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Checklist of fishes of Lower Subansiri river drainage, Northeast India

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ABSTRACT

Two hundred and four fish species belonging to 34 families were collected from natural water bodies of downstream Subansiri river drainage. Cyprinidae found to be the dominant family with 72 species. Bagridae, Sisoridae, Erethistidae, Nemacheilidae, Cobitidae, Channidae, Schilbeidae, Osphronemidae and Siluridae were the other species rich families containing five to sixteen fish species. The collection contained 4, 5 and 22 fish species belonging to Endangered, Vulnerable and Near Threatened categories respectively. Further, 16 Data Deficient fishes were also collected during the study. Accumulation of such a large number of fish species from a single river is rare in entire Indian subcontinent and elsewhere. The checklist of fishes presented herein will serve as a database for future management of fishes in Northeastern region of India.

Keywords: Subansiri, fish diversity, large dam, conservation status.

INTRODUCTION

Subansiri River originates in the Himalayas beyond the Great Himalayan range at an altitude of 5340m. The Subansiri river basin is one of the largest sub-basins in the Brahmaputra valley. The contribution of Subansiri River is estimated to be about 10 percent of the total discharge of the Brahmaputra River. Total drainage area up to the confluence with the Brahmaputra is 35,771 sq. km. The total length of the river in the mountainous terrain is 208km. Its length is approximately 126km from the dam site to the confluence with the Brahmaputra near Jamuguri. The river has maximum observed discharge 12,024 cumec at Gerukamukh and the minimum discharge record is 188 cumec while at Chauldhuwaghat it has a 21,230 cumec maximum discharge record [1]. It has an average annual runoff of 57296mm [2].

Freshwater biodiversity constitutes a vitally important component of the planet, with a species richness that is relatively higher compared to both terrestrial and marine ecosystems [3]. South and Southeast Asia is one of the most speciose areas on the planet containing 20% of all known freshwater vertebrate species and 25% of known aquatic plants [4]. The Eastern Himalaya region is part of two larger biodiversity hotspots: the Indo-Burma and the Himalaya Hotspots [5]. The high biodiversity of the region is attributed to the recent geological history (the collision of Indian, Chinese and Burmese plates) and the Himalayan orogeny which played an important role in the speciation and evolution of groups inhabiting mountain streams [6].

In earlier works for northeast India, [7] reported 126 species from the Brahmaputra River, [8] listed 157 species from Assam while [9] reported 185 species from Assam. [10] estimated Brahmaputra drainages to contain 200 species of fishes. [11] recorded 167 fish species from Upper Brahmaputra basin, while [12] enlisted 267 species from NE region. [13] published a list of 217 fish species for Assam based on the works of [14] and [15] but many of which actually do not belong to Brahmaputra Basin. 390 fish species were included from the Northeast region by

[16]. Likewise, [17] made a checklist of 213 fish species for Arunachal Pradesh by combining the results of their own work and literature reviews. [18] reported the number of fish species occurring in Eastern Himalaya is 520 including those of Brahmaputra, Chindwin, Irrawaddy and Koladyne river drainages. Based on literature survey, [19] enlisted 422 fish species from North East India, inclusive of the Himalayan and Indo Burma biodiversity hotspots. Earlier in Subansiri river, [20] reported 52 species in Arunachal Pradesh while 155 fish species was reported from lower reach of the river in Assam [21].

MATERIALS AND METHODS

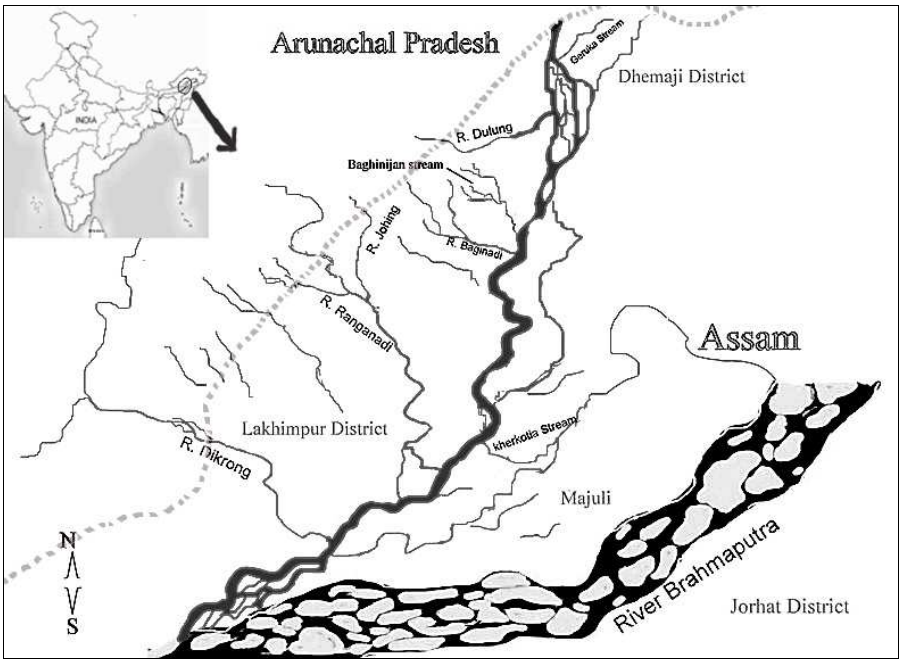

Fig. 1: Map of the study area

3.3.1 *Sampling of fish species:* **Sites**: Samplings of fishes were carried out from 2009 to 2013 in the downstream of the Lower Subansiri Hydroelectric Project being constructed at Gerukamukh of Assam-Arunachal Pradesh border. The fishes were collected from different stretches of the mainstream river (about 130 km), its tributaries (Ranga river, Baginadi river, Kherkatia river), perennial hill streams (Johing stream, Dulung stream, Gerukanala stream, Dirpai stream), ephemeral streams (Baghijan stream, Konanadi stream, Singijan stream), open wetlands/oxbow lakes (Dolamora wetland, Pujakora wetland), closed wetland (Agharomile wetland), and from different seasonally inundated water bodies and unnamed streamlets of the basin. **Gears:** Gillnets, cast nets and scoop nets of different mesh sizes, traditional fishing gears and traps were used for catching fishes. Local fishermen were hired in certain instances for catching fishes. Further, local fish landing centres and fish markets were also monitored regularly. **Preservation**: Representative specimen of each of the collected fish specimen were preserved in 10% formalin and deposited in Lakhimpur Girls' College Museum of Fishes. In case of Endangered, Vulnerable, Near Threatened and Data Deficient fishes, not more than 5 specimens were preserved and additional catches, if any, were released back to water immediately. **Identification:** The detailed identification of either fresh or preserved specimens was done following [14], [15], [22] and several recent taxonomic descriptions and revision papers regarding the fishes of South East Asia. Scientific names followed that of CAS- Ichthyology database. The conservation statuses were determined using IUCN's website www.iucnredlist.org. Ver. 2013.2.

RESULTS AND DISCUSSION

A total of 204 species belonging to 34 families and 101 genera were recorded from downstream Subansiri river drainage (Table- 1). Cyprinidae was the dominant family comprising 72 species, followed by Bagridae (16), Sisoridae (15 species), Erethistidae (13 species), Nemacheilidae (11 species), Cobitidae (9 species), Channidae (8 species), Schilbeidae (7 species), Osphronemidae (5 species) and Siluridae (5 species). Each of Ambasidae, Amblycipitidae and Psilorhynchidae contained four species whereas families viz. Clupidae, Badidae and Mastacembellidae contained three species each. On the other hand, Notopteridae, Anabantidae, Claridae and Synbranchidae were represented by two and the remaining 14 families contained single species. Again, at genus

level, *Labeo* contain maximum 10 species followed by *Channa* (8 species). Each of the genus *Garra, Glyptothorax* and *Mystus* contained 7 species while Puntius, *Pseudolaguvia* and *Schistura* included 6 species each. On the other hand, *Barilius, Lepidocephalichthys* and *Trichogaster* were also rich in species composition and contained 5 species each. The genus *Amblyceps, Batasio, Hara* and *Psilorhynchus* contained four species whereas each of *Devario, Pethia, Tor, Ompok* and *Badis* contained three species while *Aborichthys, Anabas, Botia, Bagarius, Cirrhinus, Clarias, Clupisoma, Crossocheilus, Danio, Eutropiichthys, Erethistoides, Gagata, Macrognathus, Monopterus, Nangra, Neolissocheilus, Parambassis, Rasbora, Salmophasia, Sperata* and *Systomus* were represented by two species. The remaining 60 genus were represented by single species. some species of genera -*Amblyceps, Crossocheilus, Channa, Garra, Glyptothorax, Mystus, Puntius, Trichogaster, Pseudolaguvia* and *Schistura* could not be done up to species level and presently considered as separate species. Family wise composition of different fish species are shown in Fig 2.

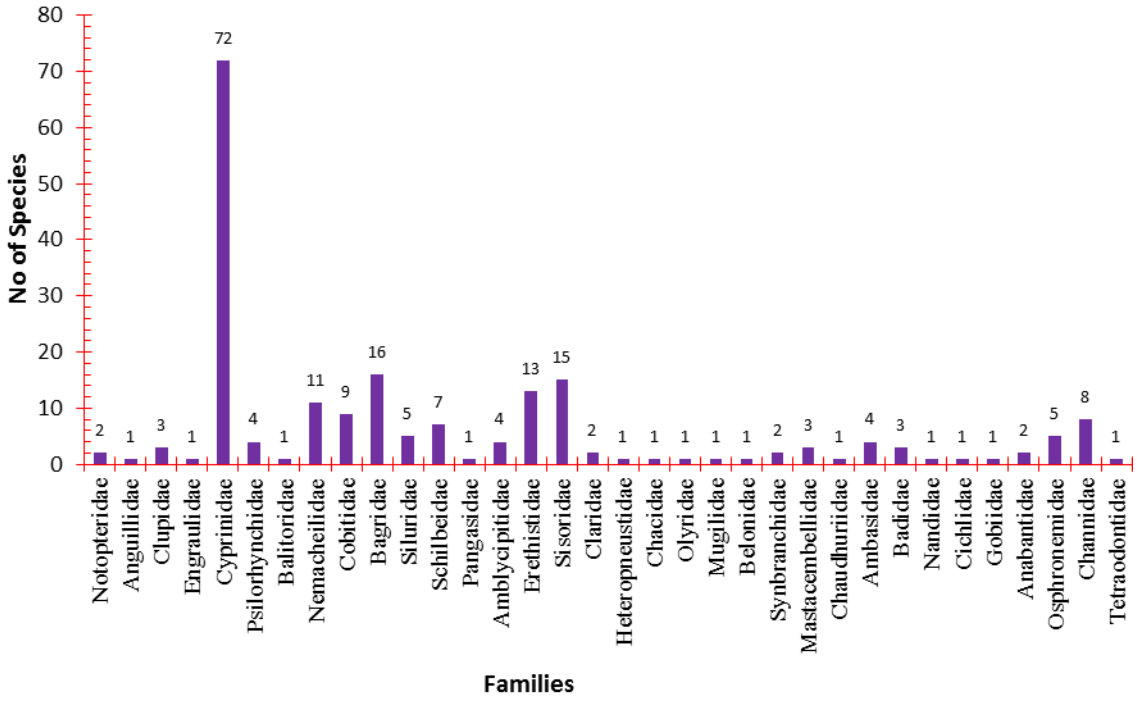

Fig. 2: Family wise composition of fishes of lower Subansiri river drainage

Four species viz. *Amblyceps arunchalensis, Clarias magur, Pillaia indica* and *Tor putitora* of Subansiri drainage belonging to Endangered category and *Botia rostrata, Cyprinion semiplotum, Cyprinus carpio, Devario assamensis* and *Schizothorax richardsonii* belongs to Vulnerable category. The Near Threatened category of IUCN included 22 species from the present collection. Most of the fishes (68.14%, 139 species) of the fishes of Subansiri basin belongs to Least Concern category while 16 fish other fish species regarded as Data Deficient by IUCN. However, the conservation status of 6 species were not available in IUCN database and that of the 12 species, which could not be identified upto species level were regarded here as not available/applicable (NA). Percent composition of different conservation groups are given in Fig 3.

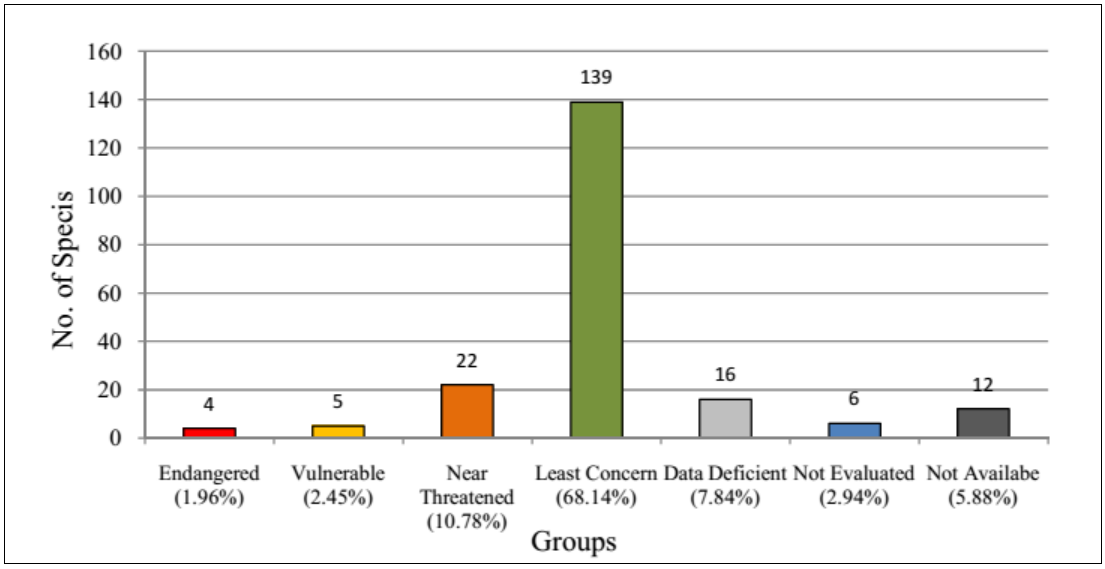

Fig 3. Distribution of fishes in different conservation categories

Subansiri is a major tributary of Brahmaputra and it reflects the fish fauna of the basin. *Chitala chitala, Notopterus notopterus, Anguilla bengalensis, Gudusia chapra, Gonialosa manmina, Setipinna phasa* are reported from different water bodies of the region. However, *Tenualosa ilisha*, anadromous fish mainly found in large river and its finding in Subansiri River near Brahmaputra is not surprising.

In northeastern region, *Aspidoparia* comprised 3 species (*A. jaya*, *A. morar*, and *A. ukhrulensis*) of which *A. ukhrulensis* Selim & Vishwanath 2001 belongs to Chindwin drainage system. Again, [23] placed *A. morar* under separate genus as *Cabdio morar*. Another species of Brahmaputra basin, *Opsarius barna* was included in genus *Barilius* before it was transformed it to *Opsarius* [24]. *Danionella* includes some miniature translucent cyprinid fishes of India and neighboring countries. Out of the 4 species of *Danionella* described so far *Danionella priapus* Britz 2009, is the only species present in Indian water. *D. priapus* was described from Jorai River of West Bengal [25] and no reports were made thereafter. Thus, the present finding extends it range eastward (about 600km) in Brahmaputra river. Among the *Danio* and *Devario* species, information regarding distribution and occurrences of *Devario assamensis* is least known. It was often treated as synonym of *Devario regina*, but [26] recognized it to be a valid species and finding of the same in Subansiri river is important. *Bangana dero* have been treated as *Sinilabeo dero* [27][28] or *Labeo dero* [14] while [24] recognized *Bangana* to be the valid generic name and is abundantly found in the rocky bed reach of the main river. Two species of *Crossocheilus* (*C. latius* and one unknown species*)* was found in the Subansiri drainage system. [29] found *C. burmanicus* Hora 1936 in Garanga wetland of lower Assam and [12] reported it from Arunachal Pradesh but it needs verification as the later is restricted to Chindwin basin of Manipur and Myanmar. The occurrences of *Labeo angra, Labeo bata, L. boga, L. calbasu, Labeo dyocheilus, L. gonius, L. pangusia* and *L. rohita* were reported from Brahmaputra drainage by various workers [14][30][31]. On the other hand, *Labeo fimbriatus* was thought to be present in mainland India only [14] but [32] noted its presence in northeastern region and the present finding also confirms its distribution range up to Northeast India. *Oreichthys casuatis* was the only species of the genus found in Subansiri while *O. crenuchoides* Schäfer 2009 is also present in Brahmaputra drainage. Likewise, *Osteobrama* contained four species in northeastern region and *O. cotio* is the single species found in Subansiri as well as in Brahmaputra drainage. Asian cyprinid genus *Puntius* (including *Pethia*) is distributed from the Indus drainage in Pakistan west to southern China [33] and their interrelationships are poorly understood [34][35]. The genus comprised of about 78 valid species in the South Asian region [14][36]. In Subansiri river 4 *Pethia* and 5 *Puntius* species were found including one unknown *Pethia* species. Eastern Himalayan Region is the home of several *Neolissochilus* and *Tor* species. In the Subansiri two species of *Neolissochilus* (*N. hexagonolepis* and *N. hexastichus*) were found while is the abode of 3 *Tor* species (*Tor progeneius, T. putitora, T. tor*). Likewise, *Cyprinion semiplotum*, the only species of the genus found in Northeast India was also recorded in present study. The genus *Schizothorax* is found in higher altitude and only *Schizothorax richardsonii* could be collected from downstream of Subansiri river, whereas [37] recorded *Schizopygopsis stoliczkai* Steindachner 1866 from upstream of the same river. Occurrence of *Schizothorax molesworthi* (Chaudhuri 1913) and *Schizothorax progastus* (McClelland 1839) were also reported from neighboring Arunachal Pradesh but not found during the study. Again, *Garra*, a species rich genus consists of approximately 70 species occurring from Borneo, southern China and southern Asia through Middle East Asia, Arabian Peninsula and East Africa to West Africa [38]. There are 10 species of *Garra* viz., *G. lissorhynchus, G. annandalei, G. gotyla, G. kempi, G. lamta, G.*

nasuta, *G. rupecula*, *G. naganensis*, *G. arupi* and *G. kalpangi* reported from Brahmaputra basin [39][40]. In lower Subansiri drainage, only 7 species of *Garra* (*G. annandalei*, *G. arupi*, *G. gotyla*, *G. lamta*, *G. lissorhynchus*, *G. nasuta* and one unknown *Garra* species were collected during the study period.

Psilorhynchidae includes eight species from the northeastern region. In the studied basin, four species of *Psilorhynchus* were found. It should be noted that *Psilorhynchus arunachalensis* was described as *Psilorhynchoides arunachalensis* (Nebeshwar, Bagra & Das 2007) but placed under the genus *Psilorhynchus* by [41].

Under the family Nemacheilidae, *Aborichthys* is the genus with all four species found in Himalayan foothill region. In Subansiri drainage, only two species of *Aborichthys* (*A. elongates* and *A. kempi*) were found. On the other hand, *Acanthocobitis botia* is the only species of the genus found in Subansiri River as well as entire Brahmaputra basin while its congener *Acanthocobitis zonalternans* is found in Chindwin drainage. Likewise, *Neonoemacheilus assamensis* is found presently in Assam while *N. morehensis* Arunkumar 2000 belongs to Lokchao River of Manipur (Chindwin basin). *Schistura*, the largest genus of the family contains about 190 nominal species across the world [42]. They are typically found amongst stones in moderately to fast flowing streams and rivers in foothill to mountainous habitats. The distributional area of the genus stretches from the Near East through the Indian subcontinent upto Vietnam and southern China [43]. In Subansiri basin, 6 species of *Schistura* (including two unknown species) were collected while the NE region is abode of about 12 other [44]. *Nemacheilus corica*, another member of the family Nemacheilidae, sometimes referred as *Schistura corica* [45] was also found in Subansiri river basin.

The family Cobitidae was represented in the study area by two *Botia* and five *Lepidocephalichthys* species. *Botia dayi*, another species often reported from Brahmaputra basin [14] is synonym of *Botia rostrata* [46] while the distribution range of *Botia histrionica* (Blyth 1860) in Northeast India is from non-Brahmaputra basin. Five out of the eight *Lepidocephalichthys* species of Brahmaputra Basin were recorded in Subansiri basin. The taxonomy of the genus is somewhat confusing in Brahmaputra basin e.g. *L. caudofurcatus* Tilak & Husain 1978 is a synonym of *L. goalparensis* [47][48], while the later (*L. goalparensis*) was itself regarded as a synonym of *L. menoni* by workers like [49]. However, [50] and [48] considered *L. goalparensis* as valid while [14] and [47] considered *L. menoni* as synonym of *L. annandalei.* [51] considered *L. annandalei* as a valid species and in the present study the same is followed. Two other species namely, *Pangio pangia* and *Canthophrys gongota* of the family Cobitidae were also found in Subansiri basin.

River Subansiri is also rich in Bagrid catfish diversity. Four out of the five species of *Batasio* belonging to Brahmaputra basin were recorded from the Subansiri basin. Among these, *B. marianiensis* was a species revalidated by [52]. *Chandramara chandramara*, a closely related species of *Batasio* was also found in the river basin. *Hemibagrus menoda*, the only species of the genus in Brahmaputra drainage occur in the Subansiri also. However, [53] reported a species- *Mystus corsula* (Day 1869) from Barak drainage, which is already regarded as a synonym of *H. menoda* by [54]. Similarly, all the *Mystus* species of Brahmaputra drainage (*M. bleekeri*, *M. carcio*, *M. cavasius*, *M. dibrugarensis*, *M. tengara* and *M. vittatus*) were also found in Subansiri basin. Moreover, the identity of one *Mystus* species, which did not belong to the above species, is included herein as an unknown species. Earlier *M. carcio* was treated as synonym *M. tengara* or *M. vittatus* [55][56] until revalidated by [57]. The report of *Mystus montanus* (Jerdon 1849) from Dikrong river, a tributary of Subansiri, Arunachal Pradesh by [17] might be a wrong identification of *M. dibrugarensis* as *M. montanus* is restricted to Peninsular India [58]. The presence of some other larger predatory catfishes like *Rita rita*, *Sperata aor* and *S. seenghala* results the total number of bagrid catfish in the basin to sixteen. Bagridae is the second species rich family of fishes in Subansiri basin.

Regarding the Silurid fishes, Subansiri basin contains all the three species of *Ompok* and the single *Wallagu attu*. On the other hand, *Pterocryptis berdmorei* is first recorded from Indian water where three other species viz. *P. gangelica* Peters 1861, *P. indicus* (Datta, Barman & Jayaram 1987) and *P. barakensis* Vishwanath & Sharma 2006 are also present in Brahmaputra basin. Except *Ailia punctate*, the studied area contained all the species of family Schilbeidae found in Brahmaputra basin. Additionally, *Pangasius pangasius* of the family Pangasiidae was also found in the river.

Four species of *Amblyceps* have been reported so far from Brahmaputra drainage and *A. laticeps* (McClelland 1842) of Meghalaya was the only species not occurring in Subansiri. Some workers considered *A. arunachalensis* as a synonym of *A. mangois* but later regarded as a valid species [59][60]. On the other hand, few individuals of *Amblyceps* collected from Subansiri basin differed morphologically and considered herein as unknown species.

Under the family Erethistoidae *Erethistes pusillus* is the only species found in India and is also present in Subansiri basin. In Northeast India four species of *Hara* are found and of which *Hara hara*, *H. horai*, *H. jerdoni* also belonging to Subansiri. Again, two least known *Erethistoides* species *(E. montana* and *E. infuscatus)* were also

found in the Subansiri drainage where finding of *E. infuscatus* is an eastward range extention of the fish. Another small bodied erethistid catfish genus *Pseudolaguvia* is also present in the studied river basin. The hidden diversity of the genus in northeast India is revealed during the last decade when more than 6 species was described from the region. In Subansiri drainage, 6 species of *Pseudolaguvia* were found of which two species - *Pseudolaguvia* sp1 and *Pseudolaguvia* sp2 could not be identified up to species level and they differ from existing species of Brahmaputra Basin. On the other hand, *P. foveolata P. flavida* and *P. ferruginea* are found for the first time outside their type localities and also for the first time in Northeast India. Likewise, *Conta* is native to India but little information is known to science. So far only two species viz., *Conta conta* and *C. pectinata* Ng 2005 are known to science.

In Sisoridae family, *Gagata cenia* and *G. sexualis* are the two species present in Subansiri basin while *G. gagata* (Hamilton 1822) of Brahmaputra and *G. dolichonema* He 1996 of Chindwin-Irrawaddy basin were the other species found in the Northeastern region. Subansiri basin contains both the species of *Nangra* (*N. assamensis* and *N. nangra*). So far, three species of *Sisor* namely *S. rabdophorus, S, barakensis* Vishwanath & Darshan 2005 and *Sisor chennuah* Ng & Lahkar 2003 were reported from Brahmaputra drainage of which *S. rabdophorus* is present in Subansiri basin. Here, it should be mentioned that the species name have been used as '*rhabdophorus'* by most of the workers while [61] discussed the problem with ICZN rules and advocated the correct spelling of the species as '*rabdophorus'*. On ther other hand, *Glyptothorax* with more than 90 nominal and about 70 valid species is the most speciose Asian catfish genus [62]. Most of the earlier reports of different *Glyptothorax* species in Brahmaputra basin were misleading [63]. In Subansiri basin, 7 species of *Glyptothorax* were collected including an unknown species. Finding of *G. dikrongensis* is the first report of the fish from Assam. Subansiri drainage also comprises *Bagarius bagarius* and one of largest freshwater fish *B. yarrelli.*

The earliest available names for the north-eastern Indian species of *Clarias* were *C. jagur* and *C. magur*, described by Hamilton (1822). But almost all the literature regarding *Clarias* used *C. batrachus* for the species found in Indian subcontinent. [64] restricted distribution of *Clarias batrachus* to Sunda Islands and recognized the Indian species as *C. magur* based on broader snout and more serretion of pectoral spine. *C. magur* is found in Subansiri basin along with *C. gariepinus*, of which the later is an alien species and its occurrence in natural water may pose threat to the native fishes. *Heteropneustes fossilis* (Heteropneustidae), *Chaca chaca* (Chacidae), *Olyra longicaudata* (Olyridae), *Rhinomugil corsula* (Mugilidae), *Xenentodon cancila* (Belonidae), *Nandus nandus* (Nandidae), and *Tetraodon cutcutia* (Tetraodontidae) of Brahmaputra Basin were also found in Subansiri river system.

Monopterus albus and *M. cuchia* were the two species found in Subansiri Northeast India while [65] discovered a new species of *Monopterus* (*M. ichthyophoides*) from Barak River drainage. Similarly, the river contains two out of the three *Macrognathus* present in northeast India (*M. aral* and *M. pancalus*) and the only species of *Mastacembelus* (*M. armatus*) of the region. The finding of *Pillaia indica*, an earthworm eels of the family Chaudhuriidae is also important.

Parambassis comprises a diverse and possibly polyphyletic group of strictly freshwater ambassids widely distributed in the Indian subcontinent, Southeast Asia and the Australian region [66]. Northeast India have four species of *Parambassis*, of which *P. lala* and *P. baculis* were well known and also found in the Subansiri drainage while the other two species viz., *P. bistigmata* Geetakumari 2012 and *P. waikhomi* Geetakumari & Basudha 2012 are discovered recently from Manipur valley. However, *Chanda nama* and *Pseudambassis ranga*, two other member of the family found during the study.

The taxonomy of *Badis* species were poorly known until the work of [67]. So far 8 species of *Badis* have been described from Brahmaputra basin. In Subansiri basin, three species namely, *B. assamensis, B. badis* and *B. singenensis* were found while *B. blosyrus* Kullander & Britz 2002, *B. kanabos* Kullander & Britz 2002, *B. tuivaiei* Vishwanath & Shanta 2004, *B. dibruensis* Geetakumari & Vishwanath 2010 and *B. triocellus* Khynriam & Sen 2013 also exist in Brahmaputra basin. *Badis singenensis* was described by [68] from Singen river of Arunachal Pradesh and encountered abundantly in Subansiri River during the present study. *B. triocellus* is probably a synonym of *B. singenensis* and few holotytpes [69] were included from Subansiri as wel as from one of its feeder stream Dirpai (mis-spelled as Dilpai in [69]).

On the other hand, *Glossogobius giuris*, a species of freshwater gobi found in Brahmaputra basin. However, [29] reported the occurrence of another species - *Glossogobius gutum* Hamilton 1822 from lower Assam, but *G. gutum* is synonym of *G. giuris* [70][71]. As far as Anabasid is concerned, Subansiri basin harbors both the *Anabas* species of India (*A. cobojius* and *A. testudineus*).

The genus *Trichogaster* of family Osphronemidae included four species (*T. fasciata, T. labiosa, T. lalius* and *T. chuna*) and all these species are present in Subansiri Basin. However, few individuals of similar type collected

during the present study did not belong to any of the above species. Therefore, there is a possibility of being a new species of *Trichogaster* as no major revision work has been done on the genera till date.

Channidae or snakeheads are medium sized to large acanthomorph teleosts living in freshwaters in tropical Africa, parts of the Middle East and Asia [72]. Eleven *Channa* species are known to occur in the Brahmaputra basin, of which seven are also found in Subansiri basin (*C. aurantimaculata, C. bleheri, C. gachua, C. marulius, C. punctata, C. stewartii* and *C. striata*). One *Channa* species collected from Subansiri basin, which resemble *C. striata* in overall morphology but distinctly lacking the zigzag pattern of stripes in lower side of body, fewer fin ray count and possibly an unknown species.

The alien fish species viz. *Hypophthalmichthys molitrix, Ctenopharyngodon idella, Cyprinus carpio, Clarias gariepinus* and *Oreochromis mossambicus* have been included in the present study because of their occurrence in natural water bodies of Subansiri drainage system. It is obvious that these allien species entered accidentally into the wetlands and even rivers during heavy flood. Like other exotic fishes, the Chichlid fish *Oreochromis mossambicus* is often cultured in the culture ponds and it is not surprising to find them in natural water bodies.

The ecological effects of regulated flow below dams have been a subject of interest of various authors [73][74][75]. Flow regulation often dramatically alters the regime of alluvial rivers both through confined water-release scenarios and through substantial reductions in transported sediment below dams [76][77][78]. Channel beds and banks may undergo a wide range of adjustments to regulation [79][80]. [81] calculated that large dam creates 73% of negative impacts on fish biodiversity resulting from obstructing rivers. The impact of dam on downstream fish ecology and diversity in Indian subcontinent are scanty and needs in depth study for maintain the downstream fish diversity [82][83][84][85]. The reservoir traps the nutrient coming from upstream watershade of the basin. Further, the sediments, which are flushed by a dam authority to maintain the storage capacity a dam reservoir often deposits few kilometers downsteam of the dam. In Subansiri River, various effects of dam construct activities like deposition of soil, riparian forest destruction, mainstream diversion, gravel collection, establishment of stone crusher in the river bed during the construction phase of the dam may also pose adverse effect on the fish fauna of the river. After completion of the dam, the deposition of flushing sediments often reduces the deep water parts of a river and the river become homogenized in its depth and bed substrate as in the case of NEEPCO hydel project of Ranga River, of Lakhimpur District [86]. Those fishes which live in the cold water region of the river, i.e. immediate downstream the dam have greater chanches of being washed out from their home by the sudden and fast water released during power generation. Further, change in natural flow the connectivity of the river to the floodplain wetlands is very important for various fish species which use those habits for breeding or for nourishing the juveniles. Loss of the connectivity may adversely the affect those species in the river basin. Again, the winter minimum discharge of about 400 cumec of water will be reduced to 6 cumec for the 20 hours of storage time while it will increase to 2400 cumec for the rest 4 hour of a day. Fishes of the downstream may not be able to adapt to this diurnal fluctuation of flow. Moreover, the adjoining floodplain wetland may also dry-up rapidly in the winter as the ground water table will fall down due to reduced flow pattern of the river. Thus it is highly necessary to maintain a minimum flow of water constantly throughout the hours of a day especially in the winter season when the contribution of water of the feeder channels became negligible. The study in the Subansiri river drainage, made before the commissioning of the 2000 MW Lower Subansiri Hydroelectric Project constructed by National Hydroelectric Project Corporation (NHPC) and it will serve as the database for evaluating downstream impact of the dam on the freshwater fish diversity in near future.

Table 1: List of Fishes of lower Subansiri river drainage

	Species Name with family	IUCN Status, 2013
I. FAMILY : NOTOPTERIDAE		
1.	*Chitala chitala* (Hamilton, 1822)	NT
2.	*Notopterus notopterus* (Pallas, 1769)	LC
II. FAMILY : ANGUILLIDAE		
3.	*Anguilla bengalensis* (Gray, 1831)	LC
III. FAMILY : CLUPIDAE		
4.	*Gudusia chapra* (Hamilton, 1822)	LC
5.	*Tenualosa ilisha* (Hamilton, 1822)	N/E
6.	*Gonialosa manmina* (Hamilton, 1822)	LC
IV. FAMILY : ENGRAULIDAE		
7.	*Setipinna phasa* (Hamilton, 1822)	LC
V. FAMILY : CYPRINIDAE		
8.	*Hypophthalmichthys molitrix* (Valenciennes, 1844)	NT
9.	*Aspidoparia jaya* (Hamilton, 1822)	LC
10.	*Cabdio morar* (Hamilton, 1822)	LC
11.	*Amblypharyngodon mola* (Hamilton, 1822)	LC
12.	*Barilius barila* (Hamilton, 1822)	LC
13.	*Opsarius barna* (Hamilton, 1822)	LC
14.	*Barilius bendelisis* (Hamilton, 1807)	LC
15.	*Barilius shacra* (Hamilton, 1822)	LC
16.	*Barilius tileo* (Hamilton, 1822)	LC
17.	*Barilius vagra* (Hamilton, 1822)	LC
18.	*Bengala elanga* (Hamilton, 1822)	LC
19.	*Chela cachius* (Hamilton, 1822)	LC
20.	*Laubuca laubuca* (Hamilton, 1822)	LC
21.	*Danio dangila* (Hamilton, 1822)	LC
22.	*Danio rerio* (Hamilton, 1822)	LC
23.	*Danionella priapus* Britz, 2009	DD
24.	*Devario aequipinnatus* (McClelland, 1839)	DD
25.	*Devario assamensis* (Barman, 1984)	VU
26.	*Devario devario* (Hamilton, 1822)	LC
27.	*Esomus danricus* (Hamilton, 1822)	LC
28.	*Raiamas bola* (Hamilton, 1822)	LC
29.	*Rasbora daniconius* (Hamilton, 1822)	LC
30.	*Rasbora rasbora* (Hamilton, 1822)	LC
31.	*Salmophasia bacaila* (Hamilton, 1822)	LC
32.	*Salmophasia phulo* (Hamilton, 1822)	LC
33.	*Securicula gora* (Hamilton, 1822)	LC
34.	*Bangana dero* (Hamilton, 1822)	LC
35.	*Catla catla* (Hamilton, 1822)	LC
36.	*Chagunius chagunio* (Hamilton, 1822)	LC
37.	*Cirrhinus mrigala* (Hamilton, 1822)	LC
38.	*Cirrhinus reba* (Hamilton, 1822)	LC
39.	*Ctenopharyngodon idella* (Valenciennes, 1844)	N/E
40.	*Cyprinus carpio* Linnaeus, 1758	VU
41.	*Crossocheilus latius* (Hamilton, 1822)	LC
42.	*Crossocheilus* sp	N/A
43.	*Labeo angra* (Hamilton, 1822)	LC
44.	*Labeo bata* (Hamilton, 1822)	LC
45.	*Labeo boga* (Hamilton, 1822)	LC
46.	*Labeo calbasu* (Hamilton, 1822)	LC
47.	*Labeo fimbriatus* (Bloch, 1795)	LC
48.	*Labeo dyocheilus* (McClelland, 1839)	LC
49.	*Labeo gonius* (Hamilton, 1822)	LC
50.	*Labeo nandina* (Hamilton, 1822)	NT
51.	*Labeo pangusia* (Hamilton, 1822)	NT
52.	*Labeo rohita* (Hamilton, 1822)	LC
53.	*Neolissochilus hexagonolepis* (McClelland, 1839)	NT
54.	*Neolissochilus hexastichus* (McClelland, 1839)	NT
55.	*Oreichthys casuatis* (Hamilton, 1822)	LC
56.	*Osteobrama cotio* (Hamilton, 1822)	LC
57.	*Pethia conchonius* (Hamilton, 1822)	LC
58.	*Pethia gelius* (Hamilton, 1822)	LC
59.	*Pethia phutunio* (Hamilton, 1822)	LC
60.	*Pethia guganio* (Hamilton, 1822)	LC
61.	*Puntius chola* (Hamilton, 1822)	LC
62.	*Puntius sophore* (Hamilton, 1822)	LC
63.	*Puntius terio* (Hamilton, 1822)	LC

64.	*Puntius ticto* (Hamilton, 1822)	LC
65.	*Puntius* sp.	N/A
66.	*Systomus clavatus* (McClelland, 1845)	NT
67.	*Systomus sarana* (Hamilton, 1822)	LC
68.	*Cyprinion semiplotum* (McClelland, 1839)	VU
69.	*Tor progeneius* (McClelland, 1839)	NT
70.	*Tor putitora* (Hamilton, 1822)	EN
71.	*Tor tor* (Hamilton, 1822)	NT
72.	*Schizothorax richardsonii* (Gray, 1832)	VU
73.	*Garra annandalei* Hora, 1921	LC
74.	*Garra arupi* Nebeshwar, Vishwanath& Das 2009	NE
75.	*Garra gotyla* (Gray, 1830)	LC
76.	*Garra lamta* (Hamilton, 1822)	LC
77.	*Garra lissorhynchus* (McClelland, 1842)	LC
78.	*Garra nasuta* (McClelland, 1838)	LC
79.	*Garra* sp.	N/A
VI. FAMILY : PSILORHYNCHIDAE		
80.	*Psilorhynchus arunachalensis* (Nebeshwar, Bagra & Das, 2007)	DD
81.	*Psilorhynchus balitora* (Hamilton, 1822)	LC
82.	*Psilorhynchus gracilis* Rainboth, 1983	LC
83.	*Psilorhynchus sucatio* (Hamilton, 1822)	LC
VII. FAMILY : BALITORIDAE		
84.	*Balitora brucei* Gray, 1830	NT
VIII. FAMILY: NEMACHEILIDAE		
85.	*Aborichthys elongatus* Hora, 1921	LC
86.	*Aborichthys kempi* Chaudhuri, 1913	NT
87.	*Acanthocobitis botia* (Hamilton, 1822)	LC
88.	*Neonoemacheilus assamensis* (Menon, 1987)	NT
89.	*Schistura beavani* (Günther, 1868)	LC
90.	*Schistura multifasciata* (Day, 1878)	LC
91.	*Schistura savona* (Hamilton, 1822)	LC
92.	*Schistura scaturigina* McClelland, 1839	LC
93.	*Schistura* sp1	N/A
94.	*Schistura* sp2	N/A
95.	*Nemacheilus corica* (Hamilton, 1822)	LC
IX. FAMILY: COBITIDAE		
96.	*Botia dario* (Hamilton, 1822)	LC
97.	*Botia rostrata* Günther, 1868	VU
98.	*Lepidocephalichthys annandalei* Chaudhuri, 1912	LC
99.	*Lepidocephalichthys goalparensis* Pillai &Yazdani 1976	LC
100.	*Lepidocephalichthys guntea* (Hamilton, 1822)	LC
101.	*Lepidocephalichthys irrorata* Hora, 1921	LC
102.	*Lepidocephalichthys menoni* Tilak and Yazdani 1976	DD
103.	*Pangio pangia* (Hamilton, 1822)	LC
104.	*Canthophrys gongota* (Hamilton, 1822)	LC
X. FAMILY : BAGRIDAE		
105.	*Batasio batasio* (Hamilton, 1822)	LC
106.	*Batasio merianiensis* (Chaudhuri, 1913)	N/E
107.	*Batasio spilurus* Ng, 2006	DD
108.	*Batasio tengana* (Hamilton, 1822)	LC
109.	*Chandramara chandramara* (Hamilton, 1822)	LC
110.	*Hemibagrus menoda* (Hamilton, 1822)	LC
111.	*Mystus bleekeri* (Day, 1877)	LC
112.	*Mystus carcio* (Hamilton, 1822)	LC
113.	*Mystus cavasius* (Hamilton, 1822)	LC
114.	*Mystus dibrugarensis* (Chaudhuri, 1913)	LC
115.	*Mystus tengara* (Hamilton, 1822)	LC
116.	*Mystus vittatus* (Bloch, 1794)	LC
117.	*Mystus* sp.	N/A
118.	*Rita rita* (Hamilton, 1822)	LC
119.	*Sperata aor* (Hamilton, 1822)	LC
120.	*Sperata seenghala* (Sykes, 1839)	LC
XI. FAMILY : SILURIDAE		
121.	*Ompok bimaculatus* (Bloch, 1794)	NT
122.	*Ompok pabda* (Hamilton, 1822)	NT
123.	*Ompok pabo* (Hamilton, 1822)	NT
124.	*Pterocryptis berdmorei* (Blyth, 1860)	LC
125.	*Wallago attu* (Bloch & Schneider, 1801)	LC
XII. FAMILY : SCHILBEIDAE		
126.	*Ailia coila* (Hamilton, 1822)	NT
127.	*Clupisoma garua* (Hamilton, 1822)	LC

128.	*Clupisoma montana* Hora, 1937	LC
129.	*Eutropiichthys murius* (Hamilton, 1822)	LC
130.	*Eutropiichthys vacha* (Hamilton, 1822)	LC
131.	*Neotropius atherinoides* (Bloch, 1794)	LC
132.	*Silonia silondia* (Hamilton, 1822)	LC
XIII. FAMILY : PANGASIDAE		
133.	*Pangasius pangasius* (Hamilton, 1822)	LC
XIV. FAMILY : AMBLYCIPITIDAE		
134.	*Amblyceps apangi* Nath & Dey, 1989	LC
135.	*Amblyceps arunachalensis* Nath & Dey, 1989	EN
136.	*Amblyceps mangois* (Hamilton, 1822)	LC
137.	*Amblyceps* sp.	N/A
XV. FAMILY : ERETHISTIDAE		
138.	*Hara hara* (Hamilton, 1822)	LC
139.	*Hara horai* Misra, 1976	LC
140.	*Hara jerdoni* Day, 1870	LC
141.	*Erethistes pusillus* Müller & Troschel, 1849	LC
142.	*Erethistoides infuscatus* Ng, 2006	DD
143.	*Erethistoides montana* Hora, 1950	DD
144.	*Pseudolaguvia ferruginea* Ng, 2009	DD
145.	*Pseudolaguvia flavida* Ng, 2009	DD
146.	*Pseudolaguvia foveolata* Ng, 2005	DD
147.	*Pseudolaguvia ribeiroi* (Hora, 1921)	LC
148.	*Pseudolaguvia* sp1	N/A
149.	*Pseudolaguvia* sp2	N/A
150.	*Conta conta* (Hamilton, 1822)	DD
XVI. FAMILY : SISORIDAE		
151.	*Bagarius bagarius* (Hamilton, 1822)	NT
152.	*Bagarius yarrellii* (Sykes, 1839)	NT
153.	*Gagata cenia* (Hamilton, 1822)	LC
154.	*Gagata sexualis* Tilak, 1970	LC
155.	*Glyptothorax cavia* (Hamilton, 1822)	LC
156.	*Glyptothorax dikrongensis* Tamang & Chaudhry, 2011	N/E
157.	*Glyptothorax gracile* (Günther, 1864)	DD
158.	*Glyptothorax indicus* Talwar, 1991	LC
159.	*Glyptothorax striatus* (McClelland, 1842)	NT
160.	*Glyptothorax telchita* (Hamilton, 1822)	LC
161.	*Glyptothorax* sp.	N/A
162.	*Gogangra viridescens* (Hamilton, 1822)	LC
163.	*Nangra assamensis* Sen & Biswas, 1994	LC
164.	*Nangra nangra* (Hamilton, 1822)	LC
165.	*Sisor rabdophorus* Hamilton, 1822	LC
XVII. FAMILY : CLARIDAE		
166.	*Clarias gariepinus* (Burchell, 1822)	N/E
167.	*Clarias magur* (Hamilton, 1822)	EN
XVIII. FAMILY : HETEROPNEUSTIDAE		
168.	*Heteropneustes fossilis* (Bloch, 1794)	LC
XIX. FAMILY : CHACIDAE		
169.	*Chaca chaca* (Hamilton, 1822)	LC
XX. FAMILY : OLYRIDAE		
170.	*Olyra longicaudata* McClelland, 1842	LC
XXI. FAMILY : MUGILIDAE		
171.	*Rhinomugil corsula* (Hamilton, 1822)	LC
XXII. FAMILY : BELONIDAE		
172.	*Xenentodon cancila* (Hamilton, 1822)	LC
XXIII. FAMILY : SYNBRANCHIDAE		
173.	*Monopterus albus* (Zuiew, 1793)	LC
174.	*Monopterus cuchia* (Hamilton, 1822)	LC
XXIV. FAMILY : MASTACEMBELLIDAE		
175.	*Macrognathus aral* (Bloch & Schneider, 1801)	LC
176.	*Macrognathus pancalus* Hamilton, 1822	LC
177.	*Mastacembelus armatus* (Lacepède, 1800)	LC
XXV. FAMILY : CHAUDHURIIDAE		
178.	*Pillaia indica* Yazdani, 1972	EN
XXVI. FAMILY : AMBASIDAE		
179.	*Chanda nama* Hamilton, 1822	LC
180.	*Parambassis lala* (Hamilton, 1822)	NT
181.	*Parambassis baculis* (Hamilton, 1822)	LC
182.	*Pseudambassis ranga* (Hamilton, 1822)	LC
XXVII. FAMILY : BADIDAE		
183.	*Badis assamensis* (Ahl, 1937)	DD

184.	*Badis badis* (Hamilton, 1822)	LC
185.	*Badis singenensis* Geetakumari & Kandu, 2011	DD
XXVIII. FAMILY : NANDIDAE		
186.	*Nandus nandus* (Hamilton, 1822)	LC
XXIX. FAMILY : CHICHLIDAE		
187.	*Oreochromis mossambicus* (Peters, 1852)	NT
XXX. FAMILY : GOBIIDAE		
188.	*Glossogobius giuris* (Hamilton, 1822)	LC
XXXI. FAMILY : ANABANTIDAE		
189.	*Anabas cobojius* (Hamilton, 1822)	LC
190.	*Anabas testudineus* (Bloch, 1792)	DD
XXXII. FAMILY : OSPHRONEMIDAE		
191.	*Trichogaster fasciata* Bloch & Schneider, 1801	LC
192.	*Trichogaster labiosa* Day, 1877	LC
193.	*Trichogaster lalius* (Hamilton, 1822)	LC
194.	*Trichogaster chuna* (Hamilton, 1822)	LC
195.	*Trichogaster* sp	N/A
XXXIII. FAMILY : CHANNIDAE		
196.	*Channa aurantimaculata* Musikasinthorn, 2000	DD
197.	*Channa bleheri* Vierke, 1991	NT
198.	*Channa gachua* (Hamilton, 1822)	LC
199.	*Channa marulius* (Hamilton, 1822)	LC
200.	*Channa punctata* (Bloch, 1793)	LC
201.	*Channa stewartii* (Playfair, 1867)	LC
202.	*Channa striata* (Bloch, 1793)	LC
203.	*Channa* sp.	N/A
XXXIV. FAMILY : TETRAODONTIDAE		
204.	*Tetraodon cutcutia* Hamilton, 1822	LC

Abbreviations: EN- Endangered, VU- Vulnerable, NT- Near Threatened, LC- Least Concerned, DD- Data Deficient, NE- Not Evaluated, N/A- Not applicable

CONCLUSION

Like many other rivers of northeast India, Subansiri River is being prepared for hydroelectric power production. The Environmental impact assessment report of the river included only 27 species of fishes from 10 km downstream to the dam site. In present study, we collected 204 species of fish from different habitat of the downstream river basin of the same river including some Endangered, Vulnerable, Near Threatened and Data Deficient fishes. Assemblage of such a large number of fish species in a single river tributary is rare and perhaps Subansiri is only one in Indian subcontinent. The commissioning of the 2000MW Lower Subansiri Hydroelectric Project will adversely affect these fish species in various ways and this paper will serve as a database for analyzing downstream impact of the dam on the ichthyofauna.

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