Peer-review of the Wildlife Conservation Plan, prepared by the Wildlife Institute of India (WII) for the Etalin Hydropower Project, Dibang Valley, Arunachal Pradesh

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EXECUTIVE SUMMARY

A group of Indian scientists including botanists, entomologists, ornithologists, mammalogists, herpetologists, aquatic fauna specialists, hydrologists, geographers and social scientists, many with research experience in Arunachal Pradesh, including in the Dibang Valley, have conducted a peer-review of the Wildlife Institute of India's (WII) Technical Report titled 'Wildlife Conservation Plan for the impact zone of Etalin HEP, Dibang Valley District, Arunachal Pradesh'(hereafter, 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 catchment area*" of the 3097 MW Etalin Hydro Electric Project (HEP) in Dibang Valley, Arunachal Pradesh. Overall, the review encountered considerable deficiencies, contradictory claims and scientific biases which have compromised the quality and the veracity of the Report's findings and conclusions. Below are some noteworthy findings:

1. The entire study was conducted in under 5 months from February to June 2018. This cannot be considered a 'multiple seasonal replicate' study and does not represent three seasons in Arunachal Pradesh with distinct rainfall and weather patterns: (a) October to February: relatively dry season/winter; (b) March-April: spring/pre-monsoon; and, (c) May to September: summer/monsoon.

2. ***Flawed methodologies and lack of rigour:*** The Report suffers from several technical shortcomings:

    a. The sampling was done in a much smaller area ('Zone of Influence', 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 a biodiversity hotspot. Most surveys were conducted along roads and other anthropogenically impacted areas using unscientific and biased methods. Not all elevations were sampled despite ample evidence that elevational gradients contribute to high biodiversity in the Eastern Himalayas.

    b. Birds were surveyed outside the breeding season significantly reducing detection rates.

    c. Several groups of taxa were not surveyed at all, including numerous insect orders such as Hymenoptera (bees, wasps and ants), Diptera (flies), Orthoptera (grasshoppers, locusts and crickets), and arthropod species such as scorpions, and pseudo-scorpions, and other taxa such as crustaceans (crabs), molluscs (snails), and protozoans despite evidence of high levels of diversity and endemism in the Dibang River basin.

    d. Approaches and methods used to analyse field data and produce results are inadequate, not clearly explained and, often, not scientifically recognised. Importantly, species accumulation curves, a key method to analyse and report data on species richness and diversity, have not been prepared for most taxa. Fish is the only taxa for which accumulation curves have been prepared but they clearly show inadequate sampling. Furthermore, nowhere are the links between topography, habitat type, biodiversity presence, local people's priorities and potential HEP impacts clearly established.

    e. The Report does not refer to recent and relevant peer-reviewed work on social, ecological, physical and geomorphological aspects of the study region, including one by some of the Report's own authors that found tigers within 10 km of the HEP site. Instead, the Report relies on limited, often outdated material.

3. ***Flawed inference:*** Because of serious methodological and analytical deficiencies and exclusion of highly diverse taxa such as insects and arthropods, the Report underestimates the study area's biodiversity values and the HEP's impacts, particularly on range-restricted, threatened and

endemic species. Comparisons with published research from Dibang Valley shows that the Report under-reports hundreds of species of butterflies and other groups of insects, and birds, and tens of species of orchids, mammals and herpetofauna. The report's species checklists contain repetitions, lack of proper taxonomic classification and wrong distributions including 12 species of butterflies that are not known to occur in Northeast India at all.

4. ***Dibang is exceptionally biodiverse:*** Even with the short survey 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 Indian Wild Life (Protection) Act, 1972.

5. Despite numerous admissions that highlight the species richness and diversity of the region, the Report ignores its own findings to outline mitigation 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 on what basis the FAC's singular mandate of *'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 to compensate for the local entire ecosystems that provide vital environmental and societal benefits. Overall, this 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.

6. There appears to be a minimization of the negative impacts of the HEP and local concerns about them throughout the Report. The section that relate to assessing socio-cultural impacts of the HEP and suggest mitigatory measure 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. Some of the job opportunities listed such as welder, fitter, plumber, electrician etc. 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.

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 catchment area"*** 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, 23rd 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, who have multiple years of research experience in Arunachal Pradesh, including in Dibang Valley, 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 of the Report, below are some key general observations:

(1) The FAC recommended a "*multiple seasonal replicate study on biodiversity assessment of the catchment area"*. The entire study however appears to have been conducted by the WII over a short period from February 2018 to June 2018, which is under 5 months and cannot be considered a 'multiple seasonal replicate' study. 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 to February: relatively dry season/winter; (b) March-April: spring/pre-monsoon; and, (c) May to September: summer/monsoon.

(2) 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.

(3) 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.

(4) 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 entirely

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.

(5) Even in the short survey conducted using biased sampling methods within a limited a 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 (highlighted in taxa-specific sections), it nonetheless collected direct evidence of 230 bird, 159 butterfly, 112 spider, 51 moth, 31 reptile, 14 amphibian and 21 mammal 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).

(6) 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 estimate vegetation types. This is followed by seven 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 development 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) raises 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, 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 threats to the region's ecology, hydrology and people because of the HEP. Specific comments on the overall lack of scientific rigour in the Report are as follows:

Impacts of HEP extend beyond the Zone of Influence

The Report broadly defines the 'Zone of Influence' (hereafter ZoI) as the farthest influence of the HEP (Page 35). However, this 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. Neither does it include the environmental impacts of subsurface tunnel construction. Additionally, Dibang valley lies in the zone-V of the earthquake hazard zone making it highly prone to earthquakes and its associated affect like landslides. The report undermines the severity of risks entailed in carrying out massive infrastructural projects in fragile landscapes and presents a myopic perspective that the HEP's impacts on biodiversity are unrelated to human well-being.

Even within the limited ZoI, the Biodiversity Conservation Plan does not account for the damage to the greater landscape by construction of over 50 km of new roads and widening of an additional 30 km 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. The landslide susceptibility of the region was not considered despite a global landslide susceptibility map developed by NASA, available at no charge (Stanley and Kirschbaum, 2017) (Page 183). The Report fails to appreciate previous studies globally and in Dibang Valley on the detrimental effects of landslides on forests, rivers, people, and biodiversity (Sassa and Canuti, 2009; Athreya and Sheth, 2016). The areas proposed for land acquisition have "high" and "very high" susceptibility to landslides according to the said global map (Stanley and Kirschbaum, 2017). This is evident from satellite images acquired before and after 2018 showing several ongoing landslides due to road widening and recent extreme precipitation. 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. Therefore, the ZoI appears greatly under-defined and not based on a careful consideration of topographical, hydrological, anthropogenic and geological factors known to impact mountain ecosystems.

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 species accumulation curves for fish, the Report does not present these curves for most 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).

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 ascertained to be "low" (Page 148). This approach is not based on any of the scientifically published methods that are used to score the impact on biodiversity due to HEPs.

Mid-elevations will be richest in Dibang Valley

Species richness peaks at different elevations for different taxa. These are well established ecological rules (Colwell and Lees, 2000; McCain and Grytnes, 2001). However, the study does not sample across different elevations to ascertain species richness-elevation relationships. Prior work in Western Arunachal demonstrates that species richness increases with elevation in certain taxa (Marathe et al., 2020; Sheth 2020 pers. comm.). Similarly, Roy et al. (2018) surveyed an elevation range from 200–3500 m in Dibang river basin documenting 38 amphibian species, 36 of which were found between 800–1500 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 and Sheth, 2016). Further, the mid-elevational 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 amd 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.

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. More importantly, the land-use land-cover data have not been integrated with datasets on biodiversity richness, geohazards and topography to

understand the importance of landscape drivers in sustaining high-levels of biodiversity in the region. This requires longer data collection over larger region to develop empirical multi-level models capable of comprehensively assessing the true extent of impacts of the proposed 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 are used (Page 63). This is important as 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 obscuring 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). Distinguishing between evergreen and/or secondary forest is difficult in Arunachal and even more so in this season especially without a robust ground-truth sampling design. While the Report states that ground-truthing data were collected, no such data, 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 and Huete, 1991). For areas with high vegetation biomass, the more sensitive EVI (Enhanced Vegetation Index) 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, commision-omission errors) to allow the accuracy of the classified imagery to be assessed.
- Due to its narrow-minded focus on the individual components of the biodiversity, the report fails to look at the impact of the proposed activities on the ecosystem processes that sustain the rich biodiversity. It is also ignores the potential impact of climate change on ecosystem processes and biodiversity in the region. 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 will exacerbate the potential impacts of warming, precipitation changes, phenological shifts and increase of extreme events on the flora and fauna of the region.

SECTION 3: REVIEW OF FLORA

Despite limited long-term botanical research in Arunachal Pradesh, the state is known to host an outstanding floral diversity (Rao and 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 and Borah, 2015; Gogoi and Borah, 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 and Borah, 2013; Bruggeman, 2016).
3. *Sapria himalayana*, called 'a floral wonder', has also been recorded from Dibang Valley (Hohl and 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 a significant underestimate based on the findings of previous studies (e.g. Liden and Adhikari, 2019) that have reported numerous new records for India from the high elevation areas of Dibang Valley, postulating that a similar number of new reports are expected from mid-to-low elevation areas. In particular, the tree diversity estimate mentioned in the Report seems low when compared to tropical and subtropical forests from other studies in neighbouring areas within the state (Borah and Garkoti, 2011; Dutta and Devi, 2013a,b; Sarkar and Devi, 2014; Sarma and Borah, 2014; Borah et al., 2016; Saikia and Khan, 2016; Bora and 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 urgently be re-examined (if 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 is 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 for the ZoI's. All of the recorded orchids are extremely 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 and 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). This is difficult to believe as 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 and Rawat, 2008) and 55 species within the Dihang Dibang Biosphere Reserve (Ghosh et al., 2014).

SECTION 4: REVIEW OF ENTOMOFAUNA

Recent reports of decline in insect populations worldwide are alarming (Hallmann et al., 2017; Leather 2018; Sánchez-Bayo and Wyckhuys, 2019), not least because insects provide crucial pollination services. Further, 73% of the world's cultivated crops are pollinated by honeybees (Raj et al., 2012). Arunachal Pradesh supports a rich diversity of bees with about 49 species recorded to date in limited surveys. These include the family Megachilidae, genus Ceratina and 13 other bee species which were recently recorded for the first time (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 (Fox 2013; 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, and their larvae are mostly plant herbivores. Finally, due to a paucity of long-term 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

Dibang Valley is believed to have more than 500 species of butterflies. Many subspecies of butterflies occurring in S.E. Tibet and Yunnan also occur up to Dibang Valley (for example, the nominotypical subspecies of Chocolate Tiger *Danaus melaneus* butterfly is distributed in S.E. 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 in 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 I for an updated butterfly checklist for Dibang Valley). All of these species, including endemics such as *Callerebia dibangensis*, occur in the elevational 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 of (159 species of butterflies, 11 species of odonates and 51 species of moths) is low and may not be a true representation of the study area's species richness. There are many threatened and endemic entomofauna even in the ZoI that have not been reported. Further, many species mentioned in the Report have been erroneously assigned to different taxonomic categories. Despite this, recording 200+ species of entomofauna within a limited sampling period and effort underscores the immense evolutionary and ecological wealth of this area. Our specific comments are as follows:

- **Butterflies**: 354 species of butterflies have been reported from Dibang Valley in the last 10 years (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. The Report poorly studies these key taxa identifying up to family level only. Further, each family is considered a different taxon (Tables 5.48 and 5.49). This is a gross underrepresentation of the actual diversity as each family contains several species. Using these family-level as opposed to species-level data, the richness of EPT taxa (Ephemeroptera, Plecoptera, Tricoptera) has been plotted in Figures 5.1 and 5.2, erroneously obtaining a very low number of 7-8 in all sites. This is misleading and an inaccurate representation of actual species richness at these sites.
- **Odonata:** The Report states that eleven odonate species occur in the ZoI's riparian habitat. This is a shockingly low number given that other studies, even from urban areas have reported many more species. More than 60 species are expected to be found in the Etalin area with adequate sampling and correct identification (Arajush Payra 2020 pers. comm.). The Report records only two damselflies, which is a serious 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 and Payra 2019), does not make it into the Report as well. As for dragonflies, eight families are known to occur in India, all of which are found in Arunachal Pradesh as well (Subramanian and Babu, 2017). However, only the most common family Libellulidae is reported. The dragonfly family Gomphidae and damselfly family Lestidae are incorrectly reported with benthic invertebrates (Page 123-124) and not with the odonates species list (Page 255).
- **Moths:** The report's account of 51 moth species is an extremely low number for this group. Around 10,000 species of moths occur in India and the Etalin area is likely to have up to 600-700 species. In other similar habitats, such as in Eaglenest and Talle Valley wildlife sanctuaries (WLS), the list of identified moth species exceeds 400 (Sanjay Sondhi, pers. comm, 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 Tale Valley WLS. It remains the only known location in the world that this species is known from. Similar moth diversity is expected from the project site.

The Report has entirely 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, has not been assessed.

The review of secondary literature is rather inadequate and important references have been left out. Some notable published omissions include several populations of range-restricted butterflies such as the False Tibetan Cupid *Tongeia pseudozuthus* (Huang, 2001), known to occur between Hunli-Anini; Tibetan Brimstone *Gonepteryx amintha thibetana* reported from Dri valley and Mayodia-Anini road (Sondhi and Roy, 2013; Das and Gogoi 2020 pers. comm.); and the Blue Posy *Drupadia scaeva cyara,* which was recorded 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. 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 any mitigation for any other entomofaunal groups that were assessed and will be affected.

Additional errors in entomofauna sections

There were also several errors in the report, 12 species of butterflies mentioned in the checklist are not distributed in Northeast India at all. Most of these species either occur in the Western Himalayas or Peninsular India. Some other species in the checklist are doubtful as their presence in Arunachal Pradesh is unlikely and has not been confirmed. Further, the butterfly checklist has numerous errors in assigning correct family names, while one species has been repeated twice with different generic combinations. If the researchers had consulted existing literature, a more accurate account could have emerged. 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'*. 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 Northeast India at all. Most are distributed in the Western Himalayas 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 Threering
7. *Ypthima sakra sakra* (Moore, 1857) Himalayan Fivering (*parasakra* occurs in NE India)
8. *Dodona durga durga* (Kollar,1844) Common Punch
9. *Papilio crino* (Fabricius, 1793) Common Banded Peacock
10. *Pareronia hippia* (Fabricius), 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
- The following species are wrongly placed under Family Papilionidae; they should be under Family Pieridae
    1. *Appias lalage lalage* (Doubleday, 1842) Spot Puffin
    2. *Colias fieldii fieldii* (*M*enetries, 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 Family Pieridae; they should be under 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 Family Nymphalidae; they should be under 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 and Babu, 2017).
    1. *Calicnemia miniata* (Selys, 1886)

    2. *Calicnemia* sp. 2

In conclusion, the Report appears to consider the importance of butterflies (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, and are vital for eco-tourism and have existence value.

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; Gurumayum et al. 2016). Of these, 32 species are endemic to the state (Gurumayum et al. 2016). 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.

Underreporting fish species from Dibang Valley

In the Dibang River basin, Darshan et al. (2019) recorded 32 species, many of which were documented within the past 10 years, suggesting the potential of new discoveries from this species-rich region. However, the Report records only 12 species from the ZoI (including both Dri and Talõ basins) suggesting poor sampling. While the Report does plot the species accumulation curve for fish, the curve does not plateau indicating several undiscovered species in unsampled stream orders. Ichthyofaunal studies in Dibang Valley have been limited and only recently have researchers started to document the species for this region (see Appendix II for a list of 8 new species that have been described from this region within the last 10 years).

Dibang Valley harbours many endemic species, especially the highly sensitive, stenotopic Glyptoternoids like *Exostoma*, *Creteuchiloglanis*, *Parachiloglanis*, *Pseudolaguvia* and *Pseudocheineis*, but the Report 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 they might have high regional importance. However, the fact is left out that the extent of the current knowledge of these species' ecology and conservation status is very limited making it difficult to make definitive assessments.

Threats to aquatic fauna underassessed

The Etalin HEP poses serious threats to the aquatic fauna of these high-altitude rivers which have not yet been adequately explored. The threats to migratory fish such as *Schizothorax* and *Tor* sp remain uncertain as there is inadequate knowledge on their migratory ranges. The location of the HEP at an altitude of 700 m is favourable for many "Intermediate Forms" of hill stream fishes including *Schizothorax*, some *Garra*, *Tor*, *Bangana*, *Neolissochilus*. These are potential "Cold Water Fishes" that migrate downstream to mid-to-low altitudes during winter. No mitigation plans are recommended to allow for the upstream to downstream movement of these fish species through species-specific fish ladders which should be based on a thorough study of species biology.

Fishing through traditional traps has also been 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 that areas upstream and downstream of the dams that will be severely altered due to storage of sediments. Once the sediments are trapped, the river downstream will turn sediment hungry, eroding the banks' riverine areas and removing spawning gravels used by fish (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 activities (Page 15). In addition:

- The mitigation plans recommend that critical minimum flows (e-flows) should be maintained in all the streams and the main river. However, they fail to detail the methodology to estimate the same (at different time of a year) for streams/rivers of different sizes and the fact that hydrological monitoring is crucial for deriving e-flows for different aquatic biota.

- 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"*. 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 (Page 200).
- The compound effects of ongoing landslides and excessive dumping of debris directly into the rivers due to highway construction that have already compromised stream health and productivity of other aquatic habitats, should be explicitly accounted for (Sassa and Canuti, 2009).
- The impact of the project on long-term sediment dynamics downstream are not addressed although short term effects of increased sedimentation during construction and immediate post-construction phase are addressed to some extent.
- The impact of altered flow and sediment regimes on riparian vegetation are not addressed.

SECTION 6: REVIEW OF AVIFAUNA

Even within Arunachal Pradesh (which has the second highest number of bird species globally), Dibang Valley is special for its birds. Four hundred and thirty-four species have been reported from Dibang Valley (see Appendix III for a checklist of birds of Dibang Valley). The Black-headed Greenfinch (*Chloris ambigua*) and Elliot's Laughingthrush (*Trochalopteron elliotii*) are recent new records for India and the Rusty-throated Wren-Babbler (*Spelaeornis badeigularis*) is a highly range-restricted and threatened species that was rediscovered from the area in 2004 after almost 60 years. The species is endemic to the region and found nowhere else in the world.

In addition, Arunachal Pradesh, including the Dibang Valley, has the highest richness of riverine birds on Earth. These species are entirely dependent on rivers and riverbank habitat of the Dibang and its tributaries. These discoveries and rediscoveries underscore that even relatively well-known faunal groups such as birds are poorly studied in Dibang Valley. While we found atleast two identification errors in the photographs (Rosy Pipit has been wrongly identified as Olive-backed Pipit and Yellow-bellied Fairy Fantail, a common bird in this area, has been wrongly identified as the Yellow-throated Fulvetta), our major comments are as follows:

Missing the elevational migrants

The Report studied the birdlife along the Talõ and Dri rivers using point counts and line transects during February to May 2018. While the objective was to conduct a multi-season study, the actual field work

(February-May 2018) was done in a single season and is a relatively short time to assess birdlife of any Himalayan region, especially the species-rich Dibang Valley. First, most species in Arunachal Pradesh are elevational migrants, breeding at higher elevations and spending the winter lower down. Therefore, a study restricted to four months cannot provide a complete picture of the region's birdlife. Second, the Eastern Himalayan bird community is exceptionally diverse, and requires identification by both sight and sound. Over such a limited sampling period, it is likely that a significant proportion of species might not have been recorded by the study.

Underestimation of species, abundance and threatened species

The Report of 230 species from the study area is likely to be an underestimate, because of the lack of a multi-season study (as outlined above), and species present were not recorded during the survey because of poor detectability. The Report specifically outlines 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 did not incorporate a formal statistical technique that could potentially account for the number of species "missed". There are likely to be threatened species such as the Blyth's Tragopan and Beautiful Nuthatch in the area. Further surveys are required to systematically determine their presence in the landscape. No species accumulation curve given to show whether sampling was adequate.

On one hand the Report outlines that detectability was poor due to dense vegetation, yet goes ahead and classifies abundance of all birds that were recorded as very low or low. While the team has used point counts and line transects for the surveys, the number of repeats carried out have not been explicitly mentioned. The low abundances for birds inferred in the Report may be an artefact of low detection probability. Given low detection probability of species, abundance cannot be inferred without statistically accounting for the detection probability.

Contradictions and inadequate mitigation plans

The Report makes numerous statements that highlight high bird species richness and diversity of the region. One striking and key 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 several times in The Report. Despite their own findings of the importance of biodiversity (in this case, birds), they suggest mitigation/conservation plans that clearly will not address the loss of these natural habitats and the direct impacts on bird populations. For instance, there are no mitigation measures suggested for the loss of habitat for riverine birds.

They also make contradictory assertions – where they admit that it is not possible to suggest any threatened and habitat specific conservation plans (which is true), and then subsequently suggest "*Habitat Rehabilitation and Restoration Plans*" that would purportedly enhance the overall habitat quality and benefit species of conservation significance.

Other limitations of habitat and species-specific plans

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

Cavity-nesting birds cannot just make do with some artificial nesting habitat, they need food, foraging areas and habitat to survive and breed. If the habitat (with nearly 2.8 lakh trees and other vegetation, associated features) 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 the population of birds. This cannot be compensated by only installing some nest boxes in adjacent areas.

The suggestion to augment only one type of breeding habitat (for cavity-nesting birds) by introducing nest boxes is an ecologically flawed idea as it may affect the population dynamics of other birds (assuming it is implemented and succeeds). There is no understanding of the abundances/population dynamics of birds in that area and no information on the existing availability of breeding habitat for cavity-nesting or other birds.

The 32 cavity-nesting species listed in the Report range from diurnal/nocturnal species, with diverse diet/foraging strategies and a range of body sizes. The birds range from tits, nuthatches, woodpeckers, barbets, to trogons and hornbills and raptors such as kestrels, hobby/owls. The design and placement of nest boxes for any particular species would require a much greater ecological understanding of the needs/requirements of specific species than one simple design based on differing entrance hole sizes catering to all species. The internal dimensions and specifications inside the nest box will also vary between different cavity-nesting species based on body size and other criteria.

The Report recommends that initially 400 such nest boxes should be set up in 2 locations (200 each) in forest patches around the staff colony and office premises. This proposal seems to be suggestive of an experimental framework and cannot be considered a mitigation strategy.

However, in other places, it is also suggested as a mitigatory measure with the idea that this would help cavity-nesting birds. This is misleading and incorrect. Till date, there is no successful project that shows the use and efficacy of nest boxes for hole-nesting bird species in India. In India, it has been tried for a handful of bird species in urban areas and in a few places for some hornbill species where years of ecological research have shown 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 couple of sites where it has needed careful and dedicated long-term engagement. In the case of hornbills or other large hole-nesting birds, installation and design of nest boxes is not an easy task, it requires multiple skills and equipment. In addition, nest boxes made of wood (as cursorily shown in the report) are also not at all ideal in places like Arunachal with high humidity and rainfall, where the boxes will rot after the first two years. Nest boxes often take a long time to be accepted and used by birds.

Many Environmental Management Plans of proposed hydel projects make this generic recommendation of installing nest boxes as a somewhat easy quick fix solution to compensate for the loss of birds/habitat. It would be very instructive to know of even a single example where this recommendation has been implemented in India in any project as a mitigatory measure.

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. Overall, flawed methodologies have been adopted to create an inadequate and incomplete assessment of the area's mammals and the HEP's impacts on them. In compiling data on mammals, the Report ignored key published checklists from the region (e.g. ZSI, 2006; 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 IV for an complete 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 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) is endemic to the Dibang River basin (Krishna et al., 2016). 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 responds to the Objective (a) (Page 28) "covering multiple seasons". Firstly, a period of 20-30 days appears inadequate to sample a range of species, many of which are wide-ranging (Wearn and Glover-Kapfer, 2017). Secondly, 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, wild dog, and clouded leopard. Finally, mammals are known to change their distribution patterns based on resource availability in response to seasonal and altitudinal variation. Many mammals in Dibang Valley including Mishmi takin, red goral undertake altitudinal migrations (Choudhury 2008). Short survey durations restricted to specific seasons are sure to underestimate mammal presence.

The description provided under 'Random sampling' (Page 48) does not correspond to any acceptable ecological 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 species such as large carnivores that may avoid human settlements (Schuette et al., 2013).

The Report claims to have conducted camera trap surveys in 53 sq. km of the 112 sq. km 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. rodents and small carnivores) or are more likely to visit

exposed riverbeds (such as otters and 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 53 sq. km 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.

A short survey duration coupled with non-representative sampling that unequally distributed sampling effort within a relatively small area (53 sq. km) render this study's findings on the study area's mammalian diversity inadequate. Yet, despite these serious methodological flaws, the Report **recorded 21 species of mammals, including the Critically Endangered Chinese Pangolin, 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 and Glover-Kapfer, 2017). Consequently, richness and abundance analyses reported here (Page 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 (i.e., assigning the same weightage to captures of rare species with large home ranges, such as Asiatic wild dog and Asiatic black bear, and those with smaller home ranges, such as Himalayan palm civet and yellow-throated marten) when comparing species capture frequencies against one another. Meaningful comparisons in abundance across species cannot be made without accounting for inter-species variation (Sollman 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 serious issues with data collection and analysis outlined above. Relative abundance index (RAI) is a poor estimator of abundance if species, survey and camera trap unit-species factors are not factored in (Sollman 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 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 10 km 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. Species such as Mishmi takin, red goral and Himalayan black bear are known to seasonally migrate between elevations, spending summers in higher altitudes and descending to lower elevation during winters (Choudhury 2008). Additionally, an aerial distance of 10 km 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, even by WII's own scientists (Nijhawan, 2018; Adhikharimayum and Gopi, 2018).

Table 5.45 fails to mention the Chinese pangolin as Schedule I (Part I) species while Asiatic wild dog, smooth-coated otter and Himalayan black bear are included in Schedule II of the IWPA, meaning that these species are legally protected by provisions of the act. Additionally, 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) and Dampa Tiger Reserves (Singh and 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 serious 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.

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). 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 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 WL sanctuaries – without providing any explanation of how only these were deemed 'sensitive' and the community forests were not. This directly contradicts a previous long-term study in Dibang Valley that showed that many community forests 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 10 km 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 10 km 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 10 km 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 and Gopi, 2018) that found camera trap evidence of tigers within 10 km radius of the HEP site, if indeed the "10 km 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 herpetofauna (Aguilar et al., 2013; Hocking and 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 95 species of herpetofauna have been reported from the Dibang river basin, including 48 amphibian, 12 lizard, and 34 snake species. (Borah and Bordoloi, 2004; Athreya and Sheth, 2016; Roy et al., 2018; Ohler et al., 2018). Several species that are found in neighbouring Myanmar and China are also found here (e.g., *Rhacophorus translineatus* and *Trimeresurus medoensis*). Recent studies in the Western Ghats have used molecular approaches to show that many species previously thought to be widespread across these mountains' complex topography may in fact be entirely distinct species (Garg et al. 2017). This is extremely likely to be the case with herpetofauna in Dibang Valley 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). Here, scientists have recently identified 23 amphibian genera and 36 reptile genera A comparison with herpetofaunal data from across Northeastern India, and West-

Central Arunachal in particular, has indicated that these recently reported species from Dibang Valley, many of which are yet to formally be described, could be new to science. These include, but are not limited to, species within the following genera: *Amolops, Bufo, Cyrtodactylus, Duttaphrynus, Ingerana, Kurixalus, Microhyla, Nasutixalus, Oreolalax, Philautus, Rhacophorus, Scutiger, Theloderma, and Xenophrys*.

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 (95) reported in all previous studies in Dibang Valley conducted in habitats and elevation gradients comparable to that of the ZoI (Borah and Bordoloi 2004; Athreya and Sheth 2016; Roy et al. 2018; Ohler et al. 2018). Shockingly, the Report fails to record a *Bufo* species (an Indo-chinese toad), locally called '*Pahu*', which is extremely abundant in Dibang Valley even during the season when the fieldwork was conducted. Furthermore, the Report includes the following species in its checklist: *Feihyhyla vittatus, Occidozyga borealis, Clinotarsus alticola, Polypedates teraiensis.* This is highly suspicious because not only are these species strict monsoon-breeders, which would make it very difficult to encounter them during the non-monsoon fieldwork, but also because none of the other multi-year extensive surveys mentioned above have been able to confirm their presence in Dibang Valley. These and many more discrepancies are a result of very limited sampling in the non-breeding season which has led to an overall underestimation of the study area's herpetofaunal diversity. These are discussed in detail below:

- The fieldwork was conducted between February and May/June, that is, before the monsoon season. This is the incorrect season for herpetofaunal surveys in the region as a large majority of the Dibang Valley's herpetofauna breed during the monsoon, and are consequently most active during this period, increasing the probability of detection (Ahmed et al., 2009; Sarkar and Ray, 2010). In direct comparison, Roy et al. (2018) reported 41 species of amphibians from field surveys conducted across all seasons, including monsoon, over three consecutive years covering 24 km 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 types of habitat spread over a larger elevation range (200-3500m). The Report does not refer to this ground-breaking, comprehensive and 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 and 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 38 km 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 mere 37.5% of the 112 km^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 are severely under-sampled based on comparisons with studies in Dibang Valley and other parts of Arunachal Pradesh (Pawar and Birand 2001; Tesia and Bordoloi 2013; 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 sizeable population of Keeled box turtle *Cuora mouhotii* (IUCN Endangered), locally called 'Ichimbo', was recorded from forest patches between 200-1000m elevation range forest patches downstream of the project site (Ahmed and 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 and Roy, 2016). Due to large-scale habitat change, this little-studied, extremely rare turtle may be pushed towards local extinction.

Even with the above-mentioned biases in sampling methodology, incorrect sampling season and inadequate survey locations and distances, **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 herpetofaunal species remain data deficient according to the IUCN's Redlist 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. 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 and 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 sociological 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 8004 (Page 34). While the 2011 Census does not specify the Idu Mishmi population of the district, it clearly mentions that 71.23% (5701) of the total population is Scheduled Tribe (ST). Since the Idu Mishmi is the primary ST in Dibang Valley, a large majority of the 5701 STs are likely to be Idu.
- **Flawed understanding of local livelihoods:** In various places, the Report claims that "about 38.2% of PAFs [Project affected families] 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 the other 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 social science 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; Singh et al., 2018).

- **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 and 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 tribe 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 practising 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 500 kg 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 Northeast 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 *reh*, 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; Jamir and Khare, 2018). 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 8004. 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 apparently 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 completely 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 mitigatory 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?

- **Romanticised notions of livelihood transitions:** The Report lists various proposed activities (job opportunities, creating supplementary income generating sources, health care, improved education) as part of their Corporate Social Responsibility (Page 202; Section 7.7.2). They state that since providing jobs to members of all affected families is not possible, they will be supporting various income generating programmes to reduce the local dependency on natural resources. Some of the jobs listed and described as 'decent' are welder, fitter, plumber, electrician etc. 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 it has negative impacts on employment rate, income level, income resource, and overall well-being of people (Nusser, 2003; Baran and Myschowoda, 2009; Richter et al., 2010; Zou, 2011; Huang et al., 2018). Sudden restrictions on access to natural resources can have negative consequences and natural resources and subsistence agriculture can act as safety nets during transition periods, particularly for the most vulnerable sections of the society (Kura et al., 2017).

CONCLUSION

At the outset, it is important to highlight that the FAC (2017) does an apt 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 Himalayas. Moreover, several groups of taxa were not surveyed, including numerous insect orders such as Diptera, Orthoptera, and arthropod species such as scorpions, and pseudoscorpions, and other taxa such as crustaceans, molluscs, and protozoans. 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 consistently 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 serious 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, underestimated 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 4 months (for all taxa, and socio-cultural impact, despite the FAC mandate for a multi-season replicated study), the Report still makes it evident that Dibang Valley is exceptionally rich in biodiversity as every grid cell that was sampled, contained at least one RET/endemic species. It is then shocking 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. All this without adequately evaluating or discussing the nature of impacts on specific groups, in particular, the Critically Endangered, Endangered, Vulnerable, range-restricted and endemics species that were recorded by the Report in the ZoI.

Data from several research studies show that the landscape is highly diverse. 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 serious 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 as well-designed ecologically meaningful measures.

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 and accounting for durability given harshness of weather). It is regrettable that given the unique and extreme importance of the landscape to regional and global biodiversity, the study does not even attempt to outline relevant and viable mitigation measures and extent of damage to wildlife habitats, ecosystem services, and the local people. For instance, no mitigatory measures are provided for the loss of habitat for 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 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. Such decisions have irreversible impacts on lives, livelihoods and the environment.

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APPENDIX I: CHECKLIST OF BUTTERFLIES OF DIBANG VALLEY (Gogoi 2020 unpublished data)

Sl no.	Family	Common name	Scientific name
1	Papilionidae	Common Rose	*Pachliopta aristolochiae aristolochiae*
2	Papilionidae	Common Birdwing	*Troides helena cerberus*
3	Papilionidae	Golden Birdwing	*Troides aeacus aeacus*
4	Papilionidae	Common Batwing	*Atrophaneura varuna astorion*
5	Papilionidae	Lesser Batwing	*Atrophaneura aidoneus*
6	Papilionidae	De Nicéville's Windmill	*Byasa polla*
7	Papilionidae	Common Windmill	*Byasa polyeuctes polyeuctes*
8	Papilionidae	Great Windmill	*Byasa dasarada dasarada*
9	Papilionidae	Tawny Mime	*Papilio agestor agestor*
10	Papilionidae	Lesser Mime	*Papilio epycides epycides*
11	Papilionidae	Common Mime	*Papilio clytia clytia*
12	Papilionidae	Common Mormon	*Papilio polytes romulus*
13	Papilionidae	Lime Butterfly	*Papilio demoleus demoleus*
14	Papilionidae	Common Raven	*Papilio castor castor*
15	Papilionidae	Red Helen	*Papilio helenus helenus*
16	Papilionidae	Yellow Helen	*Papilio nephelus chaon*
17	Papilionidae	Great Mormon	*Papilio memnon agenor*
18	Papilionidae	Spangle	*Papilio protenor euprotenor*
19	Papilionidae	Redbreast	*Papilio alcmenor alcmenor*
20	Papilionidae	Common Peacock	*Papilio polyctor ganesa*
21	Papilionidae	Paris Peacock	*Papilio paris paris*
22	Papilionidae	Krishna Peacock	*Papilio krishna*
23	Papilionidae	Blue Peacock	*Papilio arcturus*
24	Papilionidae	Fivebar Swordtail	*Graphium antiphates pompilius*
25	Papilionidae	Fourbar Swordtail	*Graphium agetes agetes*
26	Papilionidae	Common Jay	*Graphium doson axion*
27	Papilionidae	Lesser Jay	*Graphium evemon albociliatis*
28	Papilionidae	Veined Jay	*Graphium chironides chironides*
29	Papilionidae	Tailed Jay	*Graphium agamemnon agamemnon*
30	Papilionidae	Common Bluebottle	*Graphium sarpedon sarpedon*
31	Papilionidae	Great Zebra	*Graphium xenocles xenocles*
32	Papilionidae	White Dragontail	*Lamproptera curius curius*
33	Papilionidae	Green Dragontail	*Lamproptera meges indistincta*
34	Papilionidae	Brown Gorgon	*Meandrusa lachinus lachinus*
35	Papilionidae	Yellow Gorgon	*Meandrusa payeni evan*
36	Pieridae	One-Spot Grass Yellow	*Eurema andersoni andersoni*
37	Pieridae	Three-Spot Grass Yellow	*Eurema blanda silhetana*
38	Pieridae	Small Grass Yellow	*Eurema brigitta rubella*
39	Pieridae	Common Grass Yellow	*Eurema hecabe hecabe*
40	Pieridae	Tree Yellow	*Gandaca harina assamica*
41	Pieridae	Tibetan Brimstone	*Gonepteryx amintha thibetana*
42	Pieridae	Tailed Sulphur	*Dercas verhuelli doubledayi*

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

89	Lycaenidae	Slate Flash	*Rapala manea schistacea*
90	-	Copper Flash	*Rapala pheritima*
91	Lycaenidae	-	*Euaspa pavo*
92	Lycaenidae	-	*Ahlbergia sp*
93	Lycaenidae	Common Tinsel	*Catapoecilma elegans*
94	Lycaenidae	Evans Silverline	*Spindasis evansii*
95	Lycaenidae	Khaki Silverline	*Spindasis rukmini*
96	Lycaenidae	Long-banded Silverline	*Spindasis lohita himalayanus*
97	Lycaenidae	Chinese Silverline	*Spindasis zhengweilie*
98	Lycaenidae	Purple Sapphire	*Heliophorus epicles*
99	Lycaenidae	Green Sapphire	*Heliophorus moorei*
100	Lycaenidae	Golden Sapphire	*Heliophorus brahma major*
101	Lycaenidae	Common Ciliate Blue	*Anthene emolus emolus*
102	Lycaenidae	Pointed Cilate Blue	*Anthene lycaenina lycaenina*
103	Lycaenidae	Zebra Blue	*Leptotes plinius plinius*
104	Lycaenidae	Large-4-Lineblue	*Nacaduba pactolus continentalis*
105	Lycaenidae	Pale-4-Lineblue	*Nacaduba hermus nabo*
106	Lycaenidae	Transparent 6-Lineblue	*Nacaduba kurava euplea*
107	Lycaenidae	Banded Lineblue	*Prosotas aluta coelestis*
108	Lycaenidae	Common Lineblue	*Prosotas nora nora*
109	Lycaenidae	Pointed Lineblue	*Lonolyce helicon merguiana*
110	Lycaenidae	Dingy Lineblue	*Petrelaea dana*
111	Lycaenidae	Common Cerulean	*Jamides celeno celeno*
112	Lycaenidae	Dark Cerulean	*Jamides bochus bochus*
113	Lycaenidae	Glistening Cerulean	*Jamides elpis pseudelpis*
114	Lycaenidae	Metallic Cerulean	*Jamides alecto eurysaces*
115	Lycaenidae	Forget-me-not	*Catochrysops strabo srrabo*
116	Lycaenidae	Peablue	*Lampides boeticus*
117	Lycaenidae	Pale Spark	*Sinthusa virga*
118	Lycaenidae	Dark Grass Blue	*Zizeeria karsandra*
119	Lycaenidae	Pale Grass Blue	*Pseudozizeeria maha maha*
120	Lycaenidae	Eastern Grass Jewel	*Freyeria putli*
121	Lycaenidae	Lesser Grass Blue	*Zizina otis otis*
122	Lycaenidae	Malayan	*Megisba malaya*
123	Lycaenidae	Common Hedge Blue	*Acytolepis puspa gisca*
124	Lycaenidae	Pale Hedge Blue	*Udara cardia dilecta*
125	Lycaenidae	Albocerulean	*Udara albocaerulea*
126	Lycaenidae	Plain Hedge Blue	*Celastrina lavendularis limbata*
127	Lycaenidae	Hill Hedge Blue	*Celastrina argiolus sikkima*
128	Lycaenidae	White banded Hedgeblue	*Lycaenopsis transpectus*
129	Lycaenidae	Margined Hedgeblue	*Celatoxia marginata*
130	Lycaenidae	Large Hedge Blue	*Celastrina huegelii oreana*
131	Lycaenidae	Moore's Cupid	*Shijimia moorei*
132	Lycaenidae	False Tibetan Cupid	*Tongeia pseudozuthus*
133	Lycaenidae	Lime Blue	*Chilades laius laius*
134	Lycaenidae	Blue Posy	*Drupadia scaeva*

135	Riodinidae	Dark Judy	*Abisara fylla*
136	Riodinidae	Punchinello	*Zemeros flegyas indicus*
137	Riodinidae	Mixed Punch	*Doona ouida*
138	Riodinidae	Lesser Punch	*Dodona dipoea*
139	Riodinidae	Tailed Punch	*Dodona eugens*
140	Riodinidae	Striped Punch	*Dodonia adonira naga*
141	Nymphalidae	Club Beak	*Libythea myrrha sanguinalis*
142	Nymphalidae	Common Beak	*Libythea lepita lepita*
143	Nymphalidae	Striped Tiger	*Danaus genutia*
144	Nymphalidae	Blue Tiger	*Tirumala limniace mutina*
145	Nymphalidae	Dark Blue Tiger	*Tirumala septentrionis*
146	Nymphalidae	Glassy Tiger	*Parantica aglea melanoides*
147	Nymphalidae	Chestnut Tiger	*Parantica sita*
148	Nymphalidae	Chocolate Tiger	*Parantica melaneus plateniston*
149	Nymphalidae	Striped Blue Crow	*Euploea mulciber mulciber*
150	Nymphalidae	Long-branded Blue Crow	*Euploea algea deione*
151	Nymphalidae	Magpie Crow	*Euploea radamanthus radamanthus*
152	Nymphalidae	Common Nawab	*Polyura athamas athamas*
153	Nymphalidae	Great Nawab	*Polyura eudamippus eudamippus*
154	Nymphalidae	Pallid Nawab	*Polyura arja arja*
155	Nymphalidae	Stately Nawab	*Polyura dolon*
156	Nymphalidae	Tawny Rajah	*Charaxes bernardus hierax*
157	Nymphalidae	Scarce Tawny Rajah	*Charaxes aristogiton*
158	Nymphalidae	Variegated Rajah	*Charaxes kahruba*
159	Nymphalidae	Yellow Rajah	*Charaxes marmax marmax*
160	Nymphalidae	Jungle Glory	*Thaumantis diores diores*
161	Nymphalidae	Common Faun	*Faunis canens*
162	Nymphalidae	Common Duffer	*Discophora sondaica*
163	Nymphalidae	Common Evening Brown	*Melanitis leda*
164	Nymphalidae	Bamboo Treebrown	*Lethe europa niladana*
165	Nymphalidae	Common Red Forester	*Lethe mekara zuchara*
166	Nymphalidae	Angled Red Forester	*Lethe chandica flanona*
167	Nymphalidae	Tailed Red Forester	*Lethe sinorix*
168	Nymphalidae	Blue Forester	*Lethe scanda*
169	Nymphalidae	Common Forester	*Lethe insana*
170	Nymphalidae	Dull Forester	*Lethe gulnihal*
171	Nymphalidae	Brown Forester	*Lethe serbonis*
172	Nymphalidae	Common Woodbrown	*Lethe sidonis sidonis*
173	Nymphalidae	Barred Woodbrown	*Lethe maitrya*
174	Nymphalidae	Yellow Woodbrown	*Lethe nicetas*
175	Nymphalidae	Moeller's Silverfork	*Lethe moelleri*
176	Nymphalidae	Small Goldenfork	*Lethe atkinsonia*
177	Nymphalidae	Large Goldenfork	*Lethe goalpara*
178	Nymphalidae	Single Silverstripe	*Lethe ramadeva*
179	Nymphalidae	Lilacfork	*Lethe sura*
180	Nymphalidae	Scarce Labyrinth	*Neope pulahina*

181	Nymphalidae	Dusky Labyrinth	*Neope yama*
182	Nymphalidae	Veined Labyrinth	*Neope pulaha*
183	Nymphalidae	Chumbi Wall	*Chonala masoni*
184	Nymphalidae	Large Tawny Wall	*Rhapicera satricus*
185	Nymphalidae	Dusky Diadem	*Ethope himachala*
186	Nymphalidae	Yellow Owl	*Neorina hilda*
187	Nymphalidae	Yellow Kaiser	*Penthema lisarda lisarda*
188	Nymphalidae	Common Palmfly	*Elymnias hypermenestra undularis*
189	Nymphalidae	Spotted Palmfly	*Elymnias malelas malelas*
190	Nymphalidae	Whitebar Bushbrown	*Mycalesis anaxias*
191	Nymphalidae	Watson’s Bushbrown	*Mycalesis adamsoni*
192	Nymphalidae	Plain Busbrown	*Mycalesis malsarida*
193	Nymphalidae	Common Bushbrown	*Mycalesis perseus blasius*
194	Nymphalidae	Dark-brand Bushbrown	*Mycalesis mineus mineus*
195	Nymphalidae	Long-brand Bushbrown	*Mycalesis visala visala*
196	Nymphalidae	Salmon-branded Bushbrown	*Mycalesis misenus misenus*
197	Nymphalidae	Bright-eye Bushbrown	*Mycalesis nicotia*
198	Nymphalidae	Nigger	*Orsotrioena medus medus*
199	Nymphalidae	Striped Ringlet	*Ragadia crisilda crisilda*
200	Nymphalidae	Dark Catseye	*Zipoetis scylax*
201	Nymphalidae	Mottled Argus	*Hemadara narasingha*
202	Nymphalidae	Himalayan Fivering	*Ypthima parasakra*
203	Nymphalidae	Large Threering	*Ypthima newara?*
204	Nymphalidae	Common Fiverring	*Ypthima baldus baldus*
205	Nymphalidae	Ring sp.	*Ypthima sp.*
206	Nymphalidae	Roy's Argus	*Callerebia dibangensis*
207	Nymphalidae	Pallid Argus	*Callerebia scanda*
208	Nymphalidae	Argus sp	*Callerebia sp.*
209	Nymphalidae	Doherty's Satyr	*Aulocera loha*
210	Nymphalidae	Yellow Coster	*Acraea issoria issoria*
211	Nymphalidae	Tawny Coster	*Acraea violae*
212	Nymphalidae	Red Lacewing	*Cethosia biblis tisamena*
213	Nymphalidae	Leopard Lacewing	*Cethosia cyane cyane*
214	Nymphalidae	Indian Fritillary	*Argynnis hyperbius hyperbius*
215	Nymphalidae	Yellow Dryad	*Aemona amathusia*
216	Nymphalidae	Cruiser	*Vindula erota erota*
217	Nymphalidae	Common Yeoman	*Cirrochroa tyche mithila*
218	Nymphalidae	Large Yeoman	*Cirrochroa aoris aoris*
219	Nymphalidae	Rustic	*Cupha erymanthis lotis*
220	Nymphalidae	Vagrant	*Vagrans egista sinha*
221	Nymphalidae	Common Leopard	*Phalanta phalantha phalantha*
222	Nymphalidae	Green Commodore	*Sumalia daraxa daraxa*
223	Nymphalidae	Commodore	*Auzakia danava danava*
224	Nymphalidae	White Commodore	*Parasarpa dudu dudu*
225	Nymphalidae	Scarce White Commodore	*Limenitis zulema*
226	Nymphalidae	Grey Commodore	*Bhagadatta austenia*

227	Nymphalidae	Bicolour Commodore	*Parasarpa zayla*
228	Nymphalidae	Commander	*Moduza procris procris*
229	Nymphalidae	Studded Sergent	*Athyma asura asura*
230	Nymphalidae	Himalayan Sergent	*Athyma opalina orientalis*
231	Nymphalidae	Blackvein Sergent	*Athyma ranga ranga*
232	Nymphalidae	Staff Sergent	*Athyma selenophora selenophora*
233	Nymphalidae	Small Staff Sergent	*Athyma zeroca zeroca*
234	Nymphalidae	Orange Staff Sergent	*Athyma cama*
235	Nymphalidae	Common Lascar	*Pantoporia hordonia hordonia*
236	Nymphalidae	Perak Lascar	*Pantoporia peraka*
237	Nymphalidae	Great Yellow Sailer	*Neptis radha radha*
238	Nymphalidae	Yellow Sailer	*Neptis ananta ochracea*
239	Nymphalidae	Small Yellow Sailer	*Neptis miah miah*
240	Nymphalidae	Pale Hockeystick Sailer	*Neptis manasa manasa*
241	Nymphalidae	Common Sailer	*Neptis hylas astola*
242	Nymphalidae	Creamy Sailer	*Neptis soma soma*
243	Nymphalidae	Sullied Sailer	*Neptis clinia susruta*
244	Nymphalidae	Pallas Sailer	*Neptis sappho*
245	Nymphalidae	Broad-banded Sailer	*Neptis sankara amba*
246	Nymphalidae	Dingy Sailer	*Neptis pseudovikasi*
247	Nymphalidae	Plain Sailer	*Neptis cartica cartica*
248	Nymphalidae	Pale Green Sailer	*Neptis zaida*
249	Nymphalidae	Short-banded Sailer	*Phaedyma columella ophiana*
250	Nymphalidae	Common Baron	*Euthalia aconthea*
251	Nymphalidae	Blue Baron	*Euthalia telchinia*
252	Nymphalidae	Gaudy Baron	*Euthalia lubentina*
253	Nymphalidae	French Duke	*Euthalia franciae*
254	Nymphalidae	Grand Duchess	*Euthalia patala*
255	Nymphalidae	White edge Blue Baron	*Euthalia phemius*
256	Nymphalidae	Dark Archduke	*Lexias dirtea khasiana*
257	Nymphalidae	Bronze Duke	*Euthalia nara*
258	Nymphalidae	-	*Limenitis rileyi*
259	Nymphalidae	Common Map	*Cyrestis thyodamas thyodamas*
260	Nymphalidae	Common Maplet	*Chersonesia risa*
261	Nymphalidae	Tabby	*Pseudergolis wedah*
262	Nymphalidae	Constable	*Dichorrhagia nesimachus*
263	Nymphalidae	Popinjay	*Stibochiona nicea*
264	Nymphalidae	Angled Castor	*Ariadne ariadne pallidior*
265	Nymphalidae	Common Castor	*Ariadne merione tapestrina*
266	Nymphalidae	Sergeant Emperor	*Mimathyma chevana*
267	Nymphalidae	Indian Purple Emperor	*Mimathyma ambica*
268	Nymphalidae	Courtesan	*Euripus nyctelius*
269	Nymphalidae	Circe	*Hestinalis nama*
270	Nymphalidae	Eastern Courtier	*Sephisa chandra*
271	Nymphalidae	Common Jester	*Symbrenthia lilaea khasiana*
272	Nymphalidae	Spotted Jester	*Symbrenthia hypselis cotanda*

273	Nymphalidae	Indian Red Admiral	*Vanessa indica indica*
274	Nymphalidae	Painted Lady	*Vanessa cardui*
275	Nymphalidae	Blue Admiral	*Kaniska canace canace*
276	Nymphalidae	Black Prince	*Rohana parisatis*
277	Nymphalidae	Brown Prince	*Rohana parvata*
278	Nymphalidae	Chocolate Pansy	*Junonia iphita iphita*
279	Nymphalidae	Grey Pansy	*Junonia atlites*
280	Nymphalidae	Peacock Pansy	*Junonia almana almana*
281	Nymphalidae	Lemon Pansy	*Junonia lemonias lemonias*
282	Nymphalidae	Great Eggfly	*Hypolimnas bolina*
283	Nymphalidae	Orange Oakleaf	*Kallima inachus inachus*
284	Nymphalidae	Autumn Leaf	*Doleschallia bisaltide indica*
285	Nymphalidae	Panther	*Neurosigma doubledayi*
286	Nymphalidae	Abor Freak	*Callinaga aborica*
287	Nymphalidae	Tiger Brown	*Orinoma damaris*
288	Hesperiidae	Branded Orange Awlet	*Burara oedipodea aegina*
289	Hesperiidae	Orange Awlet	*Burara jaina vasundhara*
290	Hesperiidae	Small Green Awlet	*Burara amara*
291	Hesperiidae	Green Awlet	*Burara vasutana*
292	Hesperiidae	Pale Green Awlet	*Burara gomata gomata*
293	Hesperiidae	Slate Awl	*Hasora anura danda*
294	Hesperiidae	Common Awl	*Hasora badra badra*
295	Hesperiidae	Plain Banded Awl	*Hasora vita indica*
296	Hesperiidae	Common Banded Awl	*Hasora chromus*
297	Hesperiidae	White-banded Awl	*Hasora taminatus bhavara*
298	Hesperiidae	Brown Awl	*Badamia exclamationis*
299	Hesperiidae	Orange-tail Awl	*Bibasis sena sena*
300	Hesperiidae	Indian Awlking	*Choaspes benjaminii*
301	Hesperiidae	Common Spotted Flat	*Celaenorrhinus leucocera chinensis*
302	Hesperiidae	Dark Yellow-banded Flat	*Celaenorrhinus aurivittata aurivittata*
303	Hesperiidae	Himalayan White Flat	*Seseria dohertyi*
304	Hesperiidae	Fulvous Pied Flat	*Pseudocoladenia dan*
305	Hesperiidae	Hairy Angle	*Darpa hanria*
306	Hesperiidae	White Yellow-breast Flat	*Gerosis sinica indica*
307	Hesperiidae	Water Snow Flat	*Tagiades litigiosa litigiosa*
308	Hesperiidae	Yellow Flat	*Mooreana trichoneura pralaya*
309	Hesperiidae	Chestnut Angle	*Odontoptilum angulata*
310	Hesperiidae	Tawny Angle	*Ctenoptilum vasava vasava*
311	Hesperiidae	Striped Dawnfly	*Capila jayadeva*
312	Hesperiidae	Small Indian Palm Bob	*Suastus minuta aditia*
313	Hesperiidae	Common Dartlet	*Oriens gola gola*
314	Hesperiidae	Common Dart	*Potanthus pseudomaesa*
315	Hesperiidae	Broad Bident Dart	*Potanthus trachala tytleri*
316	Hesperiidae	Chinese Dart	*Potanthus confucius*
317	Hesperiidae	Sikkim Dart	*Potanthus mara*
318	Hesperiidae	Pale Palm Dart	*Telicota colon*

319	Hesperiidae	Dark Palm Dart	*Telicota ancilla*
320	Hesperiidae	Light Straw Ace	*Pithauria stramineipennis*
321	Hesperiidae	Dark Straw Ace	*Pithauria murdava*
322	Hesperiidae	Chequered Ace	*Thoressa hyrie*
323	Hesperiidae	Ace sp.	*Thoressa sp.*
324	Hesperiidae	Northern Spotted Ace	*Thoressa cerata*
325	Hesperiidae	Banded Ace	*Halpe zema zema*
326	Hesperiidae	Moore's Ace	*Halpe porus*
327	Hesperiidae	Plain Ace	*Halpe kumara*
328	Hesperiidae	Indian Ace	*Halpe homolea*
329	Hesperiidae	Tufted Ace	*Sebastonyma dolopia*
330	Hesperiidae	Brown Bush Bob	*Pedesta pandita*
331	Hesperiidae	Bush Bob sp	*Pedesta sp.*
332	Hesperiidae	Figure of 8 Swift	*Caltoris pagana*
333	Hesperiidae	Colon Swift	*Caltoris cahira cara*
334	Hesperiidae	Paintbrush Swift	*Baoris farri*
335	Hesperiidae	Contiguous Swift	*Polytremis lubricans*
336	Hesperiidae	Yellow-Spot Swift	*Polytremis eltola*
337	Hesperiidae	Straight Swift	*Parnara bada*
338	Hesperiidae	Bevan's Swift	*Pseudoborbo bevani*
339	Hesperiidae	Tree Flitter	*Hyarotis adrastus praba*
340	Hesperiidae	Purple and Gold Flitter	*Zographetus satwa*
341	Hesperiidae	Black-veined Redeye	*Matapa sasivarna*
342	Hesperiidae	Hedge Hopper	*Baracus vittatus septentrionum*
343	Hesperiidae	Large Forest Bob	*Scobura cephaloides cephaloides*
344	Hesperiidae	Dark Velvet Bob	*Koruthaialos butleri butleri*
345	Hesperiidae	Chocolate Demon	*Ancistroides nigrita*
346	Hesperiidae	Common Banded Demon	*Notocrypta paralysos alysia*
347	Hesperiidae	Spotted Demon	*Notocrypta feisthameli alysos*
348	Hesperiidae	Grass Demon	*Udaspes folus*
349	Hesperiidae	Forest Hopper	*Asticopterus jama kada*
350	Hesperiidae	Veined Scrub Hopper	*Aeromachus stigmatus*
351	Hesperiidae	Grey Scrub Hopper	*Aeromachus jhora creta*
352	Hesperiidae	Hedge Hopper sp.	*Baracus sp.*
353	Hesperiidae	Manipur Ace	*Sovia malta*
354	Hesperiidae	Lucas' Ace	*Sovia magna*

APPENDIX II: INFORMATION ON FISH SPECIES OF DIBANG VALLEY (various sources)

Fish species described from Dibang River basin in the past 10 years:

1. *Aborichthys iphipaniensis* (Kosygin et al., 2019) - Iphipani River at Roing, Lower Dibang Valley, Arunachal Pradesh, India, 28°10'44"N, 95°50'08"E, elevation 418 meters.
2. *Garra arunachalensis* (Nebeshwar and Vishwanath, 2013) - Lower Divang valley district, Deapani River at Roing, Brahmaputa basin, 29°09'35"N, 95°54'08"E, Arunachal Pradesh, India.
3. *Garra arupi* Nebeshwar (Vishwanath and Das 2009) - Deopani River at Roing, Lower Dibang Valley, Arunachal Pradesh, India.
4. *Mustura harkishorei* (Das and Darshan, 2017) - Dibang River, Brahmaputra basin, Lower Dibang Valley district, Arunachal Pradesh state, India, 28°09'59"N, 95°43'55"E.
5. *Mystus prabini* (Darshan et al., 2019) - Sinkin River (a tributary of the Siang River) at Anpum village, Lower Dibang district, Arunachal Pradesh, India, 28°0'4.4"N, 95°35'9.6"E.
6. *Pseudolaguvia jiyaensis* (Tamang and Sinha, 2014) - Arunachal Pradesh, Lower Dibang Valley District, Jiya stream, near Bolik village, approx. 14 km from Roing towards Shantipur, Assam, India, 28°00.377'N, 95°45.562'E, depth 149 meters.
7. *Pseudolaguvia magna* (Tamang and Sinha, 2014) - Arunachal Pradesh, Lower Dibang Valley District, Jiya stream, near Bolik village, approx. 14 km from Roing towards Shantipur, Assam, India, 28°00.377'N, 95°45.562'E.
8. *Aborichthys waikhomi* (Singh et. al., 2018) - Arunachal Pradesh, Sinkin river at Anpum, Lower Dibang Valley district

Recently recorded fish species from Lower Dibang Valley (Darshan et al., 2019):

- *Anguilla bengalensis* (Gray 1831)

- *Salmostoma phulo* (Hamilton 1822)
- *Garra arupi* Nebeshwar, Waikhom and Das 2009
- *Neolissochilus hexastichus* (McClelland 1839)
- *Systomus immaculatus* McClelland 1839
- *Systomus sarana* (Hamilton 1822)
- *Schizothorax progastus* (McClelland 1839)
- *Cyprinion semiplotum* (McClelland 1839)
- *Botia rostrata* Gunther 1868
- *Lepidocephalichthys arunachalensis* Datta and Barman 1984
- *Aborichthys elongatus* Hora 1921
- *Aborichthys waikhomi* Kosygin 2012
- *Schistura zonata* McClelland 1839
- *Schistura devdevi* Hora 1935
- *Schistura savona* (Hamilton 1822)
- *Mustura harkishorei* Das and Darshan 2017
- *Ompok pabda* (Hamilton 1822)
- *Batasio batasio* (Hamilton 1822)
- *Mystus dibrugarensis* Chaudhuri 1931
- *Amblyceps laticeps* (McClelland 1842)

- *Exostoma labiatum* (McClelland 1842)
- *Glyptothorax cavia* (Hamilton 1822)
- *Pseudecheneis sirenica* Vishwanath and Darshan 2007
- *Pseudolaguvia jiyaensis* Tamang and Sinha 2014
- *Pseudolaguvia magna* Tamang and Sinha 2014
- *Xenentodon cancila* (Hamilton 1822)
- *Macrognathus pancalus* Hamilton 1822
- *Channa stewartii* (Playfair 1867)
- *Nandus nandus* (Hamilton 1822)
- *Badis assamensis* Ahl 1937
- *Microphis deocata* (Hamilton 1822)
- *Leiodon cutcutia* (Hamilton 1822)

APPENDIX III: CHECKLIST OF BIRDS OF DIBANG VALLEY (Dalvi 2020, unpublished list)

S.No.	Family	Common Name	Scientific Name	WPA 1972	IUCN Redlist
1	Anatidae	Fulvous Whistling Duck	*Dendrocygna bicolor*	Sch IV	Least Concern
2	Anatidae	Lesser Whistling Duck	*Dendrocygna javanica*	Sch I	Least Concern
3	Anatidae	Greylag Goose	*Anser anser*	Sch IV	Least Concern
4	Anatidae	Gadwall	*Mareca strepera*	Sch IV	Least Concern
5	Anatidae	Eurasian Wigeon	*Mareca penelope*	Sch IV	Least Concern
6	Anatidae	Indian Spot-billed Duck	*Anas poecilorhyncha*	Sch IV	Least Concern
7	Anatidae	Tufted Duck	*Aythya fuligula*	Sch IV	Least Concern
8	Phasianidae	Hill Partridge	*Arborophila torqueola*	Sch IV	Least Concern
9	Phasianidae	Rufous-throated Partridge	*Arborophila rufogularis*	Sch IV	Least Concern
10	Phasianidae	White-cheeked Partridge	*Arborophila atrogularis*	Sch IV	Near Threatened
11	Phasianidae	Chestnut-breasted Partridge	*Arborophila mandellii*	Sch IV	Vulnerable
12	Phasianidae	Blood Pheasant	*Ithaginis cruentus*	Sch I	Least Concern
13	Phasianidae	Blyth's Tragopan	*Tragopan blythii*	Sch I	Vulnerable
14	Phasianidae	Himalayan Monal	*Lophophorus impejanus*	Sch I	Least Concern
15	Phasianidae	Sclater's Monal	*Lophophorus sclateri*	Sch I	Vulnerable
16	Phasianidae	Red Junglefowl	*Gallus gallus*	Sch IV	Least Concern
17	Phasianidae	Kalij Pheasant	*Lophura leucomelanos*	Sch IV	Least Concern
18	Phasianidae	Grey Peacock-Pheasant	*Polyplectron bicalcaratum*	Sch I	Least Concern
19	Ciconiidae	Asian Openbill	*Anastomus oscitans*	Sch IV	Least Concern
20	Ciconiidae	Black Stork	*Ciconia nigra*	Sch IV	Least Concern
21	Ciconiidae	Lesser Adjutant	*Leptoptilos javanicus*	Sch IV	Vulnerable
22	Ardeidae	Cinnamon Bittern	*Ixobrychus cinnamomeus*	Sch IV	Least Concern
23	Ardeidae	Black-crowned Night Heron	*Nycticorax nycticorax*	Sch IV	Least Concern
24	Ardeidae	Indian Pond Heron	*Ardeola grayii*	Sch IV	Least Concern
25	Ardeidae	Chinese Pond Heron	*Ardeola bacchus*	Sch IV	Least Concern
26	Ardeidae	Eastern Cattle Egret	*Bubulcus coromandus*	Sch IV	Least Concern
27	Ardeidae	Grey Heron	*Ardea cinerea*	Sch IV	Least Concern
28	Ardeidae	Purple Heron	*Ardea purpurea*	Sch IV	Least Concern
29	Ardeidae	Great Egret	*Ardea alba*	Sch IV	Least Concern
30	Ardeidae	Intermediate Egret	*Ardea intermedia*	Sch IV	Least Concern

31	Ardeidae	Little Egret	*Egretta garzetta*	Sch IV	Least Concern
32	Phalacrocoracidae	Little Cormorant	*Microcarbo niger*	Sch IV	Least Concern
33	Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	Sch IV	Least Concern
34	Pandionidae	Western Osprey	*Pandion haliaetus*	Sch I	Least Concern
35	Accipitridae	White-rumped Vulture	*Gyps bengalensis*	Sch I	Critically Endangered
36	Accipitridae	Crested Serpent Eagle	*Spilornis cheela*	Sch IV	Least Concern
37	Accipitridae	Short-toed Snake Eagle	*Circaetus gallicus*	Sch IV	Least Concern
38	Accipitridae	Mountain Hawk-Eagle	*Nisaetus nipalensis*	Sch IV	Least Concern
39	Accipitridae	Rufous-bellied Eagle	*Lophotriorchis kienerii*	Sch IV	Least Concern
40	Accipitridae	Black Eagle	*Ictinaetus malaiensis*	Sch IV	Least Concern
41	Accipitridae	Greater Spotted Eagle	*Clanga clanga*	Sch IV	Vulnerable
42	Accipitridae	Booted Eagle	*Hieraaetus pennatus*	Sch IV	Least Concern
43	Accipitridae	Steppe Eagle	*Aquila nipalensis*	Sch IV	Endangered
44	Accipitridae	Crested Goshawk	*Accipiter trivirgatus*	Sch IV	Least Concern
45	Accipitridae	Shikra	*Accipiter badius*	Sch IV	Least Concern
46	Accipitridae	Besra	*Accipiter virgatus*	Sch IV	Least Concern
47	Accipitridae	Eurasian Sparrowhawk	*Accipiter nisus*	Sch IV	Least Concern
48	Accipitridae	Northern Goshawk	*Accipiter gentilis*	Sch IV	Least Concern
49	Accipitridae	Western Marsh Harrier	*Circus aeruginosus*	Sch IV	Least Concern
50	Accipitridae	Pallid Harrier	*Circus macrourus*	Sch IV	Near Threatened
51	Accipitridae	Pied Harrier	*Circus melanoleucos*	Sch IV	Least Concern
52	Accipitridae	Black Kite	*Milvus migrans*	Sch IV	Least Concern
53	Accipitridae	Himalayan Buzzard	*Buteo burmanicus*	Sch IV	Least Concern
54	Accipitridae	Common Buzzard	*Buteo buteo*	Sch IV	Least Concern
55	Otididae	Bengal Florican	*Houbaropsis bengalensis*	Sch I	Critically Endangered
56	Rallidae	White-breasted Waterhen	*Amaurornis phoenicurus*	Sch IV	Least Concern
57	Rallidae	Common Moorhen	*Gallinula chloropus*	Sch IV	Least Concern
58	Charadriidae	Northern Lapwing	*Vanellus vanellus*	Sch IV	Near Threatened
59	Charadriidae	Red-wattled Lapwing	*Vanellus indicus*	Sch IV	Least Concern
60	Charadriidae	Little Ringed Plover	*Charadrius dubius*	Sch IV	Least Concern
61	Charadriidae	Kentish Plover	*Charadrius alexandrinus*	Sch IV	Least Concern
62	Jacanidae	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	Sch IV	Least Concern

63	Scolopacidae	Eurasian Woodcock	*Scolopax rusticola*	Sch IV	Least Concern
64	Scolopacidae	Solitary Snipe	*Gallinago solitaria*	Sch IV	Least Concern
65	Scolopacidae	Wood Snipe	*Gallinago nemoricola*	Sch IV	Vulnerable
66	Scolopacidae	Pin-tailed Snipe	*Gallinago stenura*	Sch IV	Least Concern
67	Scolopacidae	Common Greenshank	*Tringa nebularia*	Sch IV	Least Concern
68	Scolopacidae	Green Sandpiper	*Tringa ochropus*	Sch IV	Least Concern
69	Scolopacidae	Wood Sandpiper	*Tringa glareola*	Sch IV	Least Concern
70	Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	Sch IV	Least Concern
71	Scolopacidae	Temminck's Stint	*Calidris temminckii*	Sch IV	Least Concern
72	Glareolidae	Small Pratincole	*Glareola lactea*	Sch IV	Least Concern
73	Laridae	Pallas's Gull	*Ichthyaetus ichthyaetus*	Sch IV	Least Concern
74	Columbidae	Speckled Wood Pigeon	*Columba hodgsonii*	Sch IV	Least Concern
75	Columbidae	Ashy Wood Pigeon	*Columba pulchricollis*	Sch IV	Least Concern
76	Columbidae	Pale-capped Pigeon	*Columba punicea*	Sch IV	Vulnerable
77	Columbidae	Oriental Turtle Dove	*Streptopelia orientalis*	Sch IV	Least Concern
78	Columbidae	Spotted Dove	*Spilopelia chinensis*	Sch IV	Least Concern
79	Columbidae	Barred Cuckoo-Dove	*Macropygia unchall*	Sch IV	Least Concern
80	Columbidae	Common Emerald Dove	*Chalcophaps indica*	Sch IV	Least Concern
81	Columbidae	Ashy-headed Green Pigeon	*Treron phayrei*	Sch IV	Near Threatened
82	Columbidae	Green Imperial Pigeon	*Ducula aenea*	Sch IV	Least Concern
83	Columbidae	Mountain Imperial Pigeon	*Ducula badia*	Sch IV	Least Concern
84	Cuculidae	Greater Coucal	*Centropus sinensis*	Sch IV	Least Concern
85	Cuculidae	Lesser Coucal	*Centropus bengalensis*	Sch IV	Least Concern
86	Cuculidae	Green-billed Malkoha	*Phaenicophaeus tristis*	Sch IV	Least Concern
87	Cuculidae	Asian Koel	*Eudynamys scolopaceus*	Sch IV	Least Concern
88	Cuculidae	Asian Emerald Cuckoo	*Chrysococcyx maculatus*	Sch IV	Least Concern
89	Cuculidae	Banded Bay Cuckoo	*Cacomantis sonneratii*	Sch IV	Least Concern
90	Cuculidae	Plaintive Cuckoo	*Cacomantis merulinus*	Sch IV	Least Concern
91	Cuculidae	Square-tailed Drongo-Cuckoo	*Surniculus lugubris*	Sch IV	Least Concern
92	Cuculidae	Large Hawk-Cuckoo	*Hierococcyx sparverioides*	Sch IV	Least Concern
93	Cuculidae	Common Hawk-Cuckoo	*Hierococcyx varius*	Sch IV	Least Concern
94	Cuculidae	Hodgson's Hawk-Cuckoo	*Hierococcyx nisicolor*	Sch IV	Least Concern

95	Cuculidae	Lesser Cuckoo	*Cuculus poliocephalus*	Sch IV	Least Concern
96	Cuculidae	Indian Cuckoo	*Cuculus micropterus*	Sch IV	Least Concern
97	Cuculidae	Himalayan Cuckoo	*Cuculus saturatus*	Sch IV	Least Concern
98	Cuculidae	Common Cuckoo	*Cuculus canorus*	Sch IV	Least Concern
99	Tytonidae	Western Barn Owl	*Tyto alba*	Sch IV	Least Concern
100	Strigidae	Mountain Scops Owl	*Otus spilocephalus*	Sch IV	Least Concern
101	Strigidae	Collared Scops Owl	*Otus lettia*	Sch IV	Least Concern
102	Strigidae	Oriental Scops Owl	*Otus sunia*	Sch IV	Least Concern
103	Strigidae	Brown Fish Owl	*Ketupa zeylonensis*	Sch IV	Least Concern
104	Strigidae	Brown Wood Owl	*Strix leptogrammica*	Sch IV	Least Concern
105	Strigidae	Himalayan Owl	*Strix nivicolum*	Sch IV	Least Concern
106	Strigidae	Collared Owlet	*Glaucidium brodiei*	Sch IV	Least Concern
107	Strigidae	Asian Barred Owlet	*Glaucidium cuculoides*	Sch IV	Least Concern
108	Strigidae	Spotted Owlet	*Athene brama*	Sch IV	Least Concern
109	Strigidae	Long-eared Owl	*Asio otus*	Sch IV	Least Concern
110	Podargidae	Hodgson's Frogmouth	*Batrachostomus hodgsoni*	Sch IV	Least Concern
111	Caprimulgidae	Large-tailed Nightjar	*Caprimulgus macrurus*	Sch IV	Least Concern
112	Apodidae	Himalayan Swiftlet	*Aerodramus brevirostris*	Sch IV	Least Concern
113	Apodidae	White-throated Needletail	*Hirundapus caudacutus*	Sch IV	Least Concern
114	Apodidae	Asian Palm Swift	*Cypsiurus balasiensis*	Sch IV	Least Concern
115	Apodidae	Dark-rumped Swift	*Apus acuticauda*	Sch IV	Vulnerable
116	Trogonidae	Red-headed Trogon	*Harpactes erythrocephalus*	Sch IV	Least Concern
117	Trogonidae	Ward's Trogon	*Harpactes wardi*	Sch IV	Near Threatened
118	Alcedinidae	Ruddy Kingfisher	*Halcyon coromanda*	Sch IV	Least Concern
119	Alcedinidae	White-throated Kingfisher	*Halcyon smyrnensis*	Sch IV	Least Concern
120	Alcedinidae	Blue-eared Kingfisher	*Alcedo meninting*	Sch IV	Least Concern
121	Alcedinidae	Crested Kingfisher	*Megaceryle lugubris*	Sch IV	Least Concern
122	Alcedinidae	Pied Kingfisher	*Ceryle rudis*	Sch IV	Least Concern
123	Meropidae	Blue-bearded Bee-eater	*Nyctyornis athertoni*	Sch IV	Least Concern
124	Meropidae	Green Bee-eater	*Merops orientalis*	Sch IV	Least Concern
125	Meropidae	Chestnut-headed Bee-eater	*Merops leschenaulti*	Sch IV	Least Concern
126	Upupidae	Eurasian Hoopoe	*Upupa epops*	Sch IV	Least Concern
127	Bucerotidae	Rufous-necked Hornbill	*Aceros nipalensis*	Sch I	Vulnerable

128	Bucerotidae	Wreathed Hornbill	*Rhyticeros undulatus*	Sch I	Least Concern
129	Megalaimidae	Great Barbet	*Psilopogon virens*	Sch IV	Least Concern
130	Megalaimidae	Lineated Barbet	*Psilopogon lineatus*	Sch IV	Least Concern
131	Megalaimidae	Golden-throated Barbet	*Psilopogon franklinii*	Sch IV	Least Concern
132	Megalaimidae	Blue-throated Barbet	*Psilopogon asiaticus*	Sch IV	Least Concern
133	Megalaimidae	Blue-eared Barbet	*Psilopogon duvaucelii*	Sch IV	Least Concern
134	Picidae	Speckled Piculet	*Picumnus innominatus*	Sch IV	Least Concern
135	Picidae	White-browed Piculet	*Sasia ochracea*	Sch IV	Least Concern
136	Picidae	Rufous-bellied Woodpecker	*Dendrocopos hyperythrus*	Sch IV	Least Concern
137	Picidae	Fulvous-breasted Woodpecker	*Dendrocopos macei*	Sch IV	Least Concern
138	Picidae	Crimson-breasted Woodpecker	*Dryobates cathpharius*	Sch IV	Least Concern
139	Picidae	Darjeeling Woodpecker	*Dendrocopos darjellensis*	Sch IV	Least Concern
140	Picidae	Greater Yellownape	*Chrysophlegma flavinucha*	Sch IV	Least Concern
141	Picidae	Lesser Yellownape	*Picus chlorolophus*	Sch IV	Least Concern
142	Picidae	Grey-headed Woodpecker	*Picus canus*	Sch IV	Least Concern
143	Picidae	Pale-headed Woodpecker	*Gecinulus grantia*	Sch IV	Least Concern
144	Picidae	Bay Woodpecker	*Blythipicus pyrrhotis*	Sch IV	Least Concern
145	Picidae	Rufous Woodpecker	*Micropternus brachyurus*	Sch IV	Least Concern
146	Picidae	Great Slaty Woodpecker	*Mulleripicus pulverulentus*	Sch IV	Vulnerable
147	Falconidae	Amur Falcon	*Falco amurensis*	Sch IV	Least Concern
148	Falconidae	Eurasian Hobby	*Falco subbuteo*	Sch IV	Least Concern
149	Falconidae	Oriental Hobby	*Falco severus*	Sch IV	Least Concern
150	Falconidae	Peregrine Falcon	*Falco peregrinus*	Sch I	Least Concern
151	Psittaculidae	Grey-headed Parakeet	*Psittacula finschii*	Sch IV	Near Threatened
152	Psittaculidae	Red-breasted Parakeet	*Psittacula alexandri*	Sch IV	Near Threatened
153	Psittaculidae	Rose-ringed Parakeet	*Psittacula krameri*	Sch IV	Least Concern
154	Eurylaimidae	Long-tailed Broadbill	*Psarisomus dalhousiae*	Sch IV	Least Concern
155	Eurylaimidae	Silver-breasted Broadbill	*Serilophus lunatus*	Sch IV	Least Concern
156	Pittidae	Hooded Pitta	*Pitta sordida*	Sch IV	Least Concern
157	Tephrodornithidae	Bar-winged Flycatcher-shrike	*Hemipus picatus*	Sch IV	Least Concern
158	Tephrodornithidae	Large Woodshrike	*Tephrodornis virgatus*	Sch IV	Least Concern

159	Aegithinidae	Common Iora	*Aegithina tiphia*	Sch IV	Least Concern
160	Campephagidae	Large Cuckooshrike	*Coracina macei*	Sch IV	Least Concern
161	Campephagidae	Black-winged Cuckooshrike	*Lalage melaschistos*	Sch IV	Least Concern
162	Campephagidae	Grey-chinned Minivet	*Pericrocotus solaris*	Sch IV	Least Concern
163	Campephagidae	Long-tailed Minivet	*Pericrocotus ethologus*	Sch IV	Least Concern
164	Campephagidae	Short-billed Minivet	*Pericrocotus brevirostris*	Sch IV	Least Concern
165	Campephagidae	Scarlet Minivet	*Pericrocotus speciosus*	Sch IV	Least Concern
166	Laniidae	Brown Shrike	*Lanius cristatus*	Sch IV	Least Concern
167	Laniidae	Burmese Shrike	*Lanius collurioides*	Sch IV	Least Concern
168	Laniidae	Long-tailed Shrike	*Lanius schach*	Sch IV	Least Concern
169	Laniidae	Grey-backed Shrike	*Lanius tephronotus*	Sch IV	Least Concern
170	Vireonidae	Black-headed Shrike-Babbler	*Pteruthius rufiventer*	Sch IV	Least Concern
171	Vireonidae	Green Shrike-Babbler	*Pteruthius xanthochlorus*	Sch IV	Least Concern
172	Vireonidae	Black-eared Shrike-Babbler	*Pteruthius melanotis*	Sch IV	Least Concern
173	Oriolidae	Black-hooded Oriole	*Oriolus xanthornus*	Sch IV	Least Concern
174	Oriolidae	Maroon Oriole	*Oriolus traillii*	Sch IV	Least Concern
175	Dicruridae	Black Drongo	*Dicrurus macrocercus*	Sch IV	Least Concern
176	Dicruridae	Ashy Drongo	*Dicrurus leucophaeus*	Sch IV	Least Concern
177	Dicruridae	Bronzed Drongo	*Dicrurus aeneus*	Sch IV	Least Concern
178	Dicruridae	Lesser Racket-tailed Drongo	*Dicrurus remifer*	Sch IV	Least Concern
179	Dicruridae	Greater Racket-tailed Drongo	*Dicrurus paradiseus*	Sch IV	Least Concern
180	Rhipiduridae	White-throated Fantail	*Rhipidura albicollis*	Sch IV	Least Concern
181	Monarchidae	Black-naped Monarch	*Hypothymis azurea*	Sch IV	Least Concern
182	Monarchidae	Blyth's Paradise Flycatcher	*Terpsiphone affinis*	Sch IV	Least Concern
183	Corvidae	Eurasian Jay	*Garrulus glandarius*	Sch IV	Least Concern
184	Corvidae	Common Green Magpie	*Cissa chinensis*	Sch IV	Least Concern
185	Corvidae	Rufous Treepie	*Dendrocitta vagabunda*	Sch IV	Least Concern
186	Corvidae	Grey Treepie	*Dendrocitta formosae*	Sch IV	Least Concern
187	Corvidae	Collared Treepie	*Dendrocitta frontalis*	Sch IV	Least Concern
188	Corvidae	House Crow	*Corvus splendens*	Sch IV	Least Concern
189	Corvidae	Large-billed Crow	*Corvus macrorhynchos*	Sch IV	Least Concern
190	Stenostiridae	Grey-headed Canary-flycatcher	*Culicicapa ceylonensis*	Sch IV	Least Concern
191	Paridae	Yellow-browed Tit	*Sylviparus modestus*	Sch IV	Least Concern

192	Paridae	Sultan Tit	*Melanochlora sultanea*	Sch IV	Least Concern
193	Paridae	Rufous-vented Tit	*Periparus rubidiventris*	Sch IV	Least Concern
194	Paridae	Coal Tit	*Periparus ater*	Sch IV	Least Concern
195	Paridae	Grey Crested Tit	*Lophophanes dichrous*	Sch IV	Least Concern
196	Paridae	Green-backed Tit	*Parus monticolus*	Sch IV	Least Concern
197	Paridae	Yellow-cheeked Tit	*Machlolophus spilonotus*	Sch IV	Least Concern
198	Alaudidae	Bengal Bush Lark	*Mirafra assamica*	Sch IV	Least Concern
199	Alaudidae	Oriental Skylark	*Alauda gulgula*	Sch IV	Least Concern
200	Pycnonotidae	Striated Bulbul	*Pycnonotus striatus*	Sch IV	Least Concern
201	Pycnonotidae	Black-crested Bulbul	*Pycnonotus flaviventris*	Sch IV	Least Concern
202	Pycnonotidae	Red-whiskered Bulbul	*Pycnonotus jocosus*	Sch IV	Least Concern
203	Pycnonotidae	Red-vented Bulbul	*Pycnonotus cafer*	Sch IV	Least Concern
204	Pycnonotidae	White-throated Bulbul	*Alophoixus flaveolus*	Sch IV	Least Concern
205	Pycnonotidae	Mountain Bulbul	*Ixos mcclellandii*	Sch IV	Least Concern
206	Pycnonotidae	Ashy Bulbul	*Hemixos flavala*	Sch IV	Least Concern
207	Hirundinidae	Barn Swallow	*Hirundo rustica*	Sch IV	Least Concern
208	Hirundinidae	Asian House Martin	*Delichon dasypus*	Sch IV	Least Concern
209	Hirundinidae	Nepal House Martin	*Delichon nipalense*	Sch IV	Least Concern
210	Hirundinidae	Striated Swallow	*Cecropis striolata*	Sch IV	Least Concern
211	Cettiidae	Yellow-bellied Warbler	*Abroscopus superciliaris*	Sch IV	Least Concern
212	Cettiidae	Rufous-faced Warbler	*Abroscopus albogularis*	Sch IV	Least Concern
213	Cettiidae	Black-faced Warbler	*Abroscopus schisticeps*	Sch IV	Least Concern
214	Cettiidae	Mountain Tailorbird	*Phyllergates cucullatus*	Sch IV	Least Concern
215	Cettiidae	Broad-billed Warbler	*Tickellia hodgsoni*	Sch IV	Least Concern
216	Cettiidae	Grey-bellied Tesia	*Tesia cyaniventer*	Sch IV	Least Concern
217	Cettiidae	Slaty-bellied Tesia	*Tesia olivea*	Sch IV	Least Concern
218	Cettiidae	Chestnut-headed Tesia	*Cettia castaneocoronata*	Sch IV	Least Concern
219	Phylloscopidae	Dusky Warbler	*Phylloscopus fuscatus*	Sch IV	Least Concern
220	Phylloscopidae	Tickell's Leaf Warbler	*Phylloscopus affinis*	Sch IV	Least Concern
221	Phylloscopidae	Buff-barred Warbler	*Phylloscopus pulcher*	Sch IV	Least Concern
222	Phylloscopidae	Ashy-throated Warbler	*Phylloscopus maculipennis*	Sch IV	Least Concern
223	Phylloscopidae	Yellow-browed Warbler	*Phylloscopus inornatus*	Sch IV	Least Concern
224	Phylloscopidae	Greenish Warbler	*Phylloscopus trochiloides*	Sch IV	Least Concern

225	Phylloscopidae	Large-billed Leaf Warbler	*Phylloscopus magnirostris*	Sch IV	Least Concern
226	Phylloscopidae	Blyth's Leaf Warbler	*Phylloscopus reguloides*	Sch IV	Least Concern
227	Phylloscopidae	Yellow-vented Warbler	*Phylloscopus cantator*	Sch IV	Least Concern
228	Phylloscopidae	Grey-hooded Warbler	*Phylloscopus xanthoschistos*	Sch IV	Least Concern
229	Phylloscopidae	White-spectacled Warbler	*Phylloscopus intermedius*	Sch IV	Least Concern
230	Phylloscopidae	Grey-crowned Warbler	*Phylloscopus tephrocephalus*	Sch IV	Least Concern
231	Phylloscopidae	Whistler's Warbler	*Phylloscopus whistleri*	Sch IV	Least Concern
232	Phylloscopidae	Grey-cheeked Warbler	*Phylloscopus poliogenys*	Sch IV	Least Concern
233	Phylloscopidae	Chestnut-crowned Warbler	*Phylloscopus castaniceps*	Sch IV	Least Concern
234	Acrocephalidae	Paddyfield Warbler	*Acrocephalus agricola*	Sch IV	Least Concern
235	Acrocephalidae	Thick-billed Warbler	*Arundinax aedon*	Sch IV	Least Concern
236	Locustellidae	Striated Grassbird	*Megalurus palustris*	Sch IV	Least Concern
237	Cisticolidae	Zitting Cisticola	*Cisticola juncidis*	Sch IV	Least Concern
238	Cisticolidae	Striated Prinia	*Prinia crinigera*	Sch IV	Least Concern
239	Cisticolidae	Black-throated Prinia	*Prinia atrogularis*	Sch IV	Least Concern
240	Cisticolidae	Grey-breasted Prinia	*Prinia hodgsonii*	Sch IV	Least Concern
241	Cisticolidae	Graceful Prinia	*Prinia gracilis*	Sch IV	Least Concern
242	Cisticolidae	Yellow-bellied Prinia	*Prinia flaviventris*	Sch IV	Least Concern
243	Cisticolidae	Ashy Prinia	*Prinia socialis*	Sch IV	Least Concern
244	Cisticolidae	Plain Prinia	*Prinia inornata*	Sch IV	Least Concern
245	Cisticolidae	Common Tailorbird	*Orthotomus sutorius*	Sch IV	Least Concern
246	Timaliidae	Spot-breasted Scimitar Babbler	*Pomatorhinus mcclellandi*	Sch IV	Least Concern
247	Timaliidae	White-browed Scimitar Babbler	*Pomatorhinus schisticeps*	Sch IV	Least Concern
248	Timaliidae	Streak-breasted Scimitar Babbler	*Pomatorhinus ruficollis*	Sch IV	Least Concern
249	Timaliidae	Red-billed Scimitar Babbler	*Pomatorhinus ochraceiceps*	Sch IV	Least Concern
250	Timaliidae	Coral-billed Scimitar Babbler	*Pomatorhinus ferruginosus*	Sch IV	Least Concern
251	Timaliidae	Slender-billed Scimitar Babbler	*Pomatorhinus superciliaris*	Sch IV	Least Concern
252	Timaliidae	Bar-winged Wren-Babbler	*Spelaeornis troglodytoides*	Sch IV	Least Concern
253	Timaliidae	Grey-throated Babbler	*Stachyris nigriceps*	Sch IV	Least Concern
254	Timaliidae	Buff-chested Babbler	*Stachyridopsis ambigua*	Sch IV	Least Concern

255	Timaliidae	Rufous-capped Babbler	*Stachyridopsis ruficeps*	Sch IV	Least Concern
256	Timaliidae	Golden Babbler	*Stachyridopsis chrysaea*	Sch IV	Least Concern
257	Timaliidae	Chestnut-capped Babbler	*Timalia pileata*	Sch IV	Least Concern
258	Timaliidae	Pin-striped Tit-Babbler	*Macronus gularis*	Sch IV	Least Concern
259	Pellorneidae	Yellow-throated Fulvetta	*Alcippe cinerea*	Sch IV	Least Concern
260	Pellorneidae	Rufous-winged Fulvetta	*Alcippe castaneceps*	Sch IV	Least Concern
261	Pellorneidae	Rufous-throated Fulvetta	*Alcippe rufogularis*	Sch IV	Least Concern
262	Pellorneidae	Brown-cheeked Fulvetta	*Alcippe poioicephala*	Sch IV	Least Concern
263	Pellorneidae	Nepal Fulvetta	*Alcippe nipalensis*	Sch IV	Least Concern
264	Pellorneidae	Streaked Wren-Babbler	*Napothera brevicaudata*	Sch IV	Least Concern
265	Pellorneidae	Eyebrowed Wren-Babbler	*Napothera epilepidota*	Sch IV	Least Concern
266	Pellorneidae	Long-billed Wren-Babbler	*Rimator malacoptilus*	Sch IV	Least Concern
267	Pellorneidae	White-hooded Babbler	*Gampsorhynchus rufulus*	Sch IV	Least Concern
268	Pellorneidae	Spot-throated Babbler	*Pellorneum albiventre*	Sch IV	Least Concern
269	Pellorneidae	Marsh Babbler	*Pellorneum palustre*	Sch IV	Vulnerable
270	Pellorneidae	Puff-throated Babbler	*Pellorneum ruficeps*	Sch IV	Least Concern
271	Pellorneidae	Buff-breasted Babbler	*Pellorneum tickelli*	Sch IV	Least Concern
272	Leiothrichidae	Striated Babbler	*Argya earlei*	Sch IV	Least Concern
273	Leiothrichidae	White-crested Laughingthrush	*Garrulax leucolophus*	Sch IV	Least Concern
274	Leiothrichidae	Rufous-chinned Laughingthrush	*Ianthocincla rufogularis*	Sch IV	Least Concern
275	Leiothrichidae	Spotted Laughingthrush	*Ianthocincla ocellata*	Sch IV	Least Concern
276	Leiothrichidae	Lesser Necklaced Laughingthrush	*Garrulax monileger*	Sch IV	Least Concern
277	Leiothrichidae	Greater Necklaced Laughingthrush	*Pterorhinus pectoralis*	Sch IV	Least Concern
278	Leiothrichidae	Rufous-necked Laughingthrush	*Pterorhinus ruficollis*	Sch IV	Least Concern
279	Leiothrichidae	Grey-sided Laughingthrush	*Pterorhinus caerulatus*	Sch IV	Least Concern
280	Leiothrichidae	Spot-breasted Laughingthrush	*Garrulax merulinus*	Sch IV	Least Concern
281	Leiothrichidae	Striated Laughingthrush	*Grammatoptila striata*	Sch IV	Least Concern
282	Leiothrichidae	Blue-winged Laughingthrush	*Trochalopteron squamatum*	Sch IV	Least Concern

283	Leiothrichidae	Scaly Laughingthrush	*Trochalopteron subunicolor*	Sch IV	Least Concern
284	Leiothrichidae	Black-faced Laughingthrush	*Trochalopteron affine*	Sch IV	Least Concern
285	Leiothrichidae	Chestnut-crowned Laughingthrush	*Trochalopteron erythrocephalum*	Sch IV	Least Concern
286	Leiothrichidae	Assam Laughingthrush	*Trochalopteron chrysopterum*	Sch IV	Least Concern
287	Leiothrichidae	Elliot's Laughingthrush	*Trochalopteron elliotii*	Sch IV	Least Concern
288	Leiothrichidae	Himalayan Cutia	*Cutia nipalensis*	Sch IV	Least Concern
289	Leiothrichidae	Blue-winged Minla	*Actinodura cyanouroptera*	Sch IV	Least Concern
290	Leiothrichidae	Red-tailed Minla	*Minla ignotincta*	Sch IV	Least Concern
291	Leiothrichidae	Red-faced Liocichla	*Liocichla phoenicea*	Sch IV	Least Concern
292	Leiothrichidae	Rusty-fronted Barwing	*Actinodura egertoni*	Sch IV	Least Concern
293	Leiothrichidae	Streak-throated Barwing	*Actinodura waldeni*	Sch IV	Least Concern
294	Leiothrichidae	Red-billed Leiothrix	*Leiothrix lutea*	Sch IV	Least Concern
295	Leiothrichidae	Rufous-backed Sibia	*Leioptila annectens*	Sch IV	Least Concern
296	Leiothrichidae	Grey Sibia	*Heterophasia gracilis*	Sch IV	Least Concern
297	Leiothrichidae	Beautiful Sibia	*Heterophasia pulchella*	Sch IV	Least Concern
298	Leiothrichidae	Long-tailed Sibia	*Heterophasia picaoides*	Sch IV	Least Concern
299	Sylviidae	Fire-tailed Myzornis	*Myzornis pyrrhoura*	Sch IV	Least Concern
300	Sylviidae	Golden-breasted Fulvetta	*Lioparus chrysotis*	Sch IV	Least Concern
301	Sylviidae	Jerdon's Babbler	*Chrysomma altirostre*	Sch IV	Vulnerable
302	Sylviidae	Brown Parrotbill	*Cholornis unicolor*	Sch IV	Least Concern
303	Sylviidae	Fulvous Parrotbill	*Suthora fulvifrons*	Sch IV	Least Concern
304	Sylviidae	Black-throated Parrotbill	*Suthora nipalensis*	Sch IV	Least Concern
305	Sylviidae	Rufous-headed Parrotbill	*Psittiparus bakeri*	Sch IV	Least Concern
306	Sylviidae	Grey-headed Parrotbill	*Psittiparus gularis*	Sch IV	Least Concern
307	Sylviidae	Black-breasted Parrotbill	*Paradoxornis flavirostris*	Sch IV	Vulnerable
308	Sylviidae	Pale-billed Parrotbill	*Chleuasicus atrosuperciliaris*	Sch IV	Least Concern
309	Zosteropidae	Striated Yuhina	*Yuhina castaniceps*	Sch IV	Least Concern
310	Zosteropidae	White-naped Yuhina	*Yuhina bakeri*	Sch IV	Least Concern
311	Zosteropidae	Whiskered Yuhina	*Yuhina flavicollis*	Sch IV	Least Concern
312	Zosteropidae	Stripe-throated Yuhina	*Yuhina gularis*	Sch IV	Least Concern
313	Zosteropidae	Rufous-vented Yuhina	*Yuhina occipitalis*	Sch IV	Least Concern

314	Zosteropidae	Black-chinned Yuhina	*Yuhina nigrimenta*	Sch IV	Least Concern
315	Irenidae	Asian Fairy-bluebird	*Irena puella*	Sch IV	Least Concern
316	Sittidae	Chestnut-vented Nuthatch	*Sitta nagaensis*	Sch IV	Least Concern
317	Sittidae	Chestnut-bellied Nuthatch	*Sitta cinnamoventris*	Sch IV	Least Concern
318	Sittidae	White-tailed Nuthatch	*Sitta himalayensis*	Sch IV	Least Concern
319	Sittidae	Velvet-fronted Nuthatch	*Sitta frontalis*	Sch IV	Least Concern
320	Sittidae	Beautiful Nuthatch	*Sitta formosa*	Sch IV	Vulnerable
321	Certhiidae	Rusty-flanked Treecreeper	*Certhia nipalensis*	Sch IV	Least Concern
322	Sturnidae	Spot-winged Starling	*Saroglossa spilopterus*	Sch IV	Least Concern
323	Sturnidae	Common Hill Myna	*Gracula religiosa*	Sch I	Least Concern
324	Sturnidae	Great Myna	*Acridotheres grandis*	Sch IV	Least Concern
325	Sturnidae	Jungle Myna	*Acridotheres fuscus*	Sch IV	Least Concern
326	Sturnidae	Common Myna	*Acridotheres tristis*	Sch IV	Least Concern
327	Sturnidae	Chestnut-tailed Starling	*Sturnia malabarica*	Sch IV	Least Concern
328	Turdidae	Orange-headed Thrush	*Geokichla citrina*	Sch IV	Least Concern
329	Turdidae	Long-tailed Thrush	*Zoothera dixoni*	Sch IV	Least Concern
330	Turdidae	Long-billed Thrush	*Zoothera monticola*	Sch IV	Least Concern
331	Turdidae	Black-breasted Thrush	*Turdus dissimilis*	Sch IV	Least Concern
332	Turdidae	White-collared Blackbird	*Turdus albocinctus*	Sch IV	Least Concern
333	Turdidae	Grey-winged Blackbird	*Turdus boulboul*	Sch IV	Least Concern
334	Turdidae	Chestnut Thrush	*Turdus rubrocanus*	Sch IV	Least Concern
335	Turdidae	Grey-sided Thrush	*Turdus feae*	Sch IV	Vulnerable
336	Turdidae	Eyebrowed Thrush	*Turdus obscurus*	Sch IV	Least Concern
337	Turdidae	Black-throated Thrush	*Turdus atrogularis*	Sch IV	Least Concern
338	Turdidae	Red-throated Thrush	*Turdus ruficollis*	Sch IV	Least Concern
339	Turdidae	Dusky Thrush	*Turdus eunomus*	Sch IV	Least Concern
340	Turdidae	Purple Cochoa	*Cochoa purpurea*	Sch IV	Least Concern
341	Turdidae	Green Cochoa	*Cochoa viridis*	Sch IV	Least Concern
342	Muscicapidae	Oriental Magpie-Robin	*Copsychus saularis*	Sch IV	Least Concern
343	Muscicapidae	White-rumped Shama	*Copsychus malabaricus*	Sch IV	Least Concern
344	Muscicapidae	Dark-sided Flycatcher	*Muscicapa sibirica*	Sch IV	Least Concern

345	Muscicapidae	Ferruginous Flycatcher	*Muscicapa ferruginea*	Sch IV	Least Concern
346	Muscicapidae	White-gorgeted Flycatcher	*Anthipes monileger*	Sch IV	Least Concern
347	Muscicapidae	Rufous-bellied Niltava	*Niltava sundara*	Sch IV	Least Concern
348	Muscicapidae	Vivid Niltava	*Niltava vivida*	Sch IV	Least Concern
349	Muscicapidae	Large Niltava	*Niltava grandis*	Sch IV	Least Concern
350	Muscicapidae	Small Niltava	*Niltava macgrigoriae*	Sch IV	Least Concern
351	Muscicapidae	Verditer Flycatcher	*Eumyias thalassinus*	Sch IV	Least Concern
352	Muscicapidae	Gould's Shortwing	*Heteroxenicus stellatus*	Sch IV	Least Concern
353	Muscicapidae	Rusty-bellied Shortwing	*Brachypteryx hyperythra*	Sch IV	Near Threatened
354	Muscicapidae	Lesser Shortwing	*Brachypteryx leucophris*	Sch IV	Least Concern
355	Muscicapidae	Indian Blue Robin	*Larvivora brunnea*	Sch IV	Least Concern
356	Muscicapidae	Bluethroat	*Luscinia svecica*	Sch IV	Least Concern
357	Muscicapidae	Siberian Rubythroat	*Calliope calliope*	Sch IV	Least Concern
358	Muscicapidae	White-tailed Robin	*Myiomela leucura*	Sch IV	Least Concern
359	Muscicapidae	Rufous-breasted Bush Robin	*Tarsiger hyperythrus*	Sch IV	Least Concern
360	Muscicapidae	White-browed Bush Robin	*Tarsiger indicus*	Sch IV	Least Concern
361	Muscicapidae	Golden Bush Robin	*Tarsiger chrysaeus*	Sch IV	Least Concern
362	Muscicapidae	Little Forktail	*Enicurus scouleri*	Sch IV	Least Concern
363	Muscicapidae	Black-backed Forktail	*Enicurus immaculatus*	Sch IV	Least Concern
364	Muscicapidae	Slaty-backed Forktail	*Enicurus schistaceus*	Sch IV	Least Concern
365	Muscicapidae	White-crowned Forktail	*Enicurus leschenaulti*	Sch IV	Least Concern
366	Muscicapidae	Spotted Forktail	*Enicurus maculatus*	Sch IV	Least Concern
367	Muscicapidae	Blue Whistling Thrush	*Myophonus caeruleus*	Sch IV	Least Concern
368	Muscicapidae	Blue-fronted Robin	*Cinclidium frontale*	Sch IV	Least Concern
369	Muscicapidae	Slaty-backed Flycatcher	*Ficedula hodgsonii*	Sch IV	Least Concern
370	Muscicapidae	Rufous-gorgeted Flycatcher	*Ficedula strophiata*	Sch IV	Least Concern
371	Muscicapidae	Snowy-browed Flycatcher	*Ficedula hyperythra*	Sch IV	Least Concern
372	Muscicapidae	Little Pied Flycatcher	*Ficedula westermanni*	Sch IV	Least Concern
373	Muscicapidae	Ultramarine Flycatcher	*Ficedula superciliaris*	Sch IV	Least Concern
374	Muscicapidae	Slaty-blue Flycatcher	*Ficedula tricolor*	Sch IV	Least Concern
375	Muscicapidae	Sapphire Flycatcher	*Ficedula sapphira*	Sch IV	Least Concern

376	Muscicapidae	Black Redstart	*Phoenicurus ochruros*	Sch IV	Least Concern
377	Muscicapidae	Hodgson's Redstart	*Phoenicurus hodgsoni*	Sch IV	Least Concern
378	Muscicapidae	Daurian Redstart	*Phoenicurus auroreus*	Sch IV	Least Concern
379	Muscicapidae	Blue-fronted Redstart	*Phoenicurus frontalis*	Sch IV	Least Concern
380	Muscicapidae	Plumbeous Water Redstart	*Phoenicurus fuliginosus*	Sch IV	Least Concern
381	Muscicapidae	White-capped Redstart	*Phoenicurus leucocephalus*	Sch IV	Least Concern
382	Muscicapidae	Blue Rock Thrush	*Monticola solitarius*	Sch IV	Least Concern
383	Muscicapidae	Chestnut-bellied Rock Thrush	*Monticola rufiventris*	Sch IV	Least Concern
384	Muscicapidae	Pied Bush Chat	*Saxicola caprata*	Sch IV	Least Concern
385	Muscicapidae	Grey Bush Chat	*Saxicola ferreus*	Sch IV	Least Concern
386	Muscicapidae	Isabelline Wheatear	*Oenanthe isabellina*	Sch IV	Least Concern
387	Cinclidae	Brown Dipper	*Cinclus pallasii*	Sch IV	Least Concern
388	Dicaeidae	Yellow-bellied Flowerpecker	*Dicaeum melanoxanthum*	Sch IV	Least Concern
389	Dicaeidae	Plain Flowerpecker	*Dicaeum minullum*	Sch IV	Least Concern
390	Dicaeidae	Fire-breasted Flowerpecker	*Dicaeum ignipectus*	Sch IV	Least Concern
391	Dicaeidae	Scarlet-backed Flowerpecker	*Dicaeum cruentatum*	Sch IV	Least Concern
392	Nectariniidae	Ruby-cheeked Sunbird	*Chalcoparia singalensis*	Sch IV	Least Concern
393	Nectariniidae	Purple Sunbird	*Cinnyris asiaticus*	Sch IV	Least Concern
394	Nectariniidae	Green-tailed Sunbird	*Aethopyga nipalensis*	Sch IV	Least Concern
395	Nectariniidae	Black-throated Sunbird	*Aethopyga saturata*	Sch IV	Least Concern
396	Nectariniidae	Crimson Sunbird	*Aethopyga siparaja*	Sch IV	Least Concern
397	Nectariniidae	Fire-tailed Sunbird	*Aethopyga ignicauda*	Sch IV	Least Concern
398	Nectariniidae	Little Spiderhunter	*Arachnothera longirostra*	Sch IV	Least Concern
399	Nectariniidae	Streaked Spiderhunter	*Arachnothera magna*	Sch IV	Least Concern
400	Passeridae	House Sparrow	*Passer domesticus*	Sch IV	Least Concern
401	Passeridae	Eurasian Tree Sparrow	*Passer montanus*	Sch IV	Least Concern
402	Ploceidae	Baya Weaver	*Ploceus philippinus*	Sch IV	Least Concern
403	Estrildidae	Red Avadavat	*Amandava amandava*	Sch IV	Least Concern
404	Estrildidae	White-rumped Munia	*Lonchura striata*	Sch IV	Least Concern
405	Estrildidae	Chestnut Munia	*Lonchura atricapilla*	Sch IV	Least Concern
406	Prunellidae	Alpine Accentor	*Prunella collaris*	Sch IV	Least Concern
407	Prunellidae	Rufous-breasted Accentor	*Prunella strophiata*	Sch IV	Least Concern

408	Prunellidae	Maroon-backed Accentor	*Prunella immaculata*	Sch IV	Least Concern
409	Motacillidae	Western Yellow Wagtail	*Motacilla flava*	Sch IV	Least Concern
410	Motacillidae	Citrine Wagtail	*Motacilla citreola*	Sch IV	Least Concern
411	Motacillidae	Grey Wagtail	*Motacilla cinerea*	Sch IV	Least Concern
412	Motacillidae	White Wagtail	*Motacilla alba*	Sch IV	Least Concern
413	Motacillidae	Paddyfield Pipit	*Anthus rufulus*	Sch IV	Least Concern
414	Motacillidae	Blyth's Pipit	*Anthus godlewskii*	Sch IV	Least Concern
415	Motacillidae	Olive-backed Pipit	*Anthus hodgsoni*	Sch IV	Least Concern
416	Motacillidae	Rosy Pipit	*Anthus roseatus*	Sch IV	Least Concern
417	Elachuridae	Spotted Elachura	*Elachura formosa*	Sch IV	Least Concern
418	Fringillidae	Collared Grosbeak	*Mycerobas affinis*	Sch IV	Least Concern
419	Fringillidae	Brown Bullfinch	*Pyrrhula nipalensis*	Sch IV	Least Concern
420	Fringillidae	Grey-headed Bullfinch	*Pyrrhula erythaca*	Sch IV	Least Concern
421	Fringillidae	Golden-naped Finch	*Pyrrhoplectes epauletta*	Sch IV	Least Concern
422	Fringillidae	Dark-breasted Rosefinch	*Procarduelis nipalensis*	Sch IV	Least Concern
423	Fringillidae	Plain Mountain Finch	*Leucosticte nemoricola*	Sch IV	Least Concern
424	Fringillidae	Common Rosefinch	*Carpodacus erythrinus*	Sch IV	Least Concern
425	Fringillidae	Scarlet Finch	*Carpodacus sipahi*	Sch IV	Least Concern
426	Fringillidae	Dark-rumped Rosefinch	*Carpodacus edwardsii*	Sch IV	Least Concern
427	Fringillidae	Crimson-browed Finch	*Carpodacus subhimachalus*	Sch IV	Least Concern
428	Fringillidae	Black-headed Greenfinch	*Chloris ambigua*	Sch IV	Least Concern
429	Emberizidae	Crested Bunting	*Emberiza lathami*	Sch IV	Least Concern
430	Emberizidae	Tristram's Bunting	*Emberiza tristrami*	Sch IV	Least Concern
431	Emberizidae	Little Bunting	*Emberiza pusilla*	Sch IV	Least Concern
432	Emberizidae	Chestnut Bunting	*Emberiza rutila*	Sch IV	Least Concern
433	Emberizidae	Black-faced Bunting	*Emberiza spodocephala*	Sch IV	Least Concern

APPENDIX IV: CHECKLIST OF MAMMALS OF THE DIBANG VALLEY

(Incomplete list)

	Common name	Scientific name	WLPA 1972	IUCN	Source
1	Tiger	*Panthera tigris*	Schedule I	EN	CT
2	Clouded leopard	*Neofelis nebulosa*	Schedule I	VU	CT
3	Asiatic golden cat	*Pardofelis temminckii*	Schedule I	NT	CT/DS
4	Marbled cat	*Pardofelis marmorata*	Schedule I	NT	CT
5	Leopard Cat	*Prionailurus bengalensis*	Schedule I	LC	CT/DS
6	Asiatic wild dog	*Cuon alpinus*	Schedule II	EN	CT
7	Himalayan black bear	*Ursus thibetanus*	Schedule II	VU	CT
8	Red panda	*Ailurus fulgens*	Schedule I	EN	CT
9	Spotted linsang	*Prionodon pardicolor*	Schedule I	LC	CT/DS
10	Masked palm civet	*Paguma larvata*	Schedule II	LC	CT
11	Yellow throated marten	*Martes flavigula*	Schedule II	LC	CT/DS
12	Yellow bellied weasel	*Mustela kathiah*	Schedule II	LC	CT
13	Siberian weasel	*Mustela sibirica*	Schedule II	LC	CT
14	Smooth-clawed otter	*Lutrogale perspicillata*	Schedule II	VU	CT
15	Mishmi takin	*Budorcas taxicolor taxicolor*	Schedule I	EN	CT/DS
16	Himalayan serow	*Capricornis sumatraensis*	Schedule I	NT	CT/DS
17	Gongshan muntjac	*Muntiacus gongshanensis*	Status undetermined	Data deficient	CT/DS
18	Indian muntjac	*Muntiacus muntjak*	Schedule III	LC	CT/DS
19	Wild pig	*Sus scrofa cristatus*	Schedule III	LC	CT/DS
20	Red goral	*Naemorhedus baileyi*	Schedule III	VU	CT/DS
21	Arunachal macaque	*Macaca munzala*	Status undetermined	EN	CT
22	Assamese macaque	*Macaca assamensis*	Schedule II	NT	CT
23	Hoary-bellied Squirrel	*Callosciurus pygerythrus*	Schedule II	LC	CT

24	Himalayan stripped squirrel	*Tamiops mcclellandii*	Schedule IV	LC	CT
25	Himalayan pika	*Ochotona himalayana*	Status undetermined	LC	CT
26	Mithun	*Bos frontalis*	Status undetermined	LC	CT
27	Himalayan jungle rat	*Rattus nitidus*	Schedule VI	LC	CT
28	Himalayan musk deer	*Moschus leucogaster*	Schedule I	EN	HS
29	Golden jackal*	*Canis aureus*	Schedule II	LC	CT
30	Common palm civet*	*Paradoxurus hermaphroditus*	Schedule II	LC	CT
31	Indian sambar*	*Rusa unicolor*	Schedule III	VU	CT
32	Rhesus macaque*	*Macaca mulatta*	Schedule II	LC	CT
33	Malayan porcupine*	*Hystrix brachyura*	Schedule II	LC	CT
34	Asiatic brush tailed porcupine*	*Atherurus macrourus*	Schedule II	LC	CT
35	Eastern hoolock gibbon (Mishmi Hills subspecies)*	*Hoolock leuconedys mishmiensis*	Schedule I	VU	DS
36	Chinese pangolin	*Manis pentadactyla*	Schedule I	CR	CT (WII 2019)
37	Particolored Gliding Squirrel	*Hylopetes alboniger*	Schedule II	LC	Krishna et al. (2016)
38	Pallas' squirrel	*Callosciurus erythraeus*	Schedule IV	LC	DS (WII 2019)
39	Grey Headed Gliding Squirrel*	*Petaurista caniceps*	Schedule II	LC	Krishna et al. (2016)
40	Hodgson's Giant Gliding Squirrel*	*Petaurista magnificus*	Schedule II	LC	Krishna et al. (2016)
41	Bhutan Giant Gliding Squirrel*	*Petaurista nobilis*	Schedule II	LC	Krishna et al. (2016)
42	Red Giant Gliding Squirrel*	*Petaurista petaurista*	Schedule II	LC	Krishna et al. (2016)
43	Mishmi Hill Giant Gliding Squirrel	*Petaurista mishmiensis*	Schedule II	LC	Krishna et al. (2016)
44	Yunnan Giant Gliding Squirrel	*Petaurista yunanensis*	Schedule II	LC	Choudhury (2013a)
45	Malayan Sun bear*	*Helarctos malayanus*	Schedule I	VU	CT

46	Leaf-nosed bat^	*Hipposideros larvatus leptophyllus*	-	LC	ZSI 2006
47	Pere David's Vole^	*Eothenomys melanogaster libonotus*	Schedule IV	LC	ZSI 2006
48	South China field mouse^	*Apodemus draco*	Schedule V	LC	ZSI 2006
49	Millard's Rat^	*Dacnomys millardi wroughtoni*	Schedule V	DD	ZSI 2006
50	Ryley's Spiny Mouse^	*Mus cookii nagarum*	Schedule V	LC	ZSI 2006
51	Brahma white-bellied rat^	*Niviventer brahma*	Schedule V	LC	ZSI 2006
52	Himalayan white-bellied Rat^	*Niviventer niviventer*	Schedule V	LC	ZSI 2006
53	Greater Horseshoe Bat^	*Rhinolophus ferrumequinum tragatus*	-	LC	ZSI 2006

Sources: CT- Camera trap record; DS – Direct sighting; HS – Hunted specimen collected by Nijhawan (2018) and Nijhawan and Mitapo 2020 (unpublished data)
**Evidence exclusively from Lower Dibang Valley district*
^Evidence from Dihang Dibang Biosphere Reserve (ZSI 2006)