacts of urbanization and draw particular attention to the significance of such sites. Although the article mainly focusses on the biodiversity benefits, urban green spaces are also important for the provision of ecosystem services and can have a positive impact on quality of life, human health and well-being (Fuller et al. 2007; Mitchell & Popham 2008). They provide opportunities for people to interact with nature and are, therefore, vital in fostering a wider interest in nature conservation issues (Miller 2005). Such green spaces in urban areas are especially significant in the development of a personal relationship with the natural environment (Gross & Lane 2007).

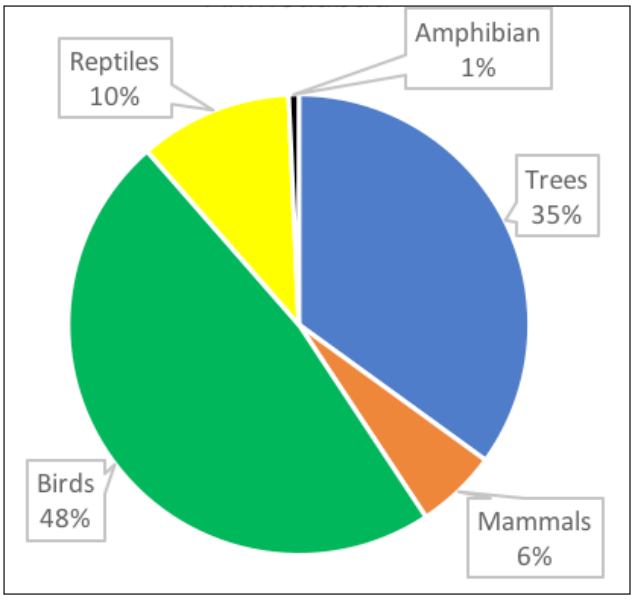
Urban green spaces are becoming an increasingly important refuge for native biodiversity. The potential value of gardens for enhancing biodiversity has long been recognised, as evidenced by many popular books, television programmes and information handouts advising on “wildlife-friendly” gardening (Goddard et al. 2009).

The objectives of the study are,

1. Documenting biodiversity of Sundarvan.
2. Through results, conveying importance of such small green spaces in urban environment to the city dwellers concerned authorities for their conservation.

Study Area

Sundarvan, Nature Discovery Centre set in the heart of Ahmedabad, Gujarat, India, is a unique facility of the Centre for Environment Education (CEE). This four-acre land was originally a mango orchard, converted into a nature discovery centre from 28 October 1978. It is a green oasis of the city and has been categorized as a mini zoo, by the Central Zoo Authority (CZA), the apex governance body for Zoos of India.



Richness of different groups recorded from Sundarvan, Ahmedabad.

Sundarvan plays a very crucial role in sensitizing and creating appreciation for wildlife, specially the lesser known species like snakes and other reptiles. Regular Snake and other awareness programmes conducted in Sundarvan have sensitized the masses of the cities on the importance of these species and their ecological role. These awareness programmes have directly led to considerable reduction in the killing of snakes by people, hence emphasizing the conservation and wildlife educational role of this facility. Annually the visitation to the mini zoo is more than a lakh with around 200 schools visiting this facility to enhance their classroom learning.

Methods

Tree: Trees with girth at breast height (GBH) more than 20cm were individually counted between 15 May and 15 June 2013. The species, number of dead and live trees, trees with or without leaves, flowers and fruits were also noted down during the study. The GBH of every tree was measured and all the counted trees were marked with paint to avoid double count.

Birds: Bird counts were carried out intermittently (at least one count per month) in Sundarvan to find out species richness and seasonal abundance of birds (the later details will be published elsewhere) from December 2014 to August 2018. Apart from these counts, the incidental records of some rarely sighted bird species were also maintained. Authentic records reported in 'ebird' are also used in the article.

Other faunal groups: Record of other vertebrates such as mammals, reptiles and amphibians were maintained from incidental sightings made from January 2012 to August 2018.

Results

A total of 48 tree species including one unidentified palm and four other unidentified trees belonging to 20 different families were recorded. Over 20cm GBH, 702 trees were recorded with 650 live and 52 dead trees. All tree species were with leaves, 13 species were with flowers and 19 species were with fruits. Among the most abundant trees, dead tree proportion against live tree was very high (22.7%) in *Azadirachta indica*. Only five trees of five different species had GBH over 200cm (Table 1).

Eight species of mammals, 67 species of birds belonging to 39 families and 15 species of reptiles were recorded from Sundarvan (See Table 2 to 4). Only one species of amphibian, Marbled Toad *Duttaphrynus*

Table 1. Details of tree species recorded in Sundarvan Nature Discovery Centre, Ahmedabad.

	Species	No.	Live	Dead	WL	WF	WFt	GBH (in CM) of Live Trees						GBH (in CM) of Dead Trees					
								20 to 50	51 to 100	101 to 150	151 to 200	201 to 250	> 251	20 to 50	51 to 100	101 to 150	151 to 200	201 to 250	> 251
Family: Fabaceae																			
1	*Butea monosperma*	2	2	0	2	0	0	1	0	1	0	0	0	0	0	0	0	0	0
2	*Derris indica*	7	7	0	7	0	0	4	3	0	0	0	0	0	0	0	0	0	0
3	*Erythrina indica*	5	5	0	5	0	0	3	1	1	0	0	0	0	0	0	0	0	0
Family: Mimosaceae																			
4	*Acacia auriculiformis*[*]	2	1	1	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0
5	*Acacia* sp.	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
6	*Albizia lebbeck*	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
7	*Leucaena leucocephala*[*]	244	233	11	231	1	61	180	53	8	3	0	0	5	6	0	0	0	0
8	*Pithecellobium dulce*	11	11	0	11	0	9	5	4	0	1	1	0	0	0	0	0	0	0
9	*Prosopis chilensis*[*]	9	8	1	8	0	0	6	1	2	0	0	0	0	0	0	0	0	0
10	*Prosopis cineraria*	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Family: Caesalpiniaceae																			
11	*Bauhinia purpurea*	2	2	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0
12	*Caesalpinia coriaria*	3	3	0	3	1	0	2	0	1	0	0	0	0	0	0	0	0	0
13	*Cassia fistula*	3	3	0	3	2	1	2	1	0	0	0	0	0	0	0	0	0	0
14	*Cassia siamea*[*]	4	4	0	4	1	0	2	0	2	0	0	0	0	0	0	0	0	0
15	*Delonix regia*[*]	14	14	0	14	6	2	7	5	2	0	0	0	0	0	0	0	0	0
16	*Peltophorum pterocarpum*[*]	5	5	0	5	1	0	1	1	1	2	0	0	0	0	0	0	0	0
17	*Tamarindus indica*	40	39	1	39	4	6	29	8	2	1	0	0	0	0	0	0	0	0
Family: Rubiaceae																			
18	*Neolamarckia cadamba*	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0

	Species	No.	Live	Dead	WL	WF	WFt	GBH (in CM) of Live Trees						GBH (in CM) of Dead Trees					
								20 to 50	51 to 100	101 to 150	151 to 200	201 to 250	> 251	20 to 50	51 to 100	101 to 150	151 to 200	201 to 250	> 251
Family: Meliaceae																			
19	*Azadirachta indica*	132	102	30	100	1	74	24	40	30	8	0	0	6	16	7	1	0	0
Family: Malvaceae																			
20	*Bombax ceiba*	2	1	1	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0
21	*Guazuma ulmifolia*	6	6	0	6	3	0	4	2	0	0	0	0	0	0	0	0	0	0
Family: Arecaceae																			
22	*Caryota urens*	3	3	0	3	0	0	1	1	1	0	0	0	0	0	0	0	0	0
23	*Phoenix sylvestris*	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
24	Unidentified Palm Species	4	3	1	3	0	0	1	3	0	0	0	0	0	0	0	0	0	0
Family: Ehretiaceae																			
25	*Cordia obliqua*	2	2	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0
26	*Cordia sebestena*	2	2	0	2	2	2	0	2	0	0	0	0	0	0	0	0	0	0
27	*Cordia wallichii*	12	9	3	8	1	2	7	1	1	0	0	0	2	1	0	0	0	0
Family: Moraceae																			
28	*Ficus benghalensis*	15	15	0	15	0	2	10	3	0	1	0	1	0	0	0	0	0	0
29	*Ficus racemosa*	6	6	0	6	0	3	0	3	2	0	1	0	0	0	0	0	0	0
30	*Ficus mysorensis*	4	4	0	4	0	0	0	2	1	1	0	0	0	0	0	0	0	0
31	*Ficus religiosa*	7	7	0	7	0	7	0	1	1	4	0	1	0	0	0	0	0	0
Family: Ulmaceae																			
32	*Holoptelea integrifolia*	34	34	0	30	0	1	17	12	4	0	0	1	0	0	0	0	0	0
Family: Anacardiaceae																			
33	*Mangifera indica*	2	2	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Family: Sapotaceae																			
34	*Manilkara hexandra*	17	17	0	17	0	0	13	4	0	0	0	0	0	0	0	0	0	0
35	*Mimusops elengi*	10	10	0	10	1	1	9	1	0	0	0	0	0	0	0	0	0	0

	Species	No.	Live	Dead	WL	WF	WFt	GBH (in CM) of Live Trees						GBH (in CM) of Dead Trees					
								20 to 50	51 to 100	101 to 150	151 to 200	201 to 250	> 251	20 to 50	51 to 100	101 to 150	151 to 200	201 to 250	> 251
Family: Moringaceae																			
36	*Moringa oleifera*	9	9	0	7	1	9	1	2	4	2	0	0	0	0	0	0	0	0
Family: Euphobiaceae																			
37	*Phyllanthus emblica*	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
38	*Putranjiva roxburghii*	13	13	0	13	0	0	6	5	1	1	0	0	0	0	0	0	0	0
Family: Annonaceae																			
39	*Polyalthia longifolia*	44	44	0	44	0	1	41	2	1	0	0	0	0	0	0	0	0	0
Family: Salvadoraceae																			
40	*Salvadora persica*	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Family: Sapindaceae																			
41	*Sapindus mukorossi*	3	2	1	2	0	1	1	2	0	0	0	0	0	0	0	0	0	0
Family: Myrtaceae																			
42	*Syzygium cumini*	5	5	0	5	0	2	4	1	0	0	0	0	0	0	0	0	0	0
Family: Combretaceae																			
43	*Terminalia arjuna*	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0
44	*Terminalia catappa*	3	2	1	2	0	0	1	1	0	0	0	0	0	1	0	0	0	0
Unidentified Tree Species																			
45	Unidentified species1	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
46	Unidentified species2	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
47	Unidentified species3	5	5	0	5	0	0	3	2	0	0	0	0	0	0	0	0	0	0
48	Unidentified species4	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Note: WL – With leaf; WF – With Flower; WFt. – With Fruit: * - Exotic.																			

Table 2. Mammal species recorded from Sundarvan Nature Discovery Centre.

	English Name	Scientific Name	IUCN Status
Family: Herpestidae			
1	Small Indian Mongoose	*Herpestes auropunctatus*	LC
Family: Cercopithecidae			
2	Northern Plains Langur	*Semnopithecus entellus*	LC
Family: Sciuridae			
3	Five-striped Palm Squirrel	*Funambulus pennantii*	LC
Family: Soricidae			
4	House Shrew	*Suncus murinus*	LC
Family: Hystricidae			
5	Indian Crested Porcupine	*Hystrix indica*	LC
Family: Muridae			
6	Indian Field Mouse	*Mus booduga*	LC
7	House Rat	*Rattus rattus*	LC
Family: Pteropodidae			
8	Indian Flying Fox	*Pteropus giganteus*	LC
Note: LC – Least Concern			

stomaticus was recorded from the place. Highest species diversity was of birds (42%) and the lowest was of amphibians (1%).

Discussion

The interaction with the senior employees showed that the entire area of Sundarvan was with only one tree species, i.e. *Mangifera indica*. When a huge amount of soil was brought to Sundarvan from the campus of Centre for Environment Education (CEE), the tree species richness increased through various seeds brought accidentally. Death of *Mongifera indica* in different points of time provided more open space and these were occupied by other trees through natural process and plantation made by the management. The exotic *Leucaena leucocephala* was the most abundant tree species and this along with *Tamarindus indica* occupy 53.5%. Apart from these tree species, the place has wide range of shrubs, herbs and grass species including wide variety of ornamental species planted by the Sundarvan Management. This diversity of plant species ensures the faunal diversity, though it is a small patch of green space located in the middle of the concrete structures.

A large roost of around 500 Indian Flying Foxes *Pteropus giganteus* is located in the zoo. The wide range of plants in Sundarvan premises offers them variety of food, though mostly the bats get food from other places in the city and its neighbourhood. The Indian Crested Porcupine *Histrix indica* is not a permanent resident in Sundarvan and used to visit from the Indian Space Research Organisation (ISRO) campus located next to Sundarvan till 2016. Once the entries to Sundarvan and the exits in ISRO were sealed, their movement is restricted only within ISRO now. There should be at least one more species of fruit bat and two microchiropteran bats in Sundarvan, as these were sighted in several occasions, but not identified. Hence, these were not included in the list in this article.

Very high bird diversity is maintained in the place. The large prominent species like the Indian Peafowl *Pavo cristatus* breeds regularly. Dead trees provide foraging space for different birds and nesting sites for hole nesting birds such as parakeets, barbets and flamebacks. The fruits of *Ficus* spp. attract

Table 3. Bird species recorded from Sundarvan Nature Discovery Centre, Ahmedabad.

	English Name	Scientific Name	Migratory Status	IUCN Status
Anatidae (Ducks, geese, swans)				
1	Lesser Whistling Duck	*Dendrocygna javanica*	R	LC
Phasianidae (Pheasants, Partridges, Turkeys, Grouse)				
2	Indian Peafowl	*Pavo cristatus*	R	LC
3	Grey Francolin	*Francolinus pondicerianus*	R	LC
Columbidae (Pigeons)				
4	Rock Pigeon	*Columba livia*	R	LC
5	Yellow-footed Green-Pigeon	*Treron phoenicoptera*	R	LC
6	Red-collared Dove	*Streptopelia tranquebarica*	R	LC
7	Eurrasian Collared Dove	*Streptopelia decaocto*	R	LC
8	Laughing Dove	*Streptopelia senegalensis*	R	LC
Apodidae (Swifts)				
9	Indian House Swift	*Apus affinis*	R	LC
Cuculidae (Cuckoos)				
10	Greater Coucal	*Centropus sinensis*	R	LC
11	Asian Koel	*Eudynamys scolopaceus*	R	LC
Rallidae (Rails and Coots)				
12	White-breasted Waterhen	*Amaurornis phoenicurus*	R	LC
Ardeidae (Herons)				
13	Black-crowned Night Heron	*Nycticorax nycticorax*	R	LC
14	Indian Pond Heron	*Ardeola grayii*	R	LC
15	Cattle Egret	*Bubulcus ibis*	R	LC
16	Little Egret	*Egretta garzetta*	R	LC
Threskiornithidae (Ibises, spoonbills)				
17	Black-headed Ibis	*Threskiornis melanocephalus*	R	NT
18	Red-napped Ibis	*Pseudibis papillosa*	R	LC
Charadriidae (Plovers & Lapwings)				
19	Red-wattled Lapwing	*Vanellus indicus*	R	LC
Burhinidae (Stone curlews)				
20	Indian Stone Curlew	*Burhinus indicus*	R	LC
Accipitridae (Hawk, Eagles)				
21	Shikra	*Accipiter badius*	R	LC
22	Black Kite	*Milvus migrans*	R	LC
Strigidae (Owls)				
23	Spotted Owlet	*Athene brama*	R	LC
Tytonidae (Barn Owls)				
24	Barn Owl	*Tyto alba*	R	LC
Bucerotidae (Hornbills)				
25	Indian Grey Hornbill*	*Ocyceros birostris*	R	LC

	English Name	Scientific Name	Migratory Status	IUCN Status
Picidae (Woodpeckers)				
26	Black-rumped Flameback	*Dinopium benghalense*	R	LC
Megalaimidae (Asian Barbets)				
27	Coppersmith Barbet	*Psilopogon haemacephalus*	R	LC
Meropidae (Bee-eaters)				
28	Green Bee-eater	*Meropes orientalis*	R	LC
Alcedinidae (Kingfishers)				
29	White-throated Kingfisher	*Halcyon smyrnensis*	R	LC
Psittacidae (Parrots)				
30	Alexandrine Parakeet	*Psittacula eupatria*	R	LC
31	Rose-ringed Parakeet	*Psittacula krameri*	R	LC
Campephagidae (Cuckoo-shrikes)				
32	Small Minivet	*Pericrocotus cinnamomeus*	R	LC
Oriolidae (Orioles and Figbirds)				
33	Indian Golden Oriole	*Oriolus kundoo*	LM	LC
Aegithinidae (Ioras)				
34	Common Iora	*Aegithina tiphia*	R	LC
Dicruidae (Drongos)				
35	Black Drongo	*Dicrurus macrocercus*	R	LC
36	Ashy Drongo	*Dicrurus leucophaeus*	R	LC
Rhipiduridae (Fantails)				
37	White-browed Fantail	*Rhipidura aureola*	R	LC
Corvidae (Crows and Jays)				
38	Rufous Treepie	*Dendrocitta vagabunda*	R	LC
39	House Crow	*Corvus splendens*	R	LC
40	Large-billed Crow	*Corvus macrorhynchos*	R	LC
Monarchidae (Monarchs)				
41	Black-napped Monarch	*Hypothymis azurea*	LM	LC
42	Indian Paradise Flycatcher	*Terpsiphone aradise*	M	LC
Dicaeidae (Flowerpeckers)				
43	Thick-billed Flowerpecker	*Dicaeum agile*	R	LC
44	Pale-billed Flowerpecker	*Dicaeum erythrorhynchos*	R	LC
Nectariniidae (Sunbirds)				
45	Purple-rumped Sunbird	*Leptocoma zeylonica*	R	LC
46	Purple Sunbird	*Cinnyris asiaticus*	R	LC
Estriididae (Finches)				
47	Indian Silverbill	*Euodice malabarica*	R	LC
Motacillidae (Wagtails and pipits)				
48	Western Yellow Wagtail	*Motacilla flava*	M	LC

	English Name	Scientific Name	Migratory Status	IUCN Status
Cisticolidae (Cisticolas and allies)				
49	Ashy Prinia	*Prinia socialis*	R	LC
50	Common Tailorbird	*Orthotomus sutorius*	R	LC
Hirundinidae (Swallows and martins)				
51	Dusky Crag Martin	*Ptyonoprogne concolor*	R	LC
Pyconotidae (Bulbuls)				
52	Red-vented Bulbul	*Pycnonotus cafer*	R	LC
Phylloscopidae (Leaf-warblers)				
53	Greenish Warbler	*Seicercus trochiloides*	M	LC
Sylvidae (Old World Warblers)				
54	Lesser Whitethroat	*Curruca curruca*	M	LC
55	Booted Warbler	*Iduna caligata*	M	LC
Zosteropidae (White-eyes)				
56	Oriental White-eye	*Zosterops palpebrosus*	R	LC
Leiothrichidae (Laughingthrushes and allies)				
57	Jungle Babbler	*Turdoides striata*	R	LC
Sturaidae (Starlings)				
58	Rosy Starling	*Pastor roseus*	M	LC
59	Brahminy Starling	*Sturnia pagodarum*	R	LC
60	Common Myna	*Acridotheres tristis*	R	LC
Muscicapidae (Chats and Old-World flycatchers)				
61	Indian Robin	*Saxicoloides fulicatus*	R	LC
62	Oriental Magpie Robin	*Copsychus saularis*	R	LC
63	Brown-breasted Flycatcher	*Muscicapa muttui*	M	LC
64	Tickell's Blue Flycatcher	*Cyornis tickelliae*	LM	LC
65	Bluethroat	*Luscinia svecica*	M	LC
66	Grey-headed Canary Flycatcher	*Culicicapa ceylonensis*	LM	LC
67	Red-breasted Flycatcher	*Ficedula parva*	M	LC

Note: All species were recorded by the author except the one marked * (was included from ebird data); R – Resident; M – Migratory; LM – Local Migratory; LC – Least Concern; NT – Near Threatened.

green pigeons to the place. The Indian Grey Hornbill *Ocyceros birostris* was not recorded during the study period and reported later by others (ebird).

Among the reptiles, large snakes such as cobra *Naja naja* and Indian Rat Snake *Ptyas mucosa* mostly come from ISRO campus in search of food. The rat snakes are one of the most frequently sighted snakes in the premises, probably due to their commonness and their large size.

The place was surrounded by agricultural fields and large areas of fallow land with some waterbodies few decades back. Due to the land cover and land use changes in recent decades, the waterbodies and wildlife-

Table 4. List of Reptiles recorded from Sundarvan Nature Discovery Centre.

	English name	Scientific Name	IUCN Status
Family: Gekkonidae			
1	Northern House Gecko	*Hemidactylus flaviviridis* Ruppell, 1835	NE
2	Brook's Gecko	*Hemidactylus brookii* Gray, 1842	LC
Family: Scincidae			
3	Bronze Grass Skink	*Eutropis macularia* (Dumeril & Bibron, 1839)	NE
4	Spotted Snake-skink	*Lygosoma punctatum* (Gmelin, 1789)	NE
5	White-dotted Snake-skink	*Lygosoma albopunctatum* (Gray, 1846)	NE
Family: Agamidae			
6	Garden lizard	*Calotes versicolor* (Daudin, 1802)	NE
Family: Varanidae			
7	Common Indian Monitor Lizard	*Varanus bengalensis* (Daudin, 1802)	LC
Family: Typhlopidae			
8	Brahminy Worm Snake	*Indotyphlops braminus* (Daudin, 1803)	NE
Family: Boidae			
9	Common Sand Boa	*Eryx conicus* (Schneider, 1801)	NE
Family: Colubridae			
10	Indian Rat Snake	*Ptyas mucosa* (Linnaeus, 1758)	NE
11	Common Wolf Snake	*Lycodon aulicus* (Linnaeus, 1758)	NE
Family: Elapidae			
12	Spectacled Cobra	*Naja naja* (Linnaeus, 1758)	NE
13	Common Indian Krait	*Bungarus caeruleus* (Schneider, 1801)	NE
Family: Trionychidae			
14	Indian Flap-shell Turtle	*Lissemys punctata* (Bonnaterre, 1790)	LC
15	Gangetic Shoftshell Turtle	*Nilssonia gangetica* (Cuvier, 1825)	VU
Note: LC – Least Concern; NA – Not Evaluated; VU - Vulnerable			

friendly green spaces disappeared. This is the main reason for very low diversity of amphibians. A small artificial pond found in Sundarvan supports few introduced fish species like catfish and ornamental guppies and also aquatic reptiles such as the exotic Red-eared Slider Turtles *Trachemys* sp., native Flap-shell Turtles *Lissemys punctata* and Gangetic Softshell Turtle *Nilssonia gangetica* (One individual introduced by someone).

Plants are essential to the existence of the fragile skin of life surrounding our planet and its rich diversity. They play a primary role in ecosystem function (Given & Meurk 2000). Besides providing foraging and breeding space to wide range of animal species, such small patches act as corridor to maintain links with larger green spaces around. As mentioned above, the place provides a wonderful opportunity to connect urban dwellers with nature through various activities of Sundarvan. Interest in maintaining and

even enhancing biodiversity within urban landscapes is increasing, not only for the inherent value of biodiversity conservation itself but also because of the tangible societal benefits (e.g., environmental awareness, and the mental health and well-being) realised from viewing and interacting with biodiversity (Livesley et al. 2016).

Ahmedabad is the seventh largest metropolis in India and the largest in the state. The city is known as the commercial capital of the state and known as the textile capital of India (Avadia & Patel, 2018). Ahmedabad is the third fastest growing city in India with an estimated population of 5.5 million (Jashnani 2015). Ahmedabad has been selected in the list of 100 cities under the Ministry of Urban Development (MoUD), Government of India's Smart City Mission.

The future planning should be inclusive of preservation of its green spaces and wildlife. These green spaces in urban areas are very important. Sundarvan already lost considerable area for developmental activities such as road expansion. The future developmental activities should spare such places to maintain urban biodiversity, also considering other services such as production of oxygen, carbon sequestration, reduction of heat wave, space for urban dwellers to stay connected with nature, etc. The city administration may identify and map all available green spaces of the city for future conservation to ensure betterment of the city dwellers.

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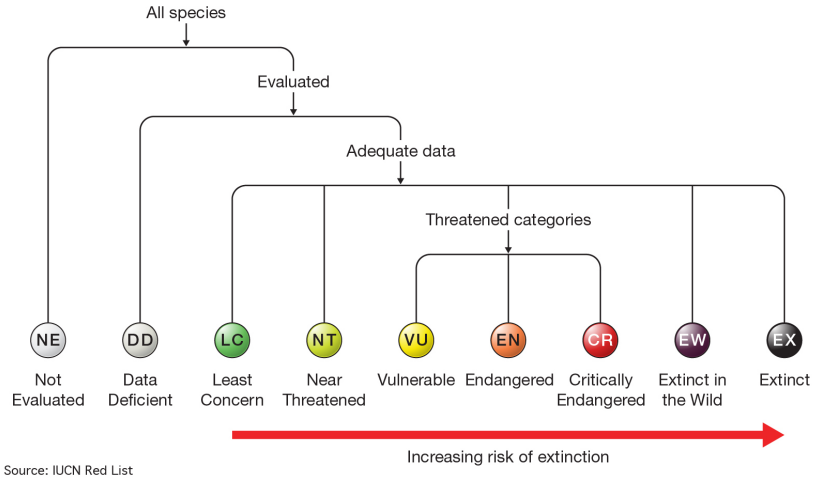
Conservation status of wildlife of Bangladesh



Source: IUCN Red List

Originated in the Pleistocene epoch, Bangladesh is the largest delta in the world, the Bengal Basin, formed by the Ganges, Brahmaputra, and Meghna (GBM) river system which covers more than 1.5 million km^2 (Byomkesh et al. 2009). Also, Bangladesh is at the junction of the Indo-Himalays and Indo-China sub regions where the species of two biogeographic realms overlap. Because of its geographic location at the eastern end of the Indian subcontinent, Bangladesh is a transitional zone for the flora and fauna of the subcontinent and that of southeastern Asia (Stanford 1991); however, Bangladesh has been endowed with a rich plant and animal diversity because of its fertile alluvial land and moderate climatic condition.

The climate of Bangladesh is the subtropical monsoon climate; its natural forests are classified on the basis of three major vegetation composition: evergreen to semi-evergreen hill forests, deciduous Sal forests and mangrove forests (Mukul 2008). Because of these diverse habitats, Bangladesh has a rich wildlife diversity as it provides for a wide variety of habitats that act as ideal foraging habitat and breeding sites for many wildlife species. Owing to the tremendous population pressure, a notable area of Bangladesh forests has been transformed into crop fields, human habitation, industrial, and commercial purposes, which are responsible for destroying wildlife habitats. The habitat loss caused by agriculture, logging, wood harvesting, livestock farming, and infrastructure development are some of the primary threats to wildlife in Bangladesh.

A total of 49 species of amphibians have been recorded in Bangladesh, of which four cryptic species (*Fejervarya asmati*, *Hoplobatrachus litoralis*, *Microhyla mymensinghensis*, and *M. mukhlesuri*) have been reported that have not yet been reported from other neighboring countries (Howlader 2011; Hasan et al. 2014), so these frogs can be considered as endemic to the country.

A total of 566 species of birds and 167 species of reptiles (3 orders and 25 families) have been recorded (IUCN Bangladesh 2015). Also, Bangladesh supports roughly 26% of the southern Asian mammals and 2.4% of all the mammalian species of the world (IUCN Bangladesh 2015). Seventy percent

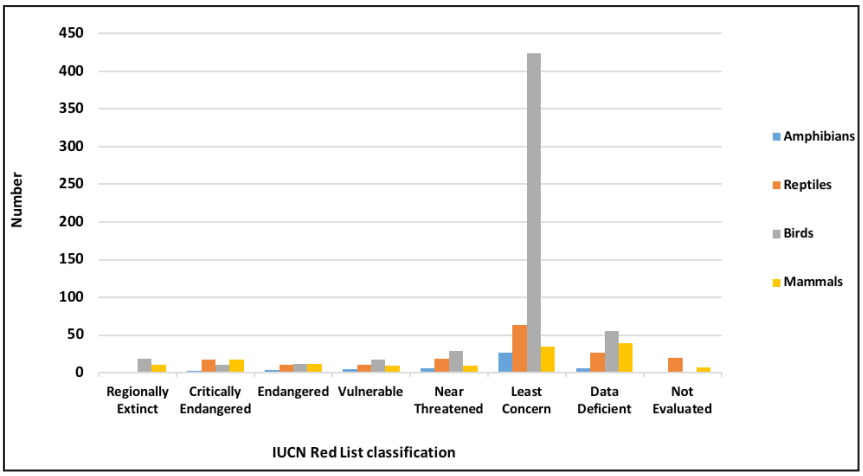


Figure 1. Conservation status of wildlife of Bangladesh as per the IUCN Red List Categories.

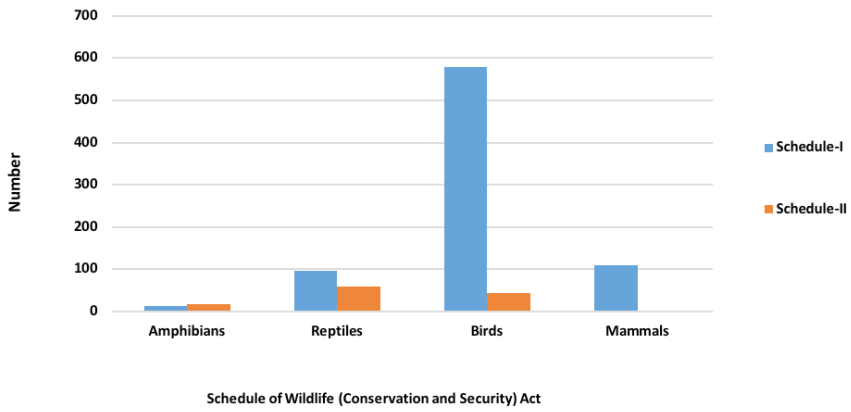


Figure 2. Conservation status of wildlife of Bangladesh as per the Wildlife (Conservation and Security) Act, 2012.

of the mammalian species of Bangladesh belong to three groups, viz., bats (Order Chiroptera, 27%), carnivores (Order Carnivora, 22%), and rodents (Order Rodentia, 21%). Herbivores and cetaceans combined constitute 14% while other six orders constitute the rest of the mammalian community in Bangladesh (IUCN Bangladesh 2015). In an overall proportion, however, conservation status of wildlife of Bangladesh is unknown.

Materials and Methods

The current conservation status of wildlife has been gathered from the IUCN Red List of Threatened Species 2015, the Wildlife (Conservation and Security) Act, 2012 and official website of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Results and Discussion

As per IUCN Red List of Bangladesh 2015, a total of 49 species of amphibians, 167 species of reptiles, 566 species of birds, and 138 species of mammals have been classified (Figure 1). There is no extinct amphibian species in Bangladesh. Two species are Critically Endangered (CR), three Endangered (EN), five species Vulnerable (VU), six species Near Threatened (NT), 27 species Least Concern (LC), and six species are Data Deficient (DD). The status of reptiles is as follows: one species (*Crocodylus palustris*) is Locally Extinct, 17 CR, 10 EN, 11 VU, 18 NT, 63 LC, 27 DD, and 20 Not Evaluated (NE). Among birds, 19 species (*Arborophila rufogularis*, *Pavo cristatus*, *Pavo muticus*, *Francolinus pondicerianus*, *Francolinus gularis*, *Asarcornis scutulata*, *Rhodonessa caryophyllacea*, *Antigone antigone*, *Houbaropsis bengalensis*, *Sypheotides indicus*, *Leptoptilos dubius*, *Ardea insignis*, *Pelecanus philippensis*, *Sarcogyps calvus*, *Actinodura egertoni*, *Paradoxornis flavirostris*, *Paradoxornis guttaticollis*, *Paradoxornis ruficeps*, *Certhia himalayana*) are Locally Extinct, 10 CR, 12 EN, 17 VU, 29 NT, 424 LC, and 55 DD. Amongst the mammals, 11 species (*Hyaena hyaena*, *Canis lupus*,

Boselaphus tragocamelus, *Bos javanicus*, *Bubalus arnee*, *Dicerorhinus sumatrensis*, *Rhinoceros sondaicus*, *Rhinoceros unicornis*, *Rucervus duvauceli*, *Antilope cervicapra*, *Melursus ursinus*) are Locally Extinct, 17 CR, 12 EN, VU, nine NT, 34 LC, 39 DD, and seven NE.

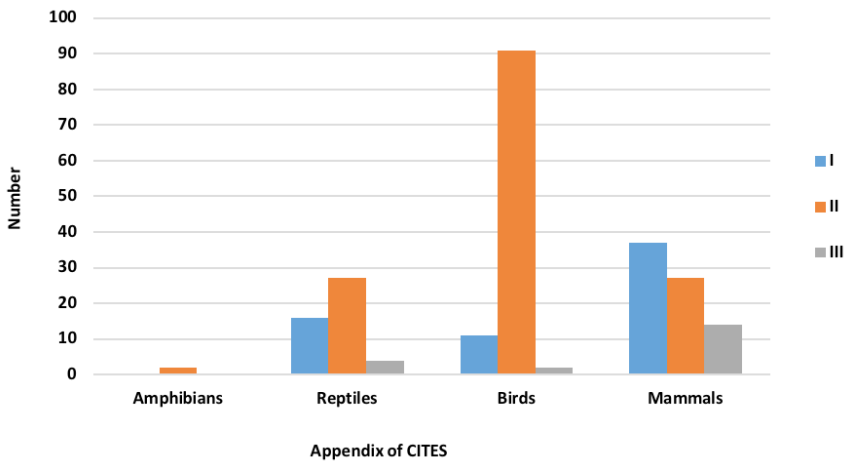


Figure 3. Conservation status of wildlife of Bangladesh as per the CITES.

As per the Wildlife (Conservation and Security) Act, 2012, there are 32 species of amphibians are listed under the Schedule I to II (Figure 2) of which 14 species are in Schedule I and 18 species in Schedule II. In Reptiles, 154 species are listed under the Schedule I to II (Figure 2) of which 96 species are in Schedule I and 58 species in Schedule II. In birds, 622 species are listed under the Schedule I to II (Figure 2) of which 578 species are in Schedule I and 44 species in Schedule II. In mammals, 113 species are listed under the Schedule I to II (Figure 2) in where 100 species are in Schedule I and three species in Schedule II.

As per the CITES, only two species of amphibians of Bangladesh are listed under Appendix II (Figure 3). In Reptiles, 47 species are listed under Appendix I–III (Figure 3) out of which 16 species are listed in Appendix I, 27 species in Appendix II, and four species in Appendix III. In birds, 104 species are listed under the Appendix I–III (Figure 3) of which 11 in Appendix I, 91 in Appendix II, and two in Appendix III. In mammals, 78 species in Appendix I–III (Figure 2) of which 37 in Appendix I, 27 in Appendix II, and 14 in Appendix III.

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New geographical distribution of Asiatic Softshell Turtle from Mizoram, India

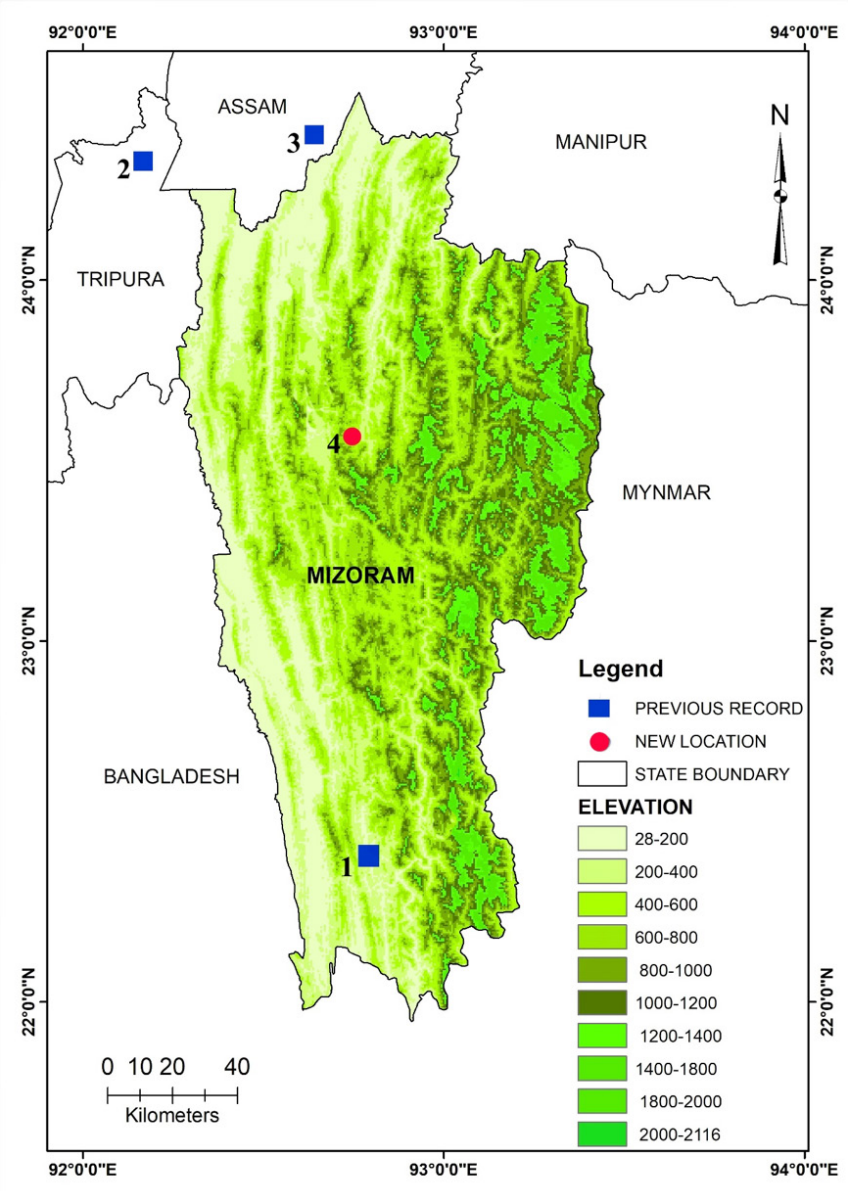
Sub–adult male *Amyda cartilaginea* from Tuirial River, Mizoram, northeastern India.

Eight species of trionychid turtle are known to occur in India, including *Chitra indica*, *Lissemys punctata* (two sub species *punctata* and *andersonii*), *Nilssonia gangetica*, *N. hurum*, *N. leithii*, *N. nigricans*, *Pelochelys cantorii*, and *Amyda cartilaginea* (Frazier & Das 1994; Pawar & Choudhury 2000; Fritz et al. 2014). The Asiatic Softshell Turtle *Amyda cartilaginea* (Boddaert, 1770) (Testudines: Trionychidae) inhabits freshwater bodies such as lowland rivers, ponds, canals, hill streams, and possibly estuaries (Boulenger 1912; Moll 1976; Ahmed et al. 2009). The first report of the country is from Ngengpui River basin in the extreme southern part of north–eastern India (Pawar & Choudhury 2000). Four species of trionychids (*Nilssonia gangetica*, *N. hurum*, *Chitra indica*, and *Lissemys punctata*) were reported from the Barak Valley, Assam (Das & Gupta 2011) and

two individuals of *Amyda cartilaginea* were reported from Tripura (North District), Narichera Stream (Das et al. 2016). Recently, this turtle was reported from the Assam-Mizoram border at Dhalchera River, Phaisen Hills, Cachar District, Assam (Nath et al. 2018).

While surveying the herpetofauna of Tuirial River drainage (23.555^{0}N & 92.779^0 E), Aizawl District, Mizoram, a sub–adult individual of *A. cartilaginea* was captured from the swift flowing water by V.L. Mawia at around 12.30h on 13 December 2019. This specimen represents the second report for the state of Mizoram and fourth for the country, respectively. Based on the presence of a distinct row of tubercles along the anterior edge of the carapace and a head with numerous indistinct yellow spots on an olive background, the specimen was identified as the Malayan Softshell Turtle (*Amyda cartilaginea*: Trionychidae: Trionychinae) (Ahmed et al. 2009). Although Ahmed et al. (2009) mentioned a greenish or olive carapace with yellow and black speckling, such speckling was not found in our specimen. As the tail extended beyond the posterior border of the carapace, it was probably a male (Ahmed et al. 2009).

The long axis length of the carapace measured 200.3mm, whereas its breadth was 170.3mm. The circumference of the carapace was 170mm and that of the plastron was 160mm. The length of the



Map showing geographical distribution of *Amyda cartilaginea* in India. 1) Ngengpui Wildlife Sanctuary. 2) Narichera Stream. 3) Dhalchera River. 4) Tuirial River.

plastron including the tail was 200mm. After taking measurements and photographs, it was released back into the natural environment. This report highlights the extension range from the previous locality at Ngengpui Wildlife Sanctuary (92.753–92.838 ^{0}E & 22.356–22.501 ^{0}N) from the southern part of Mizoram towards the north approximately 123km and links the type locality reported from Phaisen Hill (Assam-Mizoram border), Dhalchera (24.446^{0}N & 92.698^{0}E), Assam (Nath et al. 2018) to the north, which is about ca. 96km from the present locality.

The occurrence of *A. cartilaginea* in the drainage of Tuirial River which flows northward to join Barak River in Cachar plain of Assam suggests the possibility of this turtle species to migrate (or was washed downstream) from Mizoram to the adjacent Assam-Mizoram border as assumed by Nath et al. (2018). The presence of *Amyda cartilaginea* in the Tuirial drainage and Ngengpui River that joins Kolodyne River in the south, however, reveals that this species could be more widespread in other drainages than currently known in the state. In the present study, the specimens were occasionally found in various local markets of Mizoram and in the Aizawl Zoological Park but there is no proper record from where the specimens were collected. This shows that *Amyda cartilaginea* are not very rare species sparsely distributed in the state of Mizoram.

At present, the species is known to be harvested for local, regional, and international consumption (van Dijk 1999). Large numbers are caught for rural consumption, while regional networks of hunters and traders supply restaurants and the international trade (Jenkins 1995; van Dijk 1999). The IUCN Red List of Threatened Species lists this species as Vulnerable (Asian Turtle Trade Working Group 2000). This turtle may also occur in the adjacent states of Manipur and Nagaland bordering Myanmar (Ahmed et al. 2009). Therefore, there is a need for the study of the distribution and population trend of this species to enrich scientific knowledge and to understand its threat status in order to implement conservation measures.

IUCN Red List: Vulnerable (Asian Turtle Trade Working Group 2000).

Global distribution: Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Singapore, Thailand, Vietnam, India and Bangladesh (Tana et al. 2000; Platt et al. 2007, 2012; Khan 2012; Kabir et al. 2015).

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Genetic aberration in a Continental Common Pierrot from West Bengal, India

The genetic aberration of Common Pierrot *Castalius rosimon* (Fabricius, 1775). © Arunava Garai.

The southern region of West Bengal has a fairly good distribution of lycaenid butterflies. Checklists obtained from different parts of West Bengal have collectively established the Continental Common Pierrot (CCP) *Castalius rosimon rosimon* (Fabricius, 1775) to be a common butterfly species (Mukherjee et al. 2015; Payra et al. 2017). The species has been sighted throughout the southern part of the West Bengal. The normal phenotypic description of the species includes, hind wing with one tail each, underside white with many irregularly arranged black spots and a basal streak on both the wings. Upper side with black border (termen and costa) in males, which is similar in females but with much darker and thicker markings. Basal part of upper side of forewing and hindwing has metallic scales. Forewing of female has rounded termen (Bingham 1907; Kehimkar 2008).

During our field survey on 15 May 2019 at 12.36h, we observed a group of Lycaenidae butterflies fluttering (at Shyamkhola (22.424^{0}N, 88.390^{0}E), near Shyamkhola Birding Place, at Narendrapur, Kolkata, West Bengal), which consisted of CCP and Asian Zebra Blues *Leptotes plinius plinius* (Fabricius, 1793), on and around a bush at an elevation of about 2m. A few butterflies were found to be sun basking while others were

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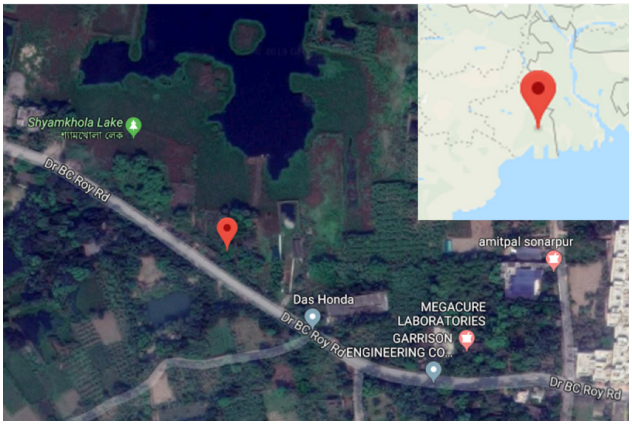

Google map image showing the point where we observed the genetically aberrant butterfly. Shyamkhola (22.424^{0}N, 88.390^{0}E), near Shyamkhola Birding Place, at Narendrapur, Kolkata, West Bengal, India.

nectar feeding. From the group, one was observed to have distinctly dark colouration on the underside of both the wings which is not the natural colour pattern of the CCP. The dark colouration was located at the underside of both forewing and hindwing, ranging from the apical (touching the costal margin) to the basal region of forewing but not touching the termen (outer margin), and sub-apical to post-basal region of hindwing. By comparing the previously published descriptions of the subspecies, we identified it to be a genetic aberration of CCP. Owing to its active erratic flight, only one proper photograph was successfully captured after which it flew away and we were not able to relocate it. The image of the butterfly which is used in this report, has already been uploaded in https://www.ifoundbutterflies.org with media code: dq615 by the second author, to retain his priority; however, the same image has been used here with consent from Garai (the second co-author) who holds the copyright permission and from the chief editor of the website (Saji 2020).

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Notes on the distribution of *Tephrosia noctiflora* Bojer ex Baker (Leguminosae) in Andhra Pradesh

The genus *Tephrosia* Persoon is distributed mostly in the tropical and subtropical regions of the world with ca. 350 species (Mabberley 2008). In India, the genus is represented with 27 species and one variety (Sanjappa 1992; Krishnaraj et al. 2013).

Tephrosia noctiflora is a pantropical species initially collected from Zanzibar regions of Africa by Bojer (1837) and described without any description. This was later described and validated by Baker (1871) in Flora of Tropical Africa.

The species was later on collected from Malay Peninsula, Philippines, Celebes and New Guinea and also recorded in tropical South America, Seychelles, Madagascar, China, Taiwan, Sumatra, Flores, Borneo, Solomon Islands and New Caledonia (Boseman & de Haas, 1983).

***Tephrosia noctiflora* Bojer ex Baker.**
A–Habit | B–Inflorescence | C–Pods | D–Seed.

In India, the species was reported by Baker (1876) in the name of *Tephrosia hookeriana* Wight & Arn, which was later correctly identified as *T. noctiflora* by Drummond (1918). He reported the species from Tamil Nadu based on Walker collections with a question mark. Subsequently, the species was reported in

many publications based on Drummond's report (Nair & Henry 1983; Sanjappa, 1992). No collections were available in the Madras Herbarium (MH), Botanical Survey of India, Deccan Regional Centre Herbarium (BSID) and Central National Herbarium (CAL).

While working on a project entitled "Preparation of Non Detriment Findings (NDFs) Report on Red Sanders Tree (*Pterocarpus santalinus* L.f.) in India", the senior author collected an interesting *Tephrosia* species from Maddimadugu west Beat, Kadapa Forest Division of Andhra Pradesh. This was later identified as *Tephrosia noctiflora* Bojer ex Baker, an imperfectly known species from India.

It is closely related to *T. villosa* and *T. purpurea* and differentiated from the former species by its 3-4 mm long lateral calyx teeth (6-7 mm long in *T. villosa*), the carinal teeth linear, 2.2—2.5 times as long as the cup (narrowly triangular -linear, 3—4.5 times as long as the cup in *T. villosa*), 4—8 pairs of lateral nerves (6—17 pairs in *T. villosa*), and the later species by its 1—2 or rarely 3 flowered fascicles (4—6 flowered fascicles in *T. purpurea*), 3.8—5.1 mm long carinal teeth (0.8—4 mm long in *T. purpurea*), reticulately ridged seeds (smooth seeds in *T. purpurea*). Scrutiny of literature revealed thatthis species presently known was from Tamil Nadu and not reported from Andhra Pradesh (Pullaiah & Ramamurthy 2018). Hence, this has been reported here as an addition to the flora of Andhra Pradesh.

Herbarium image of *Tephrosia noctiflora* Bojer ex Baker (J. Swamy 008802, BSID).

TAXONOMIC TREATMENT

Tephrosia noctiflora Bojer [Hort. Maur. 93. 1837, nom. nud.] ex Baker in Oliv., Fl. Trop. Afr. 2: 112. 1871; Drummond in Gamble, Fl. Madras 1: 318. 1918; Bosman & A.J.P.de Haas in Blumea 28: 458. 1983; Nair & Henry, Fl. Tamil Nadu Ind., Ser I: Analysis 1: 123. 1983; Sanjappa, Legumes India 257. 1992. *T. hookeriana* auct non Wight & Arn 1834; Baker in Hook.f., Fl. Brit. India 2: 113. 1876, pro parte.

Specimens examined: 008802 (BSID), 09.viii.2017, Maddimadugu West Beat, Kadapa Range, Kadapa Forest Division, Kadapa District, Andhra Pradesh, 14.333^{0}N, 78.726^{0}E, 265m, J. Swamy.

Annual or perennial under shrubs up to 1m high. Indument strigose to sericeous or silky pubescent to velutinous or ferruginous silky. Stipules 2.5 x 0.8 mm. Rachis of leaf 3.5—7 cm long, 1 mm diam.; the infrajugal parts of the longest 13 mm long and the interjugal parts of the longest rachis 5–8 mm long. Petiolules subsessile to 0.8 mm long. Leaflets 4—9 pairs, in the maxijugal leaf 4—10, obovate to narrowly obovate or elliptic, base cuneate or acute, apex rounded to emarginate with mucro tip, terminal leaflet larger than or as large as the lateral ones, 15—21 x 3—4 mm; lateral leaflets 8—20 x 2.5—3 mm; midrib raised, or flat, or raised in a furrow above; nerves 8—17 pairs, raised on both surfaces. Pseudoracemes terminal, or axillary, or leaf-opposed, 13—28 cm long; some basal bracts similar to vegetative leaves. Fascicles with 1—2 flowered and rarely 3 flowered. Bracts to the fascicles narrowly triangular to linear triangular, 1—3 x 0.2—0.8 mm. Bracts to the flowers narrowly triangular to linear triangular, 1—3.5 x 0.1—0.3 mm. Pedicel 2—2.5 mm long. Flower 6—9 mm long. Calyx cup 1.8—2 x 4—4.6 mm, densely clothed with ferruginous silky hairs; teeth pubescent within at apex; the vexillary one broadly triangular, 2.62—2.82 x 3.5—4.5 mm; the lateral ones triangular to linear triangular, 3.0—4.0 x 1.25—1.5 mm; the carinal one linear, 3.8—5.1 x 0.6—0.7 mm, longer than the other teeth and 2.2—2.5 times as long as the cup.

Standard blade broadly ovate to transversely elliptic, apex truncate to emarginate, 5.7—6.0 x 7—8 mm, densely ferruginous silky hairs on upper surface; claw 2—2.38 mm long, strongly curved. Wing blades 5.28—6 x 2.4—2.6 mm, glabrous, lateral ribs extending over 1.8—2.2 mm; claw 1.9—2.1 mm long. Keel blades 4.5—5 long x 2.26—2.40 mm; claw 1.2—1.5 mm long. Staminal tube 5.4—6.6 mm long, glabrous. Vexillary filament free at base and connate halfway, 6.0—6.5 mm long, glabrous, the other filaments alternately longer and shorter; the longer ones 2—2.2 mm long and the shorter ones 1.2—1.5 mm long; anthers 0.45—0.27 mm long. Ovary densely sericeous, 4.47—5.2 x 0.8—1.2 mm; style twisted, 3.62—4.0 mm long, glabrous; stigma penicillate at base. Pod linear, flat, slightly turgid, 25—30 x 5-6 mm, slightly convex around seeds. Seeds 5—10, transversely elliptic to rectangular, reticulately ridged, brown to dark brown, 2.83—3 x 4.0—4.4 mm.

Flowering and Fruiting: July-–December.

Distribution: Native of Africa and probably of India (Tamil Nadu), naturalized in the Malay Peninsula, Indonesia. Also recorded from tropical South America, Seychelles, Madagascar, China, Taiwan, Solomon Islands and New Caledonia (Bosman & de Hass, 1983).

Habitat: Occasional on rocky crevices and surface of scrub forest, associated with *Cymbopogon* sp., *Diospyros melanoxylon* Roxb., *Polycarpaea aurea* Wight & Arn and *Waltheria indica* L.

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Esophageal stricture in a White Tiger

Case Report

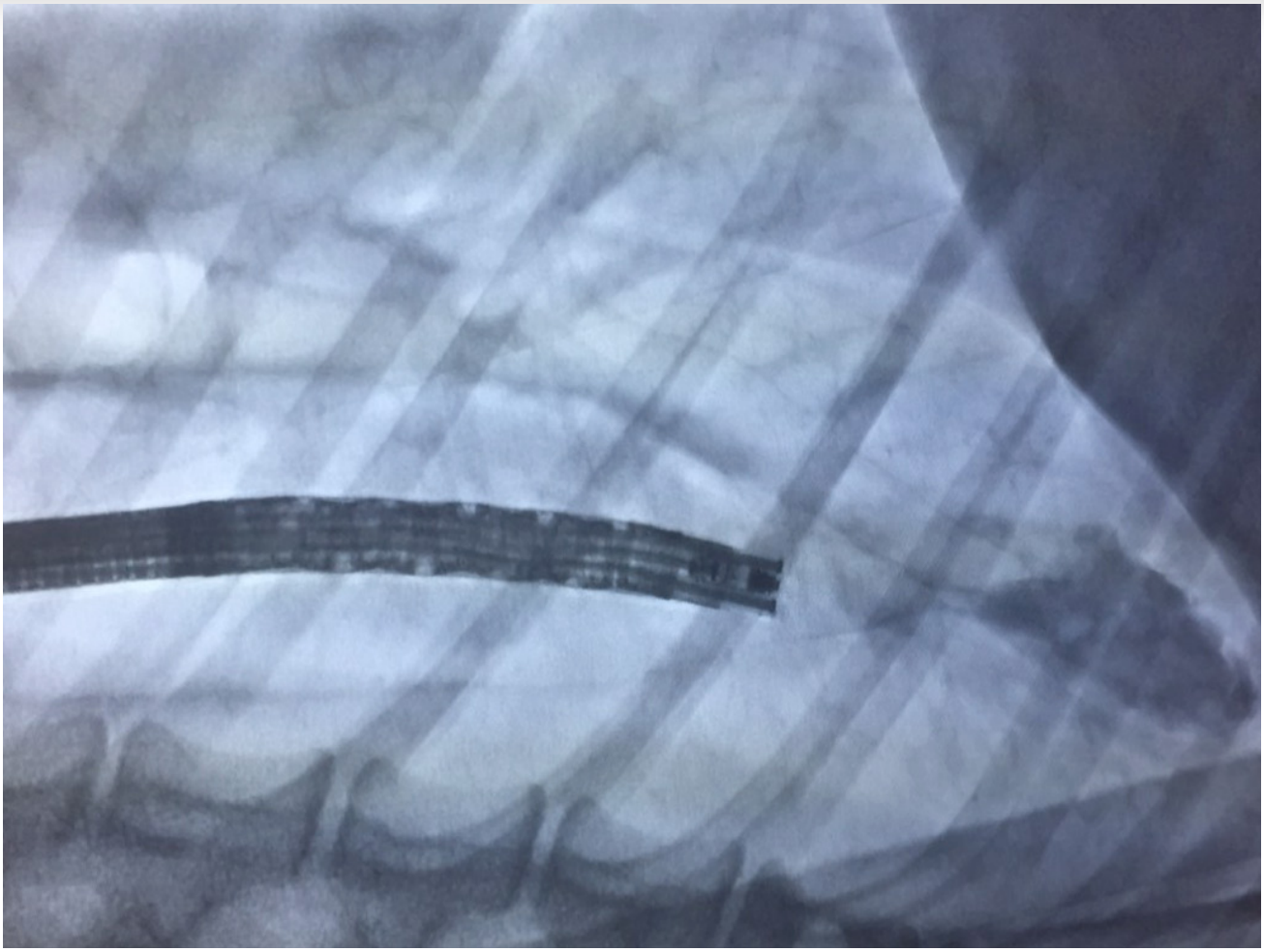
A five-year-old, intact, female, captive-born white tiger, 350 pounds, was presented due to a one-month history of dysphagia and regurgitation. Her etiology is complex. At four months of age, the tiger was diagnosed with urinary and fecal incontinence that was determined to be neurological in nature, along with hip dysplasia and hind limb paresis. Recurrent urinary tract infections were treated with Amoxicillin as needed. One month before admittance to the University of Florida Veterinary Hospital, the tiger suffered a stressful event when a tractor repeatedly drove past her habitat on 23 July 2018, harassing the tiger, causing her to loudly vocalize, race the length of her habitat, and slam into the cage doors. She stopped eating immediately.

Fear can cause psychological stress in animals and frightening noises can cause environmental stress (Matthews 2014). This tiger was tormented for an extended time period by the tractor which produced extremely loud, frightening noises as the driver hit the railroad tie barriers adjacent to the tiger's cage, ramming the ties into the sides of the cage.

The tiger was presented to Julington Creek Animal Hospital in Jacksonville, Florida, sedated with 2cc Telazol (Tiletamine/ Zolazepam), and given a bolus of 2 liters of IV lactated ringers. Blood work showed elevated WBC (56.94 K/uL). After three weeks of anorexia and general depression, the tiger was transported to First Coast Veterinary Specialists in Jacksonville, Florida. Radiographs confirmed an intestinal blockage and an abdominal exploratory surgery was performed. The patient was manually deobstipated, and large quantities of hair, sand, and feces were removed.

One week later, clinical signs did not subside, anorexia continued and white blood cell count remained elevated. The tiger was presented to the University of Florida (UF) Veterinary hospital due to inappetance, depression, significant weight loss, and increased white blood cells.

The tiger received IV fluids while under anesthesia, and was treated with oral Enroflaxacin, the antacid Famotidine, the anti-emetic Cerenia and B vitamins. The next day, the tiger suffered two seizures. An anti-convulsive drug (Levetiracetam) was administered and a CSF tap performed, which was mildly reactive with no evidence of infection. Distemper, toxoplasma, neospora, and blood cultures were negative. CT scan revealed small, mineralized intraluminal material in the mid-esophagus of unknown origin, which was also noted in the stomach. CBC revealed elevated white blood cell count (61,000) with moderate toxicity and decreased red blood cell count (PCV 27%). Urinalysis revealed glucose in the urine



Endoscope on left, nearing the stricture. Dark area on right is the stomach.

(>2,000 mg/dL), >3+ blood in urine; no bacteria or white blood cells seen. The tiger returned home five days after eating well at the UF hospital, and was discharged with Baytril, Keppra, Cerenia, and Omeprazol. Three weeks later, on 7 September 2018, the tiger was returned to UF for an endoscopy. She had eaten very little horsemeat since returning home and began vomiting white foam. Her weight decreased from her original healthy weight of 350 pounds to 162 pounds.

On presentation, the animal was obtunded and ataxic, suspected secondary to sedation with 2cc Telazol prior to travel. She exhibited moderate ptyalism, also suspected secondary to travel. After sedation with 300mg Ketamine, 7.5mg Midazolam and 3mg Dexmetomidine intramuscularly, the patient was anesthetized with Isofluorane. The coat was examined and determined unkempt, and the tiger exhibited severe muscle wasting, worse in the hind limbs. Dehydration was estimated at 7–10% based on moderate skin tenting. CBC revealed mild anemia (6.67M/uL), mild thrombocytosis (546K/uL), and mildly elevated total white blood cell count (19K).

The tiger's blood chemistry revealed mild hypoalbumenia (2.5), hyperglobulinemia (5.5), mild hyperkalemia (4.9), hyponatremia (142),

Table 1. Represents esophageal stricture changes during each of the six treatments.

Date	Weight	Stricture Dilation	Endoscopy Findings	Patient Response
07.ix.2018	Original weight 350 lbs. Now 162 lbs.	12mm scope, 15mm balloon catheter, then 18mm catheter	Esophagitis on smooth muscle of distal esophagus	Within 4 days, stricture prevented the animal from eating
18.ix.2018	178 lbs.	7.8mm scope, 18mm balloon catheter, then 20mm catheter	Healing abrasions observed from previous endoscopy and dilation. Mytomycin applied	Within 6 days, stricture prevented the animal from eating
05.x.2018	No weight taken	7.8mm scope, 18mm, 19mm and 20mm balloon catheter	Stricture is 5mm long, narrowed at rostral end. Irritation and fibrous tissue observed, making it difficult to dilate. Dilated to 30mm	Within 8 days, stricture prevented the animal from eating
12.x.2018	192 lbs.	35mm balloon catheter, dilating the site to 35mm	Based on amount of tearing through fibrotic tissue, stricture was expected to recur	Within 5 days, stricture prevented the animal from eating
23.x.2018	208 lbs.	7.8mm scope inserted 95cm. CO2 laser used to score stricture. 35mm balloon used to dilate to 35mm	Stricture's length decreased since last dilation	Within 8 days, stricture prevented the animal from eating
06.xi.2018	No weight taken	35mm balloon used to dilate to 35mm.	This was the final procedure. Quality of life poor, euthanasia recommended	Within 10 days, stricture prevented the animal from eating

and hypochloremia (109). These findings are consistent with regurgitation/vomiting of lower stomach acid, as well as mild inflammation, which is consistent with her clinical signs. Kidney and liver values were normal (Table 1).

While under anesthesia, an endoscopy was performed with a 12mm scope. Esophagitis was noted on the smooth muscle of the distal esophagus and a hard, white foreign body was lodged within the distal esophagus. The obstruction, a piece of bone, was removed and a 15mm balloon catheter was utilized to dialate the stricture to allow the scope to advance. The antrum of the stomach had small multifocal areas of digested blood. The remainder of the stomach and proximal duodenum did not have any gross abnormalities. Biopsies of the duodenum, stomach, and esophagus were submitted for histopathology. The esophageal stricture was dilatated with a 15mm balloon followed by an 18mm balloon.

The patient then received a 60ml bolus of fluids, followed by 2.5 liters of fluids IV and 1.5 liters SQ. Pantoprazole (100mg) was given IV. Pantoprazole is a proton pump inhibitor that works similar to omeprazole to decrease stomach acidity to help combat ulceration and inflammation of the esophagus and stomach. Patient also received Cobalamine (vitamin B-12)

2,000mcg subcutaneously due to her previously low Cobalamine and Folate levels. Recommended diet included a blended diet, such as Toronto brand horsemeat, formed into meatballs. The recommended amount was 2–3% of the animal's body weight per day. Because patient was anorexic for so long, patient was started on 2% of her body weight (3.5 pounds/day).

Due to the patient's esophageal stricture, bone shards are more likely to get lodged and cause or worsen strictures, so they should not be offered. Medications post OP include Cerenia, one-half tablet every 24 hours as needed for nausea or vomiting, Cisapride (20mg capsules), one capsule by mouth every eight hours, and Omeprazole (20mg capsules), four capsules by mouth every 12 hours for 14 days.

Approximately three weeks later on 18 September 2018, the tiger was returned to UF due to regurgitation. Her weight totalled 178 pounds, up 16 pounds from the last visit. The tiger wanted to eat, but could no longer pass any food into its stomach, after four days of eating successfully. Another upper gastric endoscopy, fluoroscopy, and balloon dilation were performed with a 7.8mm scope, showing healing abrasions from the previous endoscopy and dilation. An 18mm balloon and a 20mm balloon were used to dilate the stricture site, and Mytomycin, a chemotherapeutic drug, was applied to the fibrous tissue where the stricture was.

The patient returned to UF approximately three weeks later on October 5, 2018, exhibiting the same regurgitation symptoms after six days of eating normally. The tiger was sedated with the same drugs used previously. She was given a 1 liter bolus of lactated ringer solution IV and another 1 liter subcutaneously later on, which corrected her measured acidosis.

The patient was given 1mg/kg Maropitant intravenously and 1mg/kg Pantoprazole intravenously. She became hypotensive during anesthesia and was given 0.25mg/ml Dobutamine in 0.9% sodium chloride at a rate of 15mcg/hr for five minutes, which corrected her hypotension. Under anesthesia, a 7.8mm scope was inserted 90–95cm down the esophagus to the stricture site. The stricture was 5mm long and had a focal area of narrowing at the rostral end. Reddened irritation and a large degree of fibrous tissue were observed at the site. An 18mm, 19mm, 20mm balloon and a second balloon were used to dilate the stricture. There was more fibrous response from the esophagus during dilation, making it more difficult to dilate. The site could only be dilated to 30mm. Based on the amount of tearing through fibrotic tissue, the stricture was expected to recur. After the procedure, the tiger was reversed using 15mg Atipamezole and 500mcg Flumazenil, both intramuscularly.

The patient returned to UF after one week on 12 October 2018. She weighed 192 pounds. She stopped eating normally after eight days and began regurgitating her food once again. During this procedure, a 35mm balloon was used to dilate the stricture. The site could

only be dilated to 35mm. Based on the amount of tearing through fibrotic tissue, the stricture was expected to recur. The patient was able to eat normally for five days before beginning regurgitation.

The tiger was again transported to UF for treatment on 23 October 2018. A body condition score of 2/5 was determined, with a weight of 208 pounds. She had mild to moderate muscle wasting with severe muscle wasting in her hind limbs. Her mucous membranes were pink and moist, her CRT was <2 seconds, and she appeared euhydrated. Under anesthesia, a 7.8mm scope was inserted 95cm down her esophagus to the stricture site.

The stricture's length had decreased since the last balloon dilation, with a focal area of narrowing at the rostral end. Reddened irritation and fibrous tissue in the dorsal portion of the esophagus was observed at the site. A CO2 laser was used to score the area of the strictured esophagus and allow better stretching of the esophagus with balloon dilation. A 35mm balloon was then used to dialate the stricture. The site could only be dilated to 35mm. The area was completely opened, including the focal area of narrowing at the rostral end. Triamcinolone was injected into the wall of the esophagus where the balloon dilation occurred to help prevent fibrosis of the esophagus. The tiger was diagnosed with a urinary tract infection and treated accordingly.

After eight days of eating normally, on 6 November 2018, the tiger again resumed regurgitation and vomiting up of white foam. She was again transported to UF for her sixth and final endoscopy procedure. The patient's mobility decreased over the past few days. She was able to take four or five steps before lying down. Veterinarians were concerned about her quality of life at this time. She still had no control over urination or defecation. Complete blood count and chemistry panel were within normal limits. An ultrasound was performed. Her bladder, cervix, uterus and kidneys were all within normal limits. A small, hypoechoic, non-symmetrical structure was seen in the right inguinal region at the level of the insertion of the prepubic tendon. This structure may have been a muscle insertion or lymph node, which is unusual. A balloon dilation was performed via fluoroscopy to allow veterinarians to see a "moving x-ray," providing a clearer view of the stricture.

As in the past, the caudal portion of the previous stricture was closed down very small. The length of the restricted portion of the esophagus was mildly shorter than in the past. A 35mm balloon was used to dilate the stricture. The site was dilated to 35mm. The area was completely opened and Triamcinolone was injected into the wall of the esophagus where the balloon dilation occurred to help prevent fibrosis of the esophagus. Patient was able to eat normally for 10 days before resuming regurgitation.

Veterinarians discussed this tiger's quality of life. While she appeared happy and ate a substantial amount for several days after her six procedures, with her limited mobility and recurrent esophageal stricture, her prognosis

for a normal life was determined to be poor. The tiger was prescribed steroids to decrease inflammation associated with her esophageal stricture and hind limb weakness. The patient was prescribed Prednisolone, 6mg, six tablets by mouth every 12 hours. She still had an active urinary tract infection at this point. An injection of Excede (Ceftiofur) was recommended and administered.

As of 29 November 2018, the tiger had eaten little to nothing. Regurgitation resumed, and the animal was again losing weight. Euthanasia was recommended. On 30 November 2018, the owner began pureeing ground chicken and milk, offering the tiger four pounds of the mixture along with two quarts of milk twice daily. The tiger drank all of it. The next morning, no regurgitation was evident; the tiger was able to keep the blended mixture down. The tiger resumed regurgitation periodically, however, until she was only able to keep food down for a day or two before regurgitating all of her diet for several days in a row. This continued until 14 January 2019, when it was determined that her quality of life was only going to deteriorate more rapidly from this point on.

Other case studies

It is unknown if stricture formation in exotic felids is a common occurrence, due to lack of diagnosis, treatment, or lack of reporting. Desmarchelier described an esophageal stricture in a large felid in 2009, whereby a seven-month-old Cougar *Puma concolor* was diagnosed with a segmental intraluminal esophageal stricture in the middle of her esophagus, believed to have been caused by previous anesthesia. The cougar required three endoscopic balloon dilations. Two months after the successful third procedure, she was killed by a cage mate, so no further study could be accomplished (Desmarchelier 2009).

Ayala (2018) discussed esophagitis and a 13mm stricture in an African Lion *Panthera leo*. The lion's stricture was successfully dilated with a 20mm balloon followed by a 35mm balloon. The lion required no further treatment and exhibited no further signs after one year.

Discussion

Although strictures can be congenital in dogs and cats, acquired strictures occur due to injury of the esophagus, chronic vomiting, foreign bodies, thermal burns or from corrosive substances. The injured esophagus will heal by fibrosis and contracture of the wound, narrowing the lumen, resulting in esophageal obstruction.

The most common cause of stricture formation is from esophageal reflux that can occur when the animal is under anesthesia. Strictures in felines can also be caused by oral antibiotics, specifically, Clindamycin and Doxycycline. Such medication-induced strictures can occur when the tablet or capsule remains in the esophagus, resulting in esophagitis and the formation of strictures. It is recommended that a water bolus be administered after oral tablets have been consumed to clear the esophagus (Johnston 2018).

Although this tiger's stricture may have been caused while under anesthesia when the intestinal blockage was repaired, she has also received oral medications in the past, including Clindamycin; however, the tiger did not dry-swallow the drugs. The Clindamycin was placed inside of a piece of meat, which the tiger then swallowed. When dry-swallowed, capsules can become retained in the oropharynx or cervical esophagus (Glanemann 2008). Owner suspects that the stressful event involving a tractor that occurred on 23 July 2018, led to this tiger's complications with esophageal strictures.

The stressful event that this tiger experienced due to the tractor incident could have caused her intestinal blockage and inappetance, both of which occurred at the time of the stressful incident. Abdominal surgery and subsequent anorexia, followed by her appetite resumption and an overproduction of stomach acid could have led to the formation of the stricture.

Immunocompetence is modulated by stress, which possibly leads to an increased susceptibility to disease in animals (Beerda 1999). Stress is an effect that is produced by external physical or environmental events, or internal physiological or psychological factors. Fear can cause psychological stress, and frightening noises can cause environmental stress. This tiger was distressed, a state in which she could not escape from the stressors that resulted in negative effects on her well-being. Massaging the stressed animal produces the homeostatic effect of reducing stress hormones and increasing endorphins, serotonin and norepinephrine (Matthews 2014). Since the stressor incident, the owner took steps to reduce stress, to include visiting with the tiger several times a day, talking to her, brushing her, and minimizing noise levels, all techniques used to reduce stress. The damage, however, was already done with this tiger; after surgery and several dilation procedures, she had to be euthanized.

Gross necropsy findings

A necropsy was performed on 15 January 2019 by Lisa L. Farina, DVM, DACVP and Sunil N. More, DVM, PhD, Resident. The gallbladder contained a moderate amount of soft, black particulate material. There were numerous, tan colored, pin-point foci in the splenic parenchyma (lymphoid follicles) of the spleen. Urinary bladder was distended with yellow urine. The tissue surrounding the right and left ovaries each contained two 1-1.5 x 0.5-1 x 0.51cm cysts, filled with a pale yellow fluid. Lungs were multifocally mottled red; there were multifocal areas of air trapped in the connective tissue surrounding the hilus. A small amount of green grass material was found in the bronchi. The lungs exuded red-tinged fluid on severed sections.

In the digestive tract, the caudal portion of the esophagus was palpably firm. Approximately 2cm proximal to the gastroesophageal junction, the mucosa narrowed to approximately 3cm in circumference. The remaining mucosa was approximately 7cm in circumference. The muscularis of the caudal one-third of the esophagus was 0.4cm in thickness; the

muscularis of the cranial esophagus was 0.2cm in thickness. At the stricture level extending cranially, there were four, tan to yellow, shiny, sharply demarcated areas in the mucosa, presumed to be ulcers, that ranged in size of 1 x 0.3cm to 2 x 4cm. Mild dilation of the mid esophagus cranial to the stricture was found. Stomach was filled with granular, brownish food material. Contents of the intestines were brown and mucoid.

In the lumbar spinal cord, beginning at L4 to the cauda equine dorsally, a longitudinal cavitation was found, measuring from 2mm to 5mm. On cut sections, the dorsal spinal cord sections contained cystic space with a thin dorsal lamina. The spinal cord sections from L1 to L4 contained multiple cavitated areas up to 1mm in diameter surrounding the central canal.

Gross diagnoses

- Esophageal stricture, chronic, marked, mucosa of distal esophagus, with mucosal ulceration and gastric heterotopia.
- Presumptive syringomyelia, lumbar spinal cord.
- Paraovarian cysts, chronic, multifocal, mild, bilateral.

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ZOO'S PRINT

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