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Endemic and endangered fauna of North-East India: present scenario.

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Abstract

North-Eastern states of India with its diverse topographic, climatic as well as ecological conditions support diverse life forms. Because of its unique and rich biodiversity, this region is a distinctive part of the Indo – Burma biodiversity hotspot along with two endemic bird areas. This region harbor around 170 globally threatened species. In case of vertebrate fauna, this area is rich in their endemicity and enriched with a sizable number of endemic Icthyofauna (138), Amphibian (18 species), Reptiles (7 species), Aves (7 species) and Mammals (8 species). As increasing population and various anthropogenic activities are standing high as serious threat to biodiversity of the world. Unfortunately, the region too experiencing an increase in spopulation growth and subsequent high demand for natural resources. Thus, various developing and anthropogenic activities along with other natural calamities are pushing the biodiversity of the area towards its decline. As a result, around 15 vertebrate species are critically endangered and 70 species are being considered as endangered. Thus, in this chapter, we will be focusing on the present IUCN status of the endemic species and endangered species of the region along with the conservational approaches presently under execution. Further, stress will also be given on the adverse affect of natural calamities on biodiversity of the area and possible scope of improvement in conservation strategies.

Keywords: Faunal diversity, Endemic, Endangered, North East India

1. Introduction

The North-Eastern states of India are the home for diverse life forms with its unique topographic, climatic as well as ecological conditions. Northeastern India comprises of eight Indian states- Assam, Meghalaya, Manipur, Nagaland, Arunachal Pradesh, Tripura, Mizoram and Sikkim with a total area of around 2, 62,179 km^2 and covers only 8% of country's total area (A. Choudhury, 2006). The region lies between the latitudes of 21.57" to 29.30" N and longitudes of 84.46" to 97.30" E with an elevation of 200 to 900 m from the sea level (Sarkar & Ponniah, 2006). In its physiographic, the region is divided into six components - the Himalaya in the north, the hill ranges in the east, the Meghalaya plateau, the plains of the Brahmaputra and Barak rivers, the Manipur valley and the Mt. Kanchenjunga in western Sikkim (A. Choudhury, 2006). Diverse habitats of the region with around 51 forests types support diverse life forms. Generally, six major forest types such as- tropical wet evergreen, tropical semi evergreen, tropical moist deciduous, subtropical, temperate and Alpine forests are found in the region along with six important vegetation types out of 9 types present in India (Chatterjee, Saikia, Dutta, Ghosh, & Worah, 2006).

As the transitional zone of the three biogeographic regions- the Himalayan, the Indian and the Indo-Chinese the region forms a distinctive part of the Indo-Burma biodiversity hotspot (Previously known as Eastern Himalaya hotspot) (A. Choudhury, 2006). Biodiversity hotspots are extremely rich in species composition where at least 1,500 species of vascular plants (>0.5% of the world's total) must be endemic and the area has to have lost at least 70% of its original habitat. Globally there are 36 biodiversity hotspots including the Himalaya, Indo Burma, Sundalands and Western Ghats from India.

2. Faunal diversity of the region

The unique topography of the region supports a plethora of habitats such as grassland, wetland, swamps,

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tropical evergreen and deciduous forest, subtropical and temperate forests, and Alpine tundra (A. Choudhury, 2004). With significant forest covers, the region holds around 15 national parks and 54 wildlife sanctuaries along with many reserved forests. The Indo-Burma biodiversity hotspot which also holds two endemic bird areas (Eastern Himalaya and Andamans) (Myers, Mittermeler, Mittermeler, Da Fonseca, & Kent, 2000) are the home of around 2,185 vertebrates species of which 528 are endemic to the region (Singh, Singh, & Singh, 2009). Being a part of Indo-Burma biodiversity hotspot, NE India also holds diverse flora and fauna with significant number of endemic and threatened species. The region embrace around 300 species of mammals, 977 species of birds, 176 species of reptiles, 110 species of Amphibians, 422 species of fishes (Goswami et al., 2012; Saikia, 2013).

3. Endemic and endangered fauna of the region

3.1. Endemic fauna of the region

Endemism is referred to the restricted occurrence of a species in a locality or defined geographical area and found nowhere else in the world except that particular area. Endemic species representative the unique habitat, ecological as well as topographical characteristics of an area. If the species is recorded from another country afterwards, the endemicity of the original country gets lost.

The north eastern region of India holds around 8 endemic species mammals, 7 species of aves, 7 species of reptiles, 18 species of amphibians and around 138 species of fishes. Table 1 presents endemic vertebrates of the region expect fishes due to large number of species.

Scientific name	Common name	Distribution	IUCN Status	Population trend	Reference
Mammals					
Anourosorex assamensis	Assam Mole Shrew	Assam; Meghalaya; Manipur; Nagaland; Arunachal Pradesh	LC	Unknown	(Molur, 2016)
Biswamoyopterus biswasi	Namdapha Flying Squirrel		CR	Decreasing	(Molur, 2017)
Hadromys humei	Hume's Rat	Namdapha NP; Arunachal Pradesh	EN	Decreasing	(Molur & Laginha Pinto Correia, 2016)
Macaca munzala	Arunachal Macaque		EN	Decreasing	(Kumar, A. Sinha & Kumar, 2020)
Hipposideros khasiana	Khasian Leaf-nosed Bat	Kamrup district, Assam; Bishnupur, Senapati, Manipur at elevations	DD	Unknown	
Trachypithecus geei	Gee's Golden Langur		EN	Increasing	(Srinivasulu & Srinivasulu, 2019)
Rucervus eldii eldii	Sangai deer Pygmy Hog		EN	Unknown	
Porcula salvania		Tawang District, western part of West Kameng, Arunachal Pradesh; Similar species is found in Mouling NP, Arunachal Pradesh, however taxonomic identity of these animals needs confirmation	EN	Decreasing	(J. Das, Medhi, & Molur, 2008)
Aves			VU	Decreasing	(Gray et al., 2015)
Perdicula manipurensis	Manipur Bush-quail		VU	Decreasing	(Meijaard, Narayan, & Deka, 2016)
Pellorneum palustre	Marsh Babbler		VU	Decreasing	
Spelaeornis longicaudatus	Tawny-breasted Wren-babbler		VU	Decreasing	
Stachyris oglei	Snowy-throated Babbler		CR	Decreasing	(BirdLife International, 2017c)
Paradoxornis flavirostris	Black-breasted Parrotbill	Meghalaya	-	Unknown	(Birdlife International, 2016c)
Spelaeornis badeigularis	Rusty-throated Wren-babbler	Forest belt in western Assam between the Manas River in the east, Sankosh in the west and Brahmaputra in the south along the Indo-Bhutan border	-	Unknown	(Birdlife International, 2019)
Liocichla bugunorum	Bugun Liocichla		-	Unknown	(Birdlife International, 2017c)
Reptiles			-	Unknown	(Birdlife International, 2016b)
Cyrtodactylus gubernatoris	Sikkimese Bent-toed Gecko	Keibul Lamjao NP	-	Unknown	(Birdlife International, 2017b)
Cnemaspis assamensis	Assamese Day Gecko	Manas NP	EN	Unknown	(BirdLife International, 2018c)
Takydromus haughtonianus	Goalpara grass lizard	Dibru-Saikhowa NP; Manas NP; Bangldesh- uncertain	DD	Unknown	
Takydromus sikkimensis	Sikkim grass lizard	D'Ering WS; Dibru-Saikhowa NP; Kaziranga NP; Orang NP; Manas NP	DD	Unknown	
Amphiesma pealii	Assam Keelback		DD	Unknown	(Bohm & Richman, 2015)
Amphiesma xenura	Walls Keelback		DD	Unknown	
Stoliczkia khasiensis	Khasi earth snake	Khasi Hills of Meghalaya; North Cachar Hills; Naga Hills	LC	Unknown	The Reptile Database, 2020
	Khasi Hill Rock Toad	Namdapha NP; Kamlang WS, Arunachal Pradesh; Assam; Manipur	DD	Unknown	-do-
	Manipur Frog		LC	Decreasing	-do-
	Unknown		DD	Unknown	-do-
	Mawlindip Frog		DD	Unknown	-do-

Amphibia	Mokokchung Frog	Mishmi Hills, Eastern Arunchal Pradesh; other north-east Indian hills	VU	Decreasing	-do-
Bufoides meghalayanus	Orang Sticky Frog		DD	Unknown	-do-
	Assamese Balloon Frog		CR	Decreasing	
Euphlyctis ghoshi	Assamese Cascade Frog	Eaglenest WS	DD	Unknown	(IUCN SSC Amphibian Specialist Group, 2015)
Limnonectes khasianus	Garo Hills Frog		DD	Unknown	
Limnonectes mawlyndipi	Mawphlang Wart Frog	Sikkim	DD	Unknown	(Dutta, Ohler, Sengupta, & Bordoloi, 2004)
Nanorana mokokchungensis	Cherrapunji Bubble-nest Frog	Mayeng RF			(Ohler, 2004)
Kalophrynus orangensis	Garo Hills Bubble-nest Frog	Goalpara	LC	Unknown	(Dutta, Ohler, Bordoloi, & Sengupta, 2004a)
Kaloula assamensis	Tirap Bubble-nest Frog	Sikkim			(Bordoloi, Ohler, & Dutta, 2004)
Amolops assamensis	Shillong Bush Frog	Assam; Arunachal Pradesh			(Dutta, Ahmed, Sengupta, & Bordoloi, 2004)
Hylarana garoensis	Kuttal Caecilian	Assam; Meghalaya			(F. Ahmed, Sengupta, & Angulo, 2009)
Odorrana mawphlangensis	Garo Hills Caecilian	Meghalaya; Assam			(IUCN SSC Amphibian Specialist Group, 2010)
Chiromantis cherrapunjiae	Manipur Moustached Ichthyophis	Cherrapunjee; East Khasi Hills; May occur in Ngengpui WS, Dampa TR, Mizoram and Garo hills, Meghalaya			(Dutta, Ohler, Sengupta, Bordoloi, & Roy, 2004)
Philautus garo	Suffry Red-webbed Treefrog	Khugairk RF			(Dutta, Ohler, Bordoloi, & Sengupta, 2004b)
Philautus namdaphaensis		Khasi Hills			(Sengupta & Bordoloi, 2004)
(Raorchestes)Pseudophilautus shillongensis		Khasi Hills			(Ohler, Sengupta, & Roy, 2004)
Chikila fulleri		Mokokchung, Nagaland			(Ohler & Saibal, 2004)
Ichthyophis garoensis		Orang NP			(Dutta, Ohler, & Roy, 2004)
Ichthyophis moustakius		Nameri NP; Orang NP; Pakhui WS			(Ohler, Dutta, Gower, & Wilkinson, 2004)
Rhacophorus suffry		Mayeng Hill RF			(Dutta et al., 2015)
		Nagaland; Meghalaya; Arunachal Pradesh; Assam			(IUCN SSC Amphibian Specialist Group, 2012)
		Meghalaya; Manipur; Nagaland			(Bordoloi, Sengupta, Ohler, & Agarwal, 2008)
		Cherrapunji; Namdapha NP; Garo Hills; Dzulake			
		Namdapha NP; Tirap district, Arunachal Pradesh			
		Shillong			
		Near Silchar, Assam.			
		Garo Hills; Assam			
		Manipur			
		Nameri NP; Dihingpatkai WS; Wokha district, Nagaland; Pakke WS; Eaglenest WS			

Table 1. Endemic fauna of North Eastern India with their IUCN threatened status. NP= National Park, WS= Wildlife Sanctuary, RF= Reserve Forest, TF= Tiger Forest, CR= Critically Endangered, EN= Endangered, LC= Least Concern, VU= Vulnerable, DD-Data Deficient.

3.2. Endangered fauna of the region

Endangered species are threatened species with high risk of extinction and categorized as Critically Endangered (CR) and Endangered (EN) by the IUCN. In region, many vertebrate species are facing risk of extinction. Species enlisted in the CR category are facing very high risk of extinction due to rapidly declined population (80 to >90% over last 10 years or three consecutive generations), smaller sized current population (comprising <50 individuals), or other factors. EN species too face high risk of extinction caused by rapid population declination of 50 to >70 % over last 10 years (or three generations), current population size covers fewer than 250 individuals, or other factors. Various conservational approaches have been introduced to keep the natural habitat of the wild animals intact and can be upgraded to least threatened position. CITES (The Convention on International Trade in Endangered Species of Wild Fauna and Flora) is one of such approach. Around 5000 faunal species have been included in the three lists of appendices. Appendix I enlisted 1200 species, threatened due to trade and needs permission to export and import. Appendix II enlisted 21000 species that does not require import permit under CITES and Appendix III enlisted 170 species, which can be permitted for trade after appropriate export permit and a certificate. The Convention on Migratory Species (CMS) is an international agreement with objective to conserve migratory species. Migratory threatened species enlisted in Appendix I of the Convention, are aimed to protect strictly by conserving or restoring their native places, mitigating obstacles to migration and also controlling other factors that makes them threatened. Appendix II is considering the migratory species that are in need of international co-operation for the benefit. In India, the Wildlife Protection Act, 1972 includes six schedules; the first one includes the EN species, the trade and hunting of which is strictly prohibited. Schedule II also focuses on the prohibitions of their killing for human safety and trading. Schedule III and IV are also with protective measures. Schedule V allows hunting of some animals, while Schedule VI is associated to the prohibition of cultivation of specified endemic plants.

The region holds around 3 critically endangered and 14 endangered mammals, 6 critically endangered and 4 endangered aves, 4 critically endangered and 3 endangered reptiles and 1 critically endangered and 1 endangered amphibian and 1 critically endangered and 48 endangered fishes. Table 2 shows critically endangered species of all the five classes and endangered species of the classes except fish along with threats, conservational approaches underway and required. Endangered fishes are not listed in table 2 due to huge number of species.

Species names	Major Threats	Present Conservational approaches	Conservational measures required	References
Mammals (CR)				
Dicerorhinus sumatrensis	Habitat loss; Hunting; Anthropogenic disturbance; Drought climate	Habitat conservation & management; Ex-situ conservation;Invasive species control	Species recovery & management Species reintroduction & management	(Ellis & Talukdar, 2008a) (Ellis & Talukdar, 2008b) (Molur, 2017)
Rhinoceros sondaicus				
Biswamoyopterus biswasi	Natural habitat loss; Hunting	Habitat protection & management	Research to develop conservational measures	(Gray et al., 2015) (Meijaard et al., 2016)
Mammals (EN)	Hunting; Habitat degradation & loss due to landslide, flood	Habitat management; Distributional range survey	Conservation of natural habitat	(J. Das et al., 2008) (Brockelman, Molur, & Geissmann, 2019)
Rucervus eldii eldii				
Porcula salvania				
Trachypithecus geei	Habitat loss due to continuous inundation; Water pollution	Species relocation Pygmy hog conservation program, 1995; Captive breeding; Species reintroduction	Behavioral research; monitoring in wild Protection, restoration of habitat Site & habitat protection & management	(Glatston, Wei, Than, & Sherpa, 2015) (Braulik & Smith, 2019) (A. Choudhury et al., 2008) (Gardner, Hedges, Pudyatmoko, Gray, & Timmins, 2016) (Kaul, Williams, Rithe, Steinmetz, & Mishra, 2019)
Hoolock hoolock				
Ailurus fulgens				
Platanista gangetica				
Elephas maximus	Habitat loss & alteration;Livestock grazing, declining grassland;Hunting	Habitat conservation Habitat conservation	Habitat protection, restoration; Species reintroduction & management	
Bos javanicus				
Bubalus arnee				
Budorcas taxicolor taxicolor	Anthropogenic disturbance; Habitat fragmentation	Habitat conservation; ex-situ conservation	Habitat protection;	
Eupetaurus				

cinereus	Anthropogenic disturbance; Habitat loss; Hunting	Habitat conservation	Species recovery & management	(Song, Smith, & MacKinnon, 2008)
Caprolagus hispidus	Anthropogenic disturbance; Habitat loss, shifting & alteration;	Habitat conservation; Human –elephant conflict management;	Habitat restoration; Species management;	(Zahler, 2010)
Hadromys humei	Habitat destruction, alteration due to construction of Dams;	CITES Appendix-I	Awareness and training	(Aryal & Yadav, 2019)
Macaca munzala	Water pollution	Habitat conservation	Habitat management; ex-situ conservation;	.(Molur & Laginha Pinto Correia, 2016)
Aves (CR)	Habitat loss, degradation, fragmentation; Poaching , Human-elephant conflict	Legally protected from hunting, trade; Habitat conservation	Species	(Kumar, A. Sinha & Kumar, 2020)
Rhodonessa caryophyllacea	Habitat loss; Hunting	CITES Appendix II,	Protection of genetic diversity of the wild	(Birdlife International, 2018b)
Gyps bengalensis	Loss of genetic diversity; Hunting; Diseases	Legally protected, listed, Habitat protection	Population survey;	(BirdLife International, 2017a)
Gyps tenuirostris	Deforestation, habitat fragmentation;Hunting	Habitat conservation,	Potential protected areas for species management	(BirdLife International, 2017b)
Ardea insignis	Deforestation; Habitat loss	Schedule II of Indian wildlife Act, 1972	Habitat protection, restoration and & management	(BirdLife International, 2018a)
Houbaropsis bengalensis	Habitat loss due to human encroachment; Invasive species	Habitat conservation, Listed in Schedule I of Indian wildlife Act 1972	Protection, restoration of natural habitat; ethological research	(BirdLife International, 2018b)
Liocichla bugunorum	Habitat loss, fragmentation, Hunting, fire	Schedule V of the Indian Wildlife (Protection) Act, 1972	Extensive survey &monitoring	(BirdLife International, 2018c)
Aves (EN)	Killing by people for damaging crops	CITES Appendix II	Extensive study for management of the species	(Birdlife International, 2018a)
Ciconia boyciana	Habitat destruction and loss; Alteration of wetlands due to invasive species; Hunting	CITES Appendix I, CMS Appendix I	Protection and management of habitats, population & systematic survey	(Birdlife International, 2016a)
Leptoptilos dubius	Toxic NSAID (Diclofenac); Habitat loss; Food scarcity	CITES Appendix II, Banning of Diclofenac as veterinary drug; Vulture safe zone creation	Prevention in use of Diclofenac and other toxic drug; more safe zones, species restoration and management	(Birdlife International, 2017a)
Cairina scutulata	Toxic NSAID (Diclofenac) ; Habitat loss, Food scarcity	CITES Appendix II, CMS Appendix II; Banning of Diclofenac as veterinary drug, Vulture safe zone creation	Needs to check the use of Diclofenac and other toxic drug, more safe zones, species restoration and management	(BirdLife International, 2017c)
Perdicula manipurensis	Loss, degradation & destruction of forest and wetland; anthropogenic disturbance	Captive breeding; Community level awareness for participation in conservation	Extensive study on their population, ecology, breeding behavior	(Lang, Chowfin, & Ross, 2019)
Reptiles (CR)	Extensive habitat loss & alteration; heavy flood	CITES Appendix I;Bengal florican conservation area network (BFCA);	Protection & management of grasslands inside and outside the BFCA & its possible expansion; research on habitat requirements	(Rahman et al., 2019)
Gavialis gangeticus	Habitat fragmentation & loss	Protection & management of breeding habitats	Study on the population, ecology, threats of the species	(B. C. Choudhury et al., 2019)
Indotestudo elongata	Deforestation, destruction of wetlands, decline in breeding ground	Habitat protection	Extensive survey on population; protection, restoration & management of nesting & breeding sites, feeding ground	(I. Das, Choudhury, Praschag, Ahmed, & Singh, 2019)
Manouria emys	Habitat destruction; Hunting; nesting & feeding ground destruction; Pollutants	CITES Appendix I; CMS Appendix I; Reintroduction of species		(Asian turtle Trade Working Group, 2000)
Kachuga dhongoka	Destruction, degradation	Protection of nesting trees; Rehabilitation of species & community awareness		(Asian Turtle Trade Working Group, 2000)
Reptiles (EN)		CITES Appendix I;Habitat protection		(M. F. Ahmed, Horne, Li, P., Platt, Rahman, & Wang, 2020)
Chitra indica		Population survey is ongoing		(Dutta, Ohler, & Roy, 2004)
Pangshura sylhetensis				(IUCN SSC Amphibian Specialist Group, 2015)
Cuora mouhotii				(Vishwanath, 2010)
Amphibians (CR)				
(Raorchestes)Pseudophilautus shillongensis				
Amphibian (EN)				
Bufoides meghalayanus				
Fishes (CR)				
Schistura papulifera				

	& disturbance in riverine & forest habitats; Hunting	Habitat protection, Species protection & management; Head staring; Captive breeding & population re-establishment	Protection of nesting & feeding sites outside protected areas, research on population trend & threat, Awareness against egg collection	
	Habitat fragmentation, alteration, destruction due to anthropogenic pressure	CITES Appendix II; Schedule IV of Indian Wildlife protection Act, 1972	Extensive research on ecology and population; Captive breeding; habitat protection and management	
	Habitat degradation due to dam & barrage, water extraction, river interlinking; Mortality in fishing gears; sand mining	CITES Appendix II; Schedule IV of the Indian Wildlife (Protection) Act of 1972; Captive breeding and species reintroduction	Determination of threats for effective management and conservation; Habitat protection	
	Overexploitation for commercial use; Habitat destruction	CITES Appendix II; Head starting program; Trade monitoring & community awareness	-	
	Overexploitation for local consumption & trade; Habitat degradation & loss due to deforestation; dam construction etc.	CITES Appendix II	Habitat protection & management; Prevention of poaching & commercial trade; Population survey	
	Over exploitation for local and commercial use; Habitat degradation due to hydrological projects	CITES Appendix II	Habitat protection and management; Recovery of the species	
	Habitat degradation	CITES Appendix II,Taxonomic & ecological survey is ongoing	Poaching prevention; Captive breeding; Recovery of the species	
	Habitat alteration & degradation	-	Habitat protection & management; Research on ecology of the species	
	Over exploitation for consumption and medicinal use; Deforestation; Persistent poaching	-	Habitat protection & management; Species management	
	Habitat degradation due to urbanization	-	Prevention of poaching; trade of the species	
	Habitat degradation, alteration due to excessive rock blasting, stone quarrying		Habitat protection & management; Extensive survey	
	Habitat destruction due to limestone industry		Habitat protection, taxonomic & ecological study to develop conservation measure	
			Habitat protection & management; Introduction of the species in potential habitat sites	

Table 2. Critically endangered and endangered fauna of North Eastern India.

4. Natural causes or calamities as potential threat to the wildlife

For decades, various anthropogenic activities are being considered as major threat to wildlife, whereas, many natural cause or calamities may lead to declining of biodiversity of an area with its adverse effects (A. Choudhury, 2006). Among various natural causes, the annual flood of Assam is also an emerging potential threat to the wildlife of Assam and indirectly of the region. Flood in Assam is annual phenomenon which also severely affects the wild life of the state specially the Kaziranga National Park and Pobitora wildlife sanctuaries along with other parks and sanctuaries. Almost 85 percent of the Kaziranga National Park and 90 percent of Pobitora wildlife sanctuary found to be submerged every year. Annual flood play an important role in replenishing and maintenance of the ecosystems of the parks and sanctuaries.

But in heavy flood beyond the limit of animals' adaptation, cause a serious threat to the wildlife. In Assam, each year hundreds of animals' loss their lives due to flood in parks and sanctuaries and which is expected to be more devastating in each year. During flood animals naturally search for highlands inside or outside the parks for shelter, available food. In Kaziranaga, animals use the artificial highlands or go to the highlands of Karbi Anglong hills. But during their venture out of the park for highlands, many die out meeting accidents while crossing the corridors on the highways or due to poaching. Those stay inside the park sometimes die by drowning or entrapped in under water debris due to excess water level. Similarly, in Pobitora wildlife sanctuary too, many animals die due to drowning in excess water or poaching while they stray for highland for shelter or for food during flood.

To mitigate the problems that arise during flood and to minimal the loss of wildlife, various measures are executed. Such as the artificial Highlands in parkas and sanctuaries provide temporary shelter for animals during flood and more highlands without disturbing the natural habitats will be helpful. But many does not prefer artificial highland, for which safe passages through the animal corridors to the natural high grounds should be ensured during flood. Many anthropogenic activities such as deforestation in catchment areas are direct or indirect cause of heavy flood in parks and sanctuaries which should be strictly banned. As an important measure, the landscape conservation approaches should be prioritised which can protect the natural highlands (for example Karbi Angnlong hills near Kaziranaga and Pobitora reserve forest and Rajamayong Hilla near Pobitora wildlife sanctuary) under conservation that support and keep majority of the wild animals alive during severe flood providing shelter and food. Besides, sincere participation and effort of administration, authority, NGOs and local communities is crucial in rescue and safety of vulnerable animals during flood. Dedicated rescue operations such as- guiding strayed animals to safer ground, treatment of injured ones and strict vigilance round the clock is very important along with awareness camps against poaching, hunting and harming of vulnerable wild animals during the floods among local communities.

Conclusion

The north eastern region of India supports a number of faunal species in the diverse habitats of the states. A Significant number of the fauna are endemic to the region and many of which are also considered as critically endangered or endangered species. Various conservational measures are currently underway and showing effective results in restoration of habitats, recovery of species, but only in case of few. Whereas conservational measures for many species needs to be executed properly or needs to improve as much as possible for better conservation of the threatened species which will hold the glory of the region as a hub of rich biodiversity.

References

Ahmed, F., Sengupta, S., & Angulo, A. (2009). Kaloula assamensis. *The IUCN Red List of Threatened Species 2009: E.T61850A12567340*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2009- 2.RLTS.T61850A 12567340.en

Ahmed, M. F., Horne, B. D., Li, P., Platt, K., Rahman, S., & Wang, L. (2020). Cuora mouhotii. *The IUCN Red List of Threatened Species 2020: E.T163414A1006285*. https://doi.org/https://dx.doi.org/10.2305/ IUCN.UK.2020-2.RLTS.T163414A1006285.en

Aryal, A., & Yadav, B. (2019). Caprolagus hispidus. *The IUCN Red List of Threatened Species 2019: E.T3833A45176688*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T3833A45176688.en

Asian turtle Trade Working Group. (2000). Chitra indica. *The IUCN Red List of Threatened Species 2000: E.T4696A97399400*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2000.RLTS.T4696A11088615.en.

Asian Turtle Trade Working Group. (2000). Pangshura sylhetensis. *The IUCN Red List of Threatened Species 2000: E.T10950A97374808*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2000.RLTS.T10950A3229978.en

Birdlife International. (2016a). Leptoptilos dubius. *The IUCN Red List of Threatened Species 2016: E.T22697721A93633471*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2016- 3.RLTS.T22697721A93633471.en

Birdlife International. (2016b). Paradoxornis flavirostris. *The IUCN Red List of Threatened Species 2016: E.T22716795A94511015*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2016- 3.RLTS.T22716795A94511015.en

Birdlife International. (2016c). Pellorneum palustre. *The IUCN Red List of Threatened Species 2016: E.T22715856A94471679*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2016- 3.RLTS.T22715856A94471679.en

Birdlife International. (2017a). Asarcornis scutulata. *The IUCN Red List of Threatened Species 2017: E.T22680064A110103586*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2017- 1.RLTS.T22680064A110103586.en

Birdlife International. (2017b). Spelaeornis badeigularis. *The IUCN Red List of Threatened Species 2017: E.T22716118A110161374*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2017- 1.RLTS.T22716118A110161374.en

Birdlife International. (2017c). Stachyris oglei. *The IUCN Red List of Threatened Species 2017: E.T22716261A110271639*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2017- 1.RLTS.T22716261A110271639.en

Birdlife International. (2018a). Ciconia boyciana. *The IUCN Red List of Threatened Species 2018: E.T22697695A131942061*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2018- 2.RLTS.T22697695A131942061.en

Birdlife International. (2018b). Rhodonessa caryophyllacea (amended version of 2016 assessment). *The IUCN Red List of Threatened Species 2018: E.T22680344A125558688*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22680344A125558688.en

Birdlife International. (2019). Spelaeornis longicaudatus (amended version of 2017 assessment). *The IUCN Red List of Threatened Species 2019: E.T22716137A155473011*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2017-1.RLTS.T22716137A155473011.en

BirdLife International. (2017a). Gyps bengalensis. *The IUCN Red List of Threatened Species 2017: E.T22695194A118307773*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2017- 3.RLTS.T22695194A118307773.en

BirdLife International. (2017b). Gyps tenuirostris. *The IUCN Red List of Threatened Species 2017: E.T22729460A117367614*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2017- 3.RLTS.T22729460A117367614.en

BirdLife International. (2017c). Perdicula manipurensis. *The IUCN Red List of Threatened Species 2017: E.T22679012A112384972*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2017- 1.RLTS.T22679012A112384972.en

BirdLife International. (2018a). Ardea insignis. *The IUCN Red List of Threatened Species 2018:*

E.T22697021A134201407. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2018- 2.RLTS.T22697021A 134201407.en

BirdLife International. (2018b). Houbaropsis bengalensis. *The IUCN Red List of Threatened Species 2018: E.T22692015A130184896*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2018- 2.RLTS.T22692015A 130184896.en

BirdLife International. (2018c). Liocichla bugunorum (amended version of 2017 assessment). *The IUCN Red List of Threatened Species 2018: E.T22734628A125508034*. https://doi.org/http://dx.doi.org/10.2305/ IUCN.UK.2017-3.RLTS.T22734628A125508034.en

Bohm, M., & Richman, N. (2015). Cyrtodactylus gubernatoris. *The IUCN Red List of Threatened Species 2013: E.T174113A7017070*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2011- 1.RLTS.T174113A 7017070.en Copyright:

Bordoloi, S., Ohler, A., & Dutta, S. (2004). Nanorana mokokchungensis. *The IUCN Red List of Threatened Species 2004: E.T58433A11780625*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T58433A 11780625.en

Bordoloi, S., Sengupta, S., Ohler, A., & Agarwal, I. (2008). Rhacophorus suffry. *The IUCN Red List of Threatened Species 2008: E.T136092A4231921*. https://doi.org/http://dx.doi.org/10.2305/IUCN. UK.2008.RLTS.T136092A4231921.en

Braulik, G. T., & Smith, B. . (2019). Platanista gangetica (amended version of 2017 assessment). *The IUCN Red List of Threatened Species 2019: E.T41758A151913336*. https://doi.org/http://dx.doi.org/10.2305/ IUCN.UK.2017-3.RLTS.T41758A151913336.en.

Brockelman, W., Molur, S., & Geissmann, T. (2019). Hoolock hoolock. *The IUCN Red List of Threatened Species 2019: E.T39876A17968083*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2019- 3.RLTS.T39876A17968083.en

Chatterjee, S., Saikia, A., Dutta, P., Ghosh, D., & Worah, S. (2006). *Review of Biodiversity in North East India*.

Choudhury, A. (2004). Human–Elephant conflicts in northeast India. *Human Dimensions of Wildlife*, *9*(4), 261–270. https://doi.org/10.1080/10871200490505693

Choudhury, A. (2006). The status of endangered species in northeast. *Journal of the Bombay Natural History Society*, *103 (2-3)*, 157–167.

Choudhury, A., Lahiri Choudhury, D. K., Desai, A., Duckworth, J. W., Easa, P. S., Johnsingh, A. J. T., … Wikramanavake, F. (2008). Elephas maximus. *The IUCN Red List of Threatened Species 2008: E.T7140A12828813*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T7140A12828813.en

Choudhury, B. C., Cota, M., McCormack, T., Platt, K., Das, I., Ahmed, M. F., … Singh, S. (2019). Manouria emys (errata version published in 2019). *The IUCN Red List of Threatened Species 2019: E.T12774A152052098*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2019- 1.RLTS.T12774A 152052098.en

Das, I., Choudhury, B. C., Praschag, P., Ahmed, M. F., & Singh, S. (2019). Batagur dhongoka (errata version published in 2019). *The IUCN Red List of Threatened Species 2019: E.T10953A152042542*. https://doi.org/ http://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T10953A152042542.en

Das, J., Medhi, R., & Molur, S. (2008). Trachypithecus geei. *The IUCN Red List of Threatened Species 2008: E.T22037A9348940*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T22037A 9348940.en

Dutta, S., Ahmed, M. F., Sengupta, S., & Bordoloi, S. (2004). Kalophrynus orangensis. *The IUCN Red List of Threatened Species 2004: E.T57842A11692583*. https://doi.org/http://dx.doi.org/10.2305/

IUCN.UK.2004.RLTS.T57842A11692583.en

Dutta, S., Ohler, A., Bordoloi, S., & Sengupta, S. (2004a). Limnonectes mawlyndipi. *The IUCN Red List of Threatened Species 2004: E.T58355A11771436*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T58355A11771436.en

Dutta, S., Ohler, A., Bordoloi, S., & Sengupta, S. (2004b). Odorrana mawphlangensis. *The IUCN Red List of Threatened Species 2004: E.T58356A11771537*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T58356A11771537.en

Dutta, S., Ohler, A., & Roy, D. (2004). Raorchestes shillongensis. *The IUCN Red List of Threatened Species 2004: E.T58902A11852580*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T58902A11852580.en

Dutta, S., Ohler, A., Sengupta, S., & Bordoloi, S. (2004). Euphlyctis ghoshi. *The IUCN Red List of Threatened Species 2004: E.T58262A11758588*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T58262A11758588.en

Dutta, S., Ohler, A., Sengupta, S., Bordoloi, S., & Roy, D. (2004). Hylarana garoensis. *The IUCN Red List of Threatened Species 2004: E.T58601A11806482*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T58601A11806482.en

Dutta, S., Ohler, A., Sengupta, S., Gower, D., Wilkinson, M., & Oommen, O. V. (2015). Ichthyophis garoensis. *The IUCN Red List of Threatened Species 2004: E.T59617A11969312*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T59617A11969312.en

Ellis, S., & Talukdar, B. (2008a). Dicerorhinus sumatrensis. *The IUCN Red List of Threatened Species 2020: E.T6553A18493355*. https://doi.org/https://dx.doi.org/10.2305/IUCN.UK.2020- 2.RLTS.T6553A18493355.en

Ellis, S., & Talukdar, B. (2008b). Rhinoceros sondaicus. *The IUCN Red List of Threatened Species 2020: E.T19495A18493900*. https://doi.org/https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T19495A18493900.en

Gardner, P., Hedges, S., Pudyatmoko, S., Gray, T. N. E., & Timmins, R. J. (2016). Bos javanicus. *The IUCN Red List of Threatened Species 2016: E.T2888A46362970*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T2888A46362970.en

Glatston, A., Wei, F., Than, Z., & Sherpa, A. (2015). Ailurus fulgens. *The IUCN Red List of Threatened Species 2015: E.T714A110023718*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2015- 4.RLTS.T714A45195924.en

Goswami, U. C., Basistha, S. K., Bora, D., Shyamkumar, K., Saikia, B., & Changsan, K. (2012). Fish diversity of North East India, inclusive of the Himalayan and Indo Burma biodiversity hotspots zones: A checklist on their taxonomic status, economic importance, geographical distribution, present status and prevailing threats. *International Journal of Biodiversity and Conservation*, *4*(15), 592–613. https://doi.org/10.5897/IJBC11.228

Gray, T. N. E., Brook, S. M., Mc Shea, W. J., Mahood, S., Ranjitsingh, M. K., Miyunt, A., … Timmins, R. (2015). Rucervus eldii. *The IUCN Red List of Threatened Species 2015: E.T4265A22166803*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T4265A22166803.en

IUCN SSC Amphibian Specialist Group. (2010). Amolops assamensis. *The IUCN Red List of Threatened Species 2010: E.T158638A5244716*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2010-4.RLTS.T158638A5244716.en

IUCN SSC Amphibian Specialist Group. (2012). Ichthyophis moustakius. *The IUCN Red List of Threatened Species 2012: E.T190991A1965581*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2012-1.RLTS.T190991A1965581.en

IUCN SSC Amphibian Specialist Group. (2015). Bufoides meghalayanus. *The IUCN Red List of Threatened Species 2013: E.T54800A19625860*. https://doi.org/ttp://dx.doi.org/10.2305/IUCN.UK.2013-

1.RLTS.T54800A19625860.en

Kaul, R., Williams, A. C., Rithe, K., Steinmetz, R., & Mishra, R. (2019). Bubalus arnee. *The IUCN Red List of Threatened Species 2019: E.T3129A46364616*, (l). https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T3129A46364616.en

Kumar, A. Sinha, A., & Kumar, S. (2020). Macaca munzala. *The IUCN Red List of Threatened Species 2020: E.T136569A17948833*. https://doi.org/https://dx.doi.org/10.2305/IUCN.UK.2020- 2.RLTS.T136569A17948833.en

Lang, J., Chowfin, S., & Ross, J. P. (2019). Gavialis gangeticus (errata version published in 2019). *The IUCN Red List of Threatened Species 2019: E.T8966A149227430*.

Meijaard, E., Narayan, G., & Deka, P. (2016). Porcula salvania. *The IUCN Red List of Threatened Species 2019: E.T21172A44139115*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2019- 3.RLTS.T21172A44139115.en

Molur, S. (2016). Anourosorex assamensis. *The IUCN Red List of Threatened Species 2016: E.T136802A22311877*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T136802A22311877.en

Molur, S. (2017). Biswamoyopterus biswasi. *The IUCN Red List of Threatened Species 2016: E.T2816A115063959*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T2816A22271554.en

Molur, S., & Laginha Pinto Correia, D. (2016). Hadromys humei. *The IUCN Red List of Threatened Species 2016: E.T9618A22410442*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2016- 2.RLTS.T9618A22410442.en

Myers, N., Mittermeler, R. A., Mittermeler, C. G., Da Fonseca, G. A. B., & Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature*, *403*(6772), 853–858. https://doi.org/10.1038/35002501

Ohler, A. (2004). Limnonectes khasianus. *The IUCN Red List of Threatened Species 2004: E.T58345A11769873*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T58345A11769873.en

Ohler, A., Dutta, S., Gower, D., & Wilkinson, M. (2004). Chikila fulleri. *The IUCN Red List of Threatened Species 2004: E.T59551A11962498*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T59551A11962498.en

Ohler, A., & Saibal, S. (2004). Philautus namdaphaensis. *The IUCN Red List of Threatened Species 2004: E.T58876A11851780*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T58876A11851780.en

Ohler, A., Sengupta, S., & Roy, D. (2004). Philautus garo. *The IUCN Red List of Threatened Species 2004: E.T58846A11849059*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T58846A11849059.en

Rahman, S., Platt, K., Das, I., Choudhury, B. C., Ahmed, M. F., Cota, M., … Singh, S. (2019). Indotestudo elongata (errata version published in 2019). *The IUCN Red List of Threatened Species 2019: E.T10824A152051190*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2019-1.LTS.T10824A152051190.en

Saikia, M. K. (2013). Endemic Vertebrate Fauna of Northeast India With Special Reference To Herpetofauna , Avian and Mammalian Fauna/ : a Priliminary Review, *9*, 1–8.

Sarkar, U. K., & Ponniah, A. G. (2006). Evaluation of North East Indian Fishes for their Potential as Cultivable , Sport and Ornamental Fishes along with their Conservation and Endemic Status. *Fish Biodiversity of Northeast India*, 1–5.

Sengupta, S., & Bordoloi, S. (2004). Chiromantis cherrapunjiae. *The IUCN Red List of Threatened Species 2004: E.T58786A11828457*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T58786A11828457.en

Singh, E. J., Singh, N. K. S., & Singh, N. R. (2009). Biodiversity Conservation and Natural Resources in North East India - With Special Reference to Manipur. *NeBIO*, *1*(1), 42–47.

Song, Y.-L., Smith, A. T., & MacKinnon, J. (2008). Budorcas taxicolor. *The IUCN Red List of Threatened Species 2008: E.T3160A9643719*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T3160A 9643719.en

Srinivasulu, C., & Srinivasulu, B. (2019). Hipposideros khasiana. *The IUCN Red List of Threatened Species 2019: E.T85646546A85646555*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2019- 2.RLTS. T85646546A85646555.en

The Reptilian database. (2020). Retrived from http://reptile-database.reptarium.cz

Vishwanath, A. (2010). Schistura papulifera. *The IUCN Red List of Threatened Species 2010: E.T 168546A6511934*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2010-4.RLTS.T168546A6511934.en

Zahler, P. (2010). Eupetaurus cinereus. *The IUCN Red List of Threatened Species 2010: E.T8269A12904144*. https://doi.org/http://dx.doi.org/10.2305/IUCN.UK.2010-2.RLTS.T8269A12904144.en

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