**Review of Fauna of Dehang-Debang Biosphere Reserve, Arunachal Pradesh (India)**

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**Abstract:** The paper deals with the compilation of faunal diversity of Dehang-Debang Biosphere Reserve (DDBR) records from past works so as to create a comprehensive database of the faunal diversity of the BR at one place. Due to its rugged terrain and inaccessible landscape, the area has not been discovered so well from the biological diversity point of view, although its faunal diversity has been studied and reported by few workers. The areas in and around the Dehang Debang Biosphere Reserve contributes nearly 70% of the bird species of Arunachal Pradesh. The records reveal presence of 133 species of butterfly belonging to 8 families and 81 genera (as invertebrate record). While the vertebrate fauna is represented by 180 species of mammals, 492 species of birds,106 species of reptile, 43 amphibian species and 93 species of fish and yet to explore more.

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**Key Words:** Dehang Debang Biosphere Reserve, DDBR, Fauna, Arunachal Pradesh, Biodiversity.

**1. Introduction**

The Eastern Himalaya being the transition zone between Indian Indo-Malayan and Indian Indo-Chinese biogeographical regions is referred as “*Biogeographical gateway*” and it has created one of the biologically rich areas on the earth and recognized as Global Biodiversity Hotspots. Arunachal Pradesh is located between 26o28’and 29o30’North latitudes and 91o30’ and 96o30’ East longitude which covers an area of 83743sq.Km. The state is an abode for a wide range of floral and faunal wealth. It is one of the largest states of the Indian Himalayan Region (IHR). It is nature’s repository of medicinal plants and has an assemblage of 5 hornbill species and is one of the topmost birding areas in the world and has the second highest Important Bird Area (IBAs) in the northeast India (IBCN, 2004; Islam *et al*, 2004) and has rich avifauna with over 760 bird species and 10 species of Pheasants (SFRI, 2008). The state has nearly 213 species of fish and 55 species of Amphibians, more than 55 species of Snakes (Maheswaran, 2012) and as many as 71 species of chiropterans.

The Dehang-Debang Biosphere Reserve (DDBR) is one of the biologically very rich and largely undisturbed protected areas in Arunachal Pradesh. The DDBR was notified on 02.09.1998, it spreads over an area of 5111.5 km2, with buffer zone of 1016.7 km2. It represents one of the most diverse wildlife assemblages hosting one of the Eastern Himalayan Biodiversity Hotspot. The Reserve is an abode for wide variety of floral and faunal species. The two protected areas, Mouling National Park (483 Km2)and Debang Wildlife Sanctuary are located fully and partially within the Biosphere Reserve respectively. There are 12 major tribal communities inhabiting in and around DDBR whose main occupation is agriculture (mainly Jhum cultivation), cattle rearing and hunting and they depend directly on the forest resources for their daily needs. The topography of the Biosphere is characterized by steep to very steep and rugged terrain typical high mountainous, well drained with numerous rivers and gorges. Due to inaccessibility, the reserve though bestowed with rich faunal species, is poorly studied and much of its parts remains unexplored.

**2. Methodology**

The information available in the form of published literature paper, articles, reports, management plan and state faunal records from Zoological survey of India were collected and compiled. The different sources explored includes research papers, books, reports etc., for example Chaudhury (2003, 2004, 2008 & 2010), Sen and Mukhopadhyay (1999), Singh (1994), Athreya (2006), WWF (2006), Ghosh and Ringu (2002), Naoroji et al. (2005) etc. The data extracted from various sources was also processed and rectified with the help of online resources (such as www.iucnredlist.org) to prepare a detailed list of fauna with the systematic position, common name, scientific name, global distribution and status as per IUCN redlist of threatened animals.

**Table 1. Faunal diversity with global threat status of DDBR.**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Zoological Classification** | **Fauna** | **Family** | **Genera** | **Species** | **Global Status** | | | | | | |
|  |  |  |  |  | CE | EN | NT | VU | LC | DD | NA |
| Vertebrate | Mammals | 32 | 108 | 180 | 0 | 6 | 11 | 18 | 133 | 8 | 4 |
|  | Birds | 71 | 237 | 492 | 2 | 4 | 15 | 16 | 455 | 0 | 0 |
|  | Reptiles | 14 | 61 | 106 | 0 | 2 | 3 | 5 | 20 | 3 | 73 |
|  | Amphibian | 7 | 26 | 43 | 0 | 0 | 1 | 1 | 27 | 4 | 10 |
|  | Fish | 23 | 57 | 93 | 0 | 1 | 9 | 3 | 61 | 3 | 16 |
| Invertebrate | Butterfly | 8 | 81 | 133 | 0 | 0 | 0 | 0 | 0 | 0 | 133 |
| Total |  | 155 | 570 | 1047 | 2 | 13 | 39 | 43 | 696 | 18 | 236 |

TH-Threatened, CE-Critically Endangered, EN-Endangered, NT-Near Threatened, VU-Vulnerable, LC-Least Concern, DD-Data Deficient, NA-Not Assessed.

**3. Results and Discussion**

A total number of 1047 faunal species have been found reported in different sources belonging to (in and around) the Dehang Debang Biosphere Reserve, belonging to 570 genera and 155 families (Table 1). Table 1 is also representing faunal group wise number of species falling in different global conservation status as per IUCN redlist. Table 1 above clearly depicts that birds or avifauna is the largest group among all faunal groups reported in and around DDBR. The bird fauna contributes 47% with 492 species among other faunal groups followed by mammals (17%) and butterflies (13%) etc. (Figure 1). Amphibian is the lowest populated faunal group among others. Talking about the mammals, a total of 180 mammalian species are reported in and around DDBR which comprises of the order Chiroptera with the maximum 52 (29%) species followed by the Order Rodentia with 47 (26%) species, Carnivora of 39 (21%) species order Cetartiodactyla exhibits 16 (9%) species, order Eulipotyphla with 11(6%) species, order Primates contributes 6 (3%) species of which 5 are globally threatened, order Lagomorpha with 5 (3%) species and order Scandentia with 2 (1%) species, while the least of 1 species is contributed by the order Insectivora and Pholitoda.

**Figure 1. Percent species contribution of different faunal groups in DDBR.**

Avifauna which is the largest faunal group reported in and around DDBR comprises 492 species of 18 order, 71 families and 237 genera. The order Passeriformes is dominant with total 287 (58.3%) species belonging to 34 families followed by the order Falconiformes with 34 (6.9%) species, Charadriiformes with 28 (5.6%) species, order Galliformes 25 (5.8%) species with 8 globally threatened species, Anseriformes 23 (4.7%) species, order Piciformes 19 (3.8%) species, Ciconiiformes and Columbiformes 13 (2.6%) species each, order Coraciiformes 11 (2.2%) species, order Strigiformes and order Gruiformes 8 (1.6%) species each, order Cuculiformes, order Pelecaniformes and Apodiformes with 5 species each, order Caprimuliformes 3 species and the least species contributed by the order Podicipediformes and Trogoniformes (2 each) and Psittasiformes with only 1 species. Some 23 (4.6%) species of Migratory birds were also reported from the same area. It is important to highlight that out of 21 restricted range species in the Eastern Himalayan Endemic Bird Areas, 16 (76%) species namely *Arborophila mandellii,* *Garrulax virgatus,* *Spelaeornis caudatus, heterophasia pulchella, Tragopan blythii, Lophophorus sclateri,* *Stachyris oglei, sphenocichla humei, Actinodura waldeni, Yuhina bakeri, Alcippe ludlowi, Heterophasia picaoides, Phyllocospus cantator, Spelaeornis troglodytes,* *Tickellia hodgsoni and Harpactes wardii,* are reported to be found in DDBR.

Among the 106 species of reptilian fauna found in and around DDBR, order Squamata dominates the reptilian fauna with 97 (91%) species whereas, order Testudines represents only 9 (8.4%) species of which 8 species are threatened globally. The Threatened species includes *Batagur dhongoka, Cuora mouhotii, Cuora amboinensis*, Cyclemys dentate, *Melanochelys tricarinata, Nilssonia hurum, Ophiophagus Hannah, Pangshura smithii, Pangshura sylhetensis* and *Python molurus.*

The 43 species of Amphibian fauna is contributed by family Rhacophoridae contributing the maximum species of 15 (34.8%) species, followed by family Ranidae with 11 (25%) species, family Dicroglossidae with 7 (16%) species,family Megophryidae with 5 (11.6%) species, Bufonidae with 3 (7%) species, the family Microhylidae and Palobatidae contributes only 1 species each only. The species *Theloderma moloch* and *Rhacophorus reinwardtii* are the two threatened species that were reported among the amphibian fauna from DDBR. Among the Butterflies, the dominant family being Nymphalidea with 28 genera and 41 species followed by Papilionidae and Satyridae with 9 and 12 genera and 22 species each, Lycanidae comprising of 14 genera and 20 species and Peridae with 10 genera and 16 species.

While the 93 species of fish fauna comprises of 7 orders of which the order Cypriniformes represented by 53 (57%) species, followed by order Siluriformes with 22 (24%) species, Perciformes with 12 (12%) species, order Symbranchiformes with 3 species and least species by the order Osteoglossiformes, Clupeiformes and Beloniformes contributes only 1 species. There are 13 globally threatened fauna that were recorded from the BR, these includes *Aborichthys kempi, Bagarius bagarius, Botia rostrata, Cyprinion semiplotum, Labeo pangusia, Neolissochilus hexagonolepis, Ompok bimaculatus, Ompok pabda, Ompok pabo, Schizothorax richardsonii, Tor putitora, Tor tor* and *Wallago attu.* Most of the fish species representing the fish fauna of DDBR were recorded from Mouling National park as per the available sources.

**4. Conclusion**

As per the available database it is clearly reflected that DDBR is indeed a treasure of faunal wealth and certainly there is a lot more to be further explored. In general the biotic components face a lot of threats globally but as far as Dehang-Debang Biosphere Reserve is concern, due to its inaccessible terrain and topography the place is somewhat safe from many forms of the threats. However, in contrast, many studies have revealed that a significant number of faunal species found in and around DDBR are facing local threats because of various reasons. Among these species, many are listed under different IUCN threat categories and also listed under schedule I-IV of Wildlife Protection Act (WPA) 1972 (Table 2). As presented in Table 2, there are 36 species belonging to different faunal groups which are being harnessed for medicinal, cultural and different other uses (Chakravorty et al., 2011; Chakravorty et al., 2011; Solanki & Chutia, 2004; Chinlampiaga et al, 2013 etc.). Consequently, these species are under stress locally. Hornbills and galliformes are most threatened species. Some of the faunal species those are known to be Least Concern (LC) as per the Global status in the IUCN redlist are being hunted for various ritualistic and medicinal values. For example, Squirrels are hunted for marriage related rituals (Table 2), if hunting of this species continuous there are likely chances that squirrels may come under vulnerable (VU) or endangered (EN) status in near future. In Arunachal Pradesh, there is the seasonality of hunting and hunting is intensive during jhum cultivation and harvesting of the crops (Chutia and Solanki, 2013), although the role of Jhum agriculture can again be a matter of separate debate. However, it is important to understand that the presented facts and figures are alarming and clearly showing the need of conservation efforts.

**Table 2. Conservation status of faunal species found in and around DDBR and their local uses.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S.**  **No.** | **SCIENTIFIC NAME** | **COMMON NAME** | **IUCN STATUS (IUCN 3.1 RED DATA** | **STATUS AS PER WPA 1972 AND CITES** | **USES OF FUANAL RESOURCES IN ARUNACHAL PRADESH** |
| 1. | Neofelis nebulosa Griffith, 1821 | Clouded Leopard | Vulnerable | WPA,1972 Sch – I | Hunted for meat,skin and Bone marrow to massage body pain (Chakravorty *et a*l., 2011) |
| 2. | Panthera pardus Linnaeus, 1758 | Leopard | NT | WPA,1972 Sch – I/CITES appen - I | Hunted for meat and medicine for Malaria,typhoid and rheumatic pain. (Solanki & Chutia, 2004) |
| 3. | Panthera tigris Linnaeus, 1758) | Tiger | EN | WPA,1972 Sch – I/CITES appen - I | Hunted for meat,skin and dried bones as paste used for curing rheumatic and body pain. (Solanki & Chutia, 2004) |
| 4. | Pardofelis marmorata Martin, 1837 | Marbled Cat | VU | WPA,1972 Sch – I | Hunted for meat and skin. (Solanki & Chutia, 2004) |
| 5. | Ursus thibetanus G. [Baron] Cuvier, 1823 | Himalayan Black Bear | VU | WPA,1972 Sch – I | Hunted for meat, teeth and gall bladder (medicine for malaria, typhoid and T.B.), dried skin as armour (known as *Khuk* by Monpas) and headgear & shoulder belt (Nyshi), (Solanki & Chutia, 2004) |
| 6. | Felis chaus Schreber, 1777 | Jungle cat | LC | WPA,1972 Sch – II/CITES - II | Skin and fur for aesthetic use by males during special occasion. (Solanki & Chutia, 2004) |
| 7 | Vulpes bengalensis Shaw, 1800) | bengal fox | LC | WPA,1972 Sch – II/CITES – III | Hunted for food. Meat boiled or roasted is used for treatment of TB and bones in fertility. (Chakravorty *et a*l, 2011) |
| 8. | Canis aureus Linnaeus, 1758 | golden jackal | LC | WPA,1972 Sch – III/ CITES – III | Hunted for meat and bones to treat skin disease. (Solanki & Chutia, 2004) |
| 9. | Bos gaurus C.H. Smith, 1827 | Indian Bison | VU | WPA,1972 Sch – I/CITES appen – I | As wild meat (Solanki & Chutia, 2004) |
| 10. | Budorcas taxicolor Hodgson, 1850 | Takin | VU | WPA,1972,Sch – I/ CITES appen - II | One of the endemic species is hunted for meat,skull and skin display at household. (Solanki & Chutia, 2004) |
| 11 | Moschus fuscus Li, 1981 | Black musk deer | EN | CITES append - I | Musk pod exported illegally from the local by outsider (Solanki & Chutia, 2004) |
| 12 | Moschus moschiferus Linnaeus, 1758 | Siberian Musk Deer | VU | CITES appen - II | Hunted for meat and musk which is used for therapeutic purpose for malaria and diarrhea (Solanki & Chutia, 2004) |
| 13 | Naemorhedus goral Hardwicke, 1825 | Himalayan Goral | NT | WPA,1972,Sch – III/ CITES - I | Skin to partly covered hand fan (Solanki & Chutia, 2004) |
| 14. | Rusa unicolor Kerr, 1792 | Sambar | VU | WPA,1972,Sch – III | Dried skin as coat (known as *Pakcha)* to protect from severe climate. Crush horn with salt for bursting boils (Chakravorty *et a*l, 2011) |
| 15. | Sphaerias blanfordi Thomas, 1891 | Blandford's fruit bat | LC | ----------- | Hunted for meat,skin used for skin diseases and bones as taboo item. (Chinlampiaga et al., 2013) |
| 16. | Manis pentadactyla Linnaeus, 1758 | Chinese pangolin | EN | WPA,1972,Sch – I/CITES append - II | Nails used to pierce boils (Chakravorty *et a*l, 2011) |
| 17. | Macaca assamensis M'Clelland, 1840 | Assamese Macaque | NT | WPA,1972,Sch – II/CITES append - II | Hunted for meat as it has good medicinal properties and used to treat disease like small pox,malaria etc. (Solanki & Chutia, 2004) |
| 18. | Trachypithecus pileatus Blyth, 1843 | Capped langur | VU | WPA, 1972,Sch – I/CITES append - I | Meat as food and as ethno-medicine and for socio-cultural practices (Solanki & Chutia, 2004) |
| 19. | Macaca mulatta Zimmermann, 1780 | Rhesus Monkey | LC | WPA, 1972,Sch – I/CITES append - II | Meat for treating diseases like malaria, cholera. Skull & finger or palms are hung to door to calm evil spirit (Solanki & Chutia, 2004) |
| 20. | Macaca munzala Madhusudan & Mishra, 2005 | Arunachal Macaque | VU | CITES append -II | Hunted for meat,sport and medicine for sick livestocks as well,juveniles as pet. (Solanki & Chutia, 2004) |
| 21. | Ratufa bicolor Sparrman, 1778 | Malayan Giant Squirrel | NT | WPA,1972,Sch – II | Hunted for meat and used dowry item. (Chinlampiaga et al, 2013) |
| 22. | Hystrix brachyura Linnaeus, 1758 | Himalayan Crestless Porcupine | LC | WPA, 1972,Sch – II | Boiled gall bladder,stomach and intestine are used to cure Diahoea, gastritis and TB. (Chakravorty *et a*l, 2011) |
| 23. | Dremomys lokriah Hodgson, 1836 | Orange bellied Himalayan Squirrel | LC | WPA, 1972,Sch – IV | As gift to bride’s family during marriage ceremony and other social ceremonies and as medicine also. (Chinlampiaga et al, 2013) |
| 24 | Callosciurus pygerythrus, I. Geoffroy Hilaire, 1832 | Irrawaddy squirrel | LC | WPA, 1972,Sch – II | Hunted for meat and used dowry item (Chinlampiaga et al, 2013) |
| 25. | Hylopetes alboniger (Hodgson, 1836) | Particolored Flying Squirrel | LC | WPA, 1972,Sch – II | Hunted for meat and used dowry item (Chinlampiaga et al, 2013) |
| 26. | Belomys pearsonii Gray, 1842 | hairy footed flying squirrel | DD | WPA, 1972,Sch – II | Hunted for meat and used dowry item (Chinlampiaga et al, 2013) |
| 27. | Tamiops macclellandi Horsfield, 1840 | Himalayan striped Squirrel | LC | WPA, 1972,Sch – IV | Hunted for meat and used dowry item (Chinlampiaga et al, 2013) |
| 28. | Aceros nipalensis Hodgson, 1829 | Rufous necked hornbill | VU | WPA, 1972,Sch- I /CITES append – I/II | Mostly hunted species, beak, decorate traditional headgear (*Nyshi* tribe), feathers to adorn headdresses (*Wancho* & *Nocte* tribe), fat for body massage. (Chakravorty *et a*l., 2011) |
| 29. | Tragopan blythii Jerdon, 1870 | Blyths tragopan | VU | WPA,1972 Sch – I/CITES append- I | Tail feather as hand fan. (Aiyadurai, 2012). |
| 30. | Lophophorus sclateri Jerdon, 1870 | Sclater’s monal | VU | WPA,1972 Sch - I | Feather used as hand fan by chanting priest, wing feather worn around neck by women (Aiyadurai, 2012) |
| 31. | Gracula religiosa Linnaeus, 1758 | Hill myna | LC | -------------- | Hunted for meat as energy enhancement. (Chinlampiaga et al, 2013) |
| 32. | Python molurus Linnaeus, 1758 | Indian Python | NT | WPA,1972 Sch – I/CITES, append- I | Body fat massage for joint pain (Chakravorty *et a*l., 2011) |
| 33. | Naja kaouthia Lesson, 1831 | Monocled Cobra | LC | CITES, appendix – I | Cooked meat used in disease like cold (Chakravorty, *et a*l., 2011) |
| 34. | Bagarius bagarius Hamilton, 1822 | NA | NT | ------------- | Smoked dried bones/Fins are used for burns and stomach ache. (Chakravorty, *et a*l, 2011) |
| 35. | Sus scrofa Linnaeus, 1758 | Wild Boar | LC | WPA, 1972,Sch – III | Meat in food,bones in fertility and skull in hunting art. (Chinlampiaga et al, 2013) |
| 36. | Varanus bengalensis. | Monitor lizard | LC | WPA, 1972,Sch – III | Flesh boiled and taken as preventive measure for cough and fever. (Chakravorty *et a*l, 2011) |

TH-Threatened, CE-Critically Endangered, EN-Endangered, NT-Near Threatened, VU-Vulnerable, LC-Least Concern, DD-Data Deficient, NA-Not Assessed.

**References:**

1. Aiyadurai A. Bird Hunting in Mishmi Hills of Arunachal Pradesh, North-East India. Indian Birds 2012; 7(5):134-137.
2. Athreya R. A new species of Liocichla (Aves: Timaliidae) from Eaglenest Wildlife Sanctuary, Arunachal Pradesh, India. Indian Birds 2006; 2 (4): 82–94.
3. Chakravorty J, Meyer-Rochow VB and Gosh S. Vertebrates used as Medicine by Nyshi and Galo tribes of Arunachal Pradesh (North- East India). Journal of Ethnobiology and Ethnomedicine 2011; 7:13.
4. Chakravorty J, Ghosh S and Meyer-Rochow VB. Practice of entomophagy and entomotherapy by members of the Nyshi and Galo tribes, two ethnic groups of the state of Arunachal Pradesh (North-East India). Journal of Ethnobiology and Ethnomedicine 2011; 7:5.
5. Chinlampainga M, Ranjay KS and Shukla AC. Empirical learning with traditional knowledge holders of Mizoram and Arunachal Pradesh. Indian Journal of Traditional knowledge 2013; 12(1):18-30.
6. Choudhury AU. A pocket guide to the Birds of Arunachal Pradesh. Gibbon Books and the Rhino foundation for nature in NE India, Guwahati 2004.
7. Choudhury AU. Mammals and Birds in Dihang-Dibang Biosphere Reserve, Arunachal Pradesh. Tigerpaper 2010; XXXVII (4): 1-4.
8. Choudhury AU. Survey of mammals and birds in Dihang-Dibang Biosphere Reserve, Arunachal Pradesh. Final Report to Ministry of Environment and Forest, Govt. of India. The Rhino Foundation for nature in North East India, Guwahati 2008; 1- 70.
9. Choudhury, AU. A preliminary survey of Mammals and Birds in Dehang Debang Biosphere Reserve.Himalayan Biosphere Reserves 2003; 5(1&2): 56-60.
10. Chutia P and Solanki GS. Pattern of Bird Hunting in Arunachal Pradesh and Implications for Biodiversity Conservation. Tropical Ecology 2013; 54(2):263-267.
11. Ghose D and Ringu P. Diversity, distribution and threats to Galliform species in Dehang Debang Biosphere Reserve, Arunachal Pradesh, India. Himalayan Biosphere Reserves 2002; 4(1&2): 44-48.
12. IBCN. Important bird areas in Indian - Arunachal Pradesh. Indian Bird Conservation Network (IBCN) 2004; 169-230. (http://ibcn.in/?page\_id=593).
13. IBCN. Indian Bird Conservation Network. Important bird areas in Indian - Avifauna of India. IBCN 2004; 8-24. (<http://ibcn.in/?page_id=593>).
14. Islam MZ, Rahman AR. Important bird areas of India: Priority sites for conservation network. Bombay Natural History Society and Bird Life International (UK) 2004; 1-205.
15. IUCN. IUCN Red List Categories and Criteria version 3.1 2001. (http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria).
16. Maheswaran, G. Fauna of Protected Areas of Arunachal Pradesh. Edited by Director Zoological survey of India. Special publication on the occasion of CBD, CoP-11, 2012;1-20.
17. Naoroji R, Sangha HS. Arunachal Pradesh, India. An ornithological diary from December 2005. Indian Birds 2006; 2(5): 120–131.
18. Sen AK and Mukhopadhyay SK. Avifauna of Mouling National Park, Arunachal Pradesh, India. Current Science 1999; 76 (10): 1305-1308.
19. Singh P. Recent Bird records from Arunachal Pradesh, India. Forktail 1994; 10: 65-104.
20. Solanki GS and Chutia P. Ethno Zoological and Socio-Cultural Aspects of Monpas of Arunachal Pradesh. Journal of Human Ecology 2004; 15(4):251-254.
21. WWF. Review of biodiversity of North East India, Background paper No. 13. WWF 2006. (http://siteresources.worldbank.org/INTSAREGTOPWATRES/Resources/Background\_Paper\_13).

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