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Ichthyofaunal diversity of Arunachal Pradesh, India: A part of Himalaya biodiversity hotspot

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Abstract
A systematic, updated checklist of freshwater fishes of Arunachal Pradesh is provided. A total of 259 fish species under 105 genera, 34 families and 11 orders has been compiled based on present collection, available collections and literatures during the year 2014 to 2016. Thirty four fish species has been added to the previous report of 225 fish species. Besides, the state is type localities of 47 fish species and 32 species are considered endemic in the state. The fish fauna includes 19 threatened species as per IUCN status. The state has high fisheries potential as it harbour many commercially important food, sport or ornamental fishes. The fish fauna is a mixture of endemic hill streams, Assamese, and widely distributed forms.

Keywords: Biodiversity, Fish, conservation status, commercial importance, Arunachal Pradesh

Introduction
Arunachal Pradesh is located between 26.28° N and 29.30° N latitude and 91.20° E and 97.30° E longitude and has 83,743 square km area. The state is a part of the Himalaya biodiversity hotspot with combination of diverse habitats with a high level of endemism. The land is mostly mountainous with the Himalayan ranges running north south and the entire territory forms a complex hill system with varying elevations ranging from 50m in the foot-hills and gradually ascending to about 7000 m traversed throughout by a number of rivers and rivulets totaling to an estimated length of 2000 km. The mightiest of these rivers is Siang, called the Tsangpo in Tibet, which becomes the Brahmaputra after it is joined by the Dibang and the Lohit in the plains of Assam. Other major rivers traversing the state are Dikrong, Ranga, Siyom, Tirap, Subansiri and Kameng. Rainfall varies from 1000mm in higher reaches to 5750 mm in the foot-hill areas, spread over 8-9 months excepting the drier days in winter. This diversity of topographical and climatic conditions has made the state rich with various flora and fauna. Fish is one of the important bio resources which can be used as food, ornamental and in sport industry. Many researches on various fauna of the state is being taken up by different institutions as the bio-resources in the state had not been completely explored as most of the areas are located in unapproachable mountainous steep terrain with dense forest cover. There are still several undescribed species and far too few taxonomists to identify them, especially in such biodiversity-rich areas. Even now number of new species discovered from this state is still progressing as many researchers have taken special interest in fish taxonomy in this region because of its richness in the biological diversity.

History on the report on fish of Arunachal Pradesh is dated back as early as 1839 where McClelland [1] described 4 fish species from this state, then Chaudhuri [2] reported 21 fish species from his Abor expedition during 1911-1912, subsequently lots of fragmentary reports have come up from various water bodies (Hora [3], Jayaram and Mazumdar [4], Menon [5], Srivastava [6], Dutta and Sen [7], etc.). Still extensive faunal inventorizations by eminent researchers from Manipur University, Rajiv Gandhi University, Arunachal Pradesh, Zoological Survey of India (ZSI), Itanagar, Gauhati University, ICAR and other Institutes are continuing their taxonomic surveys augmenting the species list of the state (Sen [8], Nath *et al* [9],Tamang and Chaudhry [10], Ng and Tamang [11], Lokeshwar and Vishwanath [12], Tamang [13], Sinha and Tamang [14],Tamang and Sinha [15], Tamang and Sinha [16], Arunachalam *et al* [17], Darshan *et al* [18],Tamang *et al* [19], Vishwanath and Darshan [20], Kosygin [21], Tesia and Bordoloi [22] etc). A foremost work on the compilation of fish species available throughout the state was carried out by Nath and Dey [23]

resulting into revelation of as much as 131 fish species. Then from the year 2000 onwards explosion of literature on taxonomic research of new fish species discovered has been witnessing from this area. The most recent and notable works on the compilation of fish species reported was carried out by Bagra *et al.* [24] where they listed 213 fish species along with 7 new species discovered from the state and Sen and Khynriam [25], also listed 225 total fish species of the state. Besides these, there have been additions of new discoveries and new reports enriching the fish diversity of the state.

Materials and methods

The state is traversed throughout by a number of rivers and rivulets totaling to an estimated length of 2000 km. According to National Wetland Atlas, ISRO [26] the state has a total number of 128 rivers/streams and more than 1406 number of other wetlands which includes major ponds, lakes and reservoirs, covering total area of 15,5728 ha. A checklist of fishes of the Arunachal Pradesh has been prepared based on present collection, available collections in the National Zoological Collections of ZSI Itanagar and Universities and by consulting available literatures during the year 2014 to 2016. Fishes collected from the surveys of various water bodies viz., Dikrong river, Poma river, Ashopani river, Eme river, Eje river, Ethun river, Deopani river, Simari River, Dipu river, Senkhi river, Basarnalo river, Mehao, Ganga and Sally lakes and other small streams etc during the year 2014 to 2016 were identified and included in the list. The updated scientific names of valid taxa available in this list have followed that of catalog of fishes, California Academy of Sciences. Economic importance of fishes was worked out and also consulted reports of Goswami *et al.* [27] and Sakar and Ponniah [28] and for distribution Sen and Khynriam [25] was followed. The conservation status of 259 fish species reported in the present work was also worked out by following IUCN Red list of Threatened species [29].

Results and Discussion

A systematic, updated checklist of freshwater fishes of Arunachal Pradesh is provided. It includes a total of 259 fish species under 105 genera, 34 families and 11 orders. As per the perusal of available literatures and scrutinizing the deposited species available in the museums of ZSI, APRC, Itanagar; ZSI, Kolkata and Rajiv Gandhi University, Itanagar and also collection from different water bodies of Arunachal Pradesh, we came across and conclude herein that there are 34 more species that need to be added in the previous records of 225 species resulting into a total of 259 species reported from the state (Table 1). Out of 259 fish species listed here, altogether 152 fish species is currently housed in Arunachal Pradesh Regional Centre, ZSI which were collected from various faunastic surveys as early as 1983 by distinguished scientists. The state has been reported as type locality of 47 fish species, of which 14 type species are deposited in APRC museum and 7 type species are available in ZSI Head Quarter in Kolkata (Table 2). At present 32 of the fish species are endemic to the state.

Discovering of many fish species new to science and many new reports within a short span of time from this state reflects rich biodiversity resources of the state. Majority of the fish reported from the state has been come from the Siang, Noadihing, Dibang and Subansiri rivers and their tributaries (Fig. A) and most of the collection sites were found to be congregating around the lower altitude region of these rivers. Only few new species of fish has been reported from important river like Kameng River and its tributaries which lies on the western side of the state in higher altitude area. Though situated in the high altitude region of Greater or Higher Himalayas with heights greater than 6000m having precipitous slopes and deep gorges, from tributaries of upper reaches of Siang River like Siyom and Siren, as much as six new fish has been discovered. In contrast, so far no fish which is new to science has been reported from the mighty river like Lohit and it is tributaries. Despite their small size and less known, rivers like Ranga and Dikrong and their tributaries which lies within the lesser or Lower Himalayas range with an elevation up to 2500 m, are rich in bioresources especially in terms of fish diversity. Description of as many as 12 new fish species have come from these rivers reflecting biodiversity opulence of the areas. Another reason may possibly due to easy accessibility of the area since these areas are located in lower altitude region and not very far from the human habitations.

Before the present study, the most recent authenticated number of total fish species available in the state were 225 fishes by Sen and Khynriam [25]. Though Bagra *et al.* [24] have reported 213 species in their publication; the authors put taxonomic status of 27 species as uncertain. After wards many new fish species have been discovered by various workers from different river systems along with various new records from the state and some unreported published data make the total species list to 259. However, report of some fishes from the state, like *Barilius dogarsinghi* Hora 1921, *Garra mcclellandi* (Jerdon, 1849), *Garra gravelyi* (Annandalei, 1919), *Glyptothorax platypogonides* (Bleeker 1855), *Glyptothorax sinensis* (Regan 1908), *Glyptothorax trilineatus* Blyth, 1860, *Neolissochilus dukai* (Day, 1878), *Neolissochilus stevensonii* (Day, 1870) and *Osteochilus vittatus* (Valenciennes, 1842), *Salmophasia boopis* (Day, 1873), *Schistura kangjupkhulensis* (Hora 1821), *Schistura manipurensis* (Chaudhuri 1912), *Schistura sikmaiensis* (Hora 1921), *Schistura vinciguerrae* (Hora, 1935) though we have included in the list, are doubtful since the fishes are apparently restricted to regions or drainages, so needs further confirmation regarding its distribution in the state.

In the present study, highest diversity was observed in the family Cyprinidae with 95 species (36.8%) in which the genus *Garra* retains the highest diversity (21 species). Next to Cyprinidae, the catfish family Sisoridae retains the second highest species diversity representing 40 species (15.5%) in which the genus *Glyptothorax* has the highest diversity (15 species), followed by the family Nemacheilidae with 25 species (9.7%) in which the genus *Schistura* retains the highest diversity (14 species). Species composition represented by other groups are as follows in descending order: Family: Bagridae (14 species); Cobitidae (11 species); Channidae (8 species); Siluridae and Erethistidae (7 species each); Psilorhynchidae, Schilbeidae, Mastecembelidae, Amblycipitidae, Chandidae, and Badidae (4 species each); Synbranchidae, and Belontidae (3 species each); Notopteridae, Balitoridae, and Olyridae (2 species each) and remaining 14 families Anguillidae, Clupeidae, Engraulidae, Syngnathidae, Clariidae, Heteropneustidae, Chacidae, Salmonidae, Belonidae, Pillaiidae, Nandidae, Chichlidae, Gobiidae, and Anabantidae has least diversity represented solely by single species each.

Study on the conservation of fauna becomes very important now days because of its crucial role in ecosystem sustenance. Loss of biodiversity, especially endemic species, is a serious concern worldwide which cautions about the conservation imperatives to be adopted at the national and global levels to

check the extinction of species. Though the state lies within the one of the biologically hot spot region of the world, alarming effects of so call civilization does not spare the region. There are many threats to the fish fauna of the state because of rampant habitat destruction and overexploitation which is very prevalent in the state. To obtain a comprehensible picture of the conservation status of the fishes available in the state, status of the 259 fish species has worked out following IUCN [29]. It was found that 19 fish species has come under threatened category which includes 5 Endangered (EN) and 14 Vulnerable (VU). Fishes which come under endangered category are 1. *Tor putitora*, 2. *Devario horai,* 3. *Lepidocephalichthys arunachalensis,* 4. *Schistura kangjupkhulensis,* and 5. *Pillaia indica*. Another 22 species of fishes are considered as Near Threatened (NT), 141 species as Least Concern (LC) and 25 species are categorized under data deficient However, 52 fish species which are reported here are not evaluated. Interestingly, distribution of 32 fish species are restricted in the state, and considered as endemic to the Arunachal Pradesh, out of this two species, viz. *Devario horai* and *Lepidocephalichthys arunachalensis* categorized as endangered and two species viz., *Aborichthys tikaderi* and *Pseudecheneis sirenica* are considered as vulnerable according to IUCN [29].

The general concept of the people of north eastern India "all fishes are meant to be eaten" applies in the state as well, only the preference of one fish species to another exist. Popular cold water fishes like *Schizothorax richardsonii*, *Schizothorax prograstus*, *Tor tor*, *Tor putitora*, *Neolissochilus hexagonolepis* etc. have high food value costing more than 800/kg in the local fish market. Almost all the fish available here have economic value either as food, game or ornamental. The north eastern region of India alone accounts for nearly 85% of the freshwater ornamental fish trade which at present is dominated by the wild-caught species where the state of Arunachal Pradesh is one of the major contributors in this lucrative trade. The state with its varied topographic and climatic conditions coupled with rich bio-resources is considered as one of the gold mines for ornamental fishes. Since the state is dissected by many rivers and rivulets it provides ample prospect for sports fishery developments and can offer good angling opportunities. Besides, the state has many unchartered river terrains unknown to mankind which may have the potential for international eco-tourism and may provide adventure sport activities. Some of the places were trout and Mahseer fishing opportunities already available at the state are Bhalukpong and Tipi on the river Kameng, Pasighat on the river Siang, and Tezu on the river Lohit.

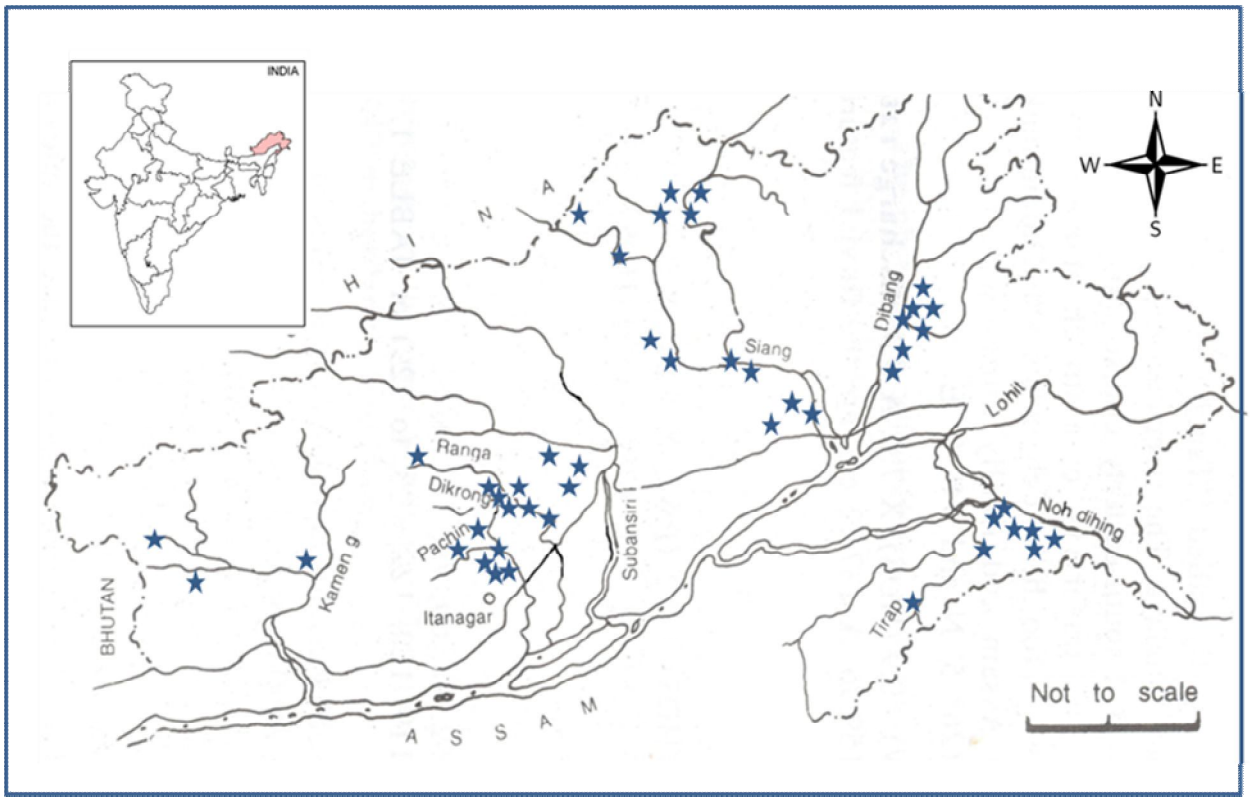

Fig. A. Type localities of 47 new fish species discovered on the drainage system of Arunachal Pradesh

Table 1: List of the fish species reported from the state of Arunachal Pradesh along with conservation status and economic value.

Sl. No	Species	Conservation status IUCN (2015)	Economic value	Reference
	Order OSTEGLOSSIFORMES			
	Family Notopteridae			
1.	*Notopterus notopterus* (Pallas 1769)	LC	F; S; O	APRCM
2.	*Chitala chitala* (Hamilton 1822)	NT	F; S; O	Ghosh & Lipton [31]
	Order ANGUILLIFORMES			
	Family Anguillidae			
3.	*Anguilla bengalensis* (Gray 1831)	NT	F	APRCM
	Order CLUPEIFORMES			

	Family Clupeidae			
4.	*Gudusia chapra* (Hamilton 1822)	LC	F; O	RGUMF
	Family: Engraulidae			
5.	*Setipinna phasa* (Hamilton 1822)	LC	F; O	Nath & Dey [23]
	Order CYPRINIFORMES			
	Family Cyprinidae			
6.	*Salmophasia bacaila* (Hamilton 1822)	LC	F; O	RGUMF
7.	*Salmophasia phulo* (Hamilton 1822)	LC	F; O	Sen [8]
8.	*Salmophasia boopis* (Day 1873)	LC	F	Sen & Khynriam [25]
9.	*Securicula gora* (Hamilton 1822)	LC	F; O	Sen [8]
10.	*Cabdio jaya* (Hamilton 1822)	NEv	F; O	APRCM
11.	*Cabdio morar* (Hamilton 1822)	LC	F; O	APRCM
12.	*Gibelion catla* (Hamilton 1822)	NEv	F	APRCM
13.	*Barilius bendelisis* (Hamilton 1807)	LC	F; O	APRCM
14.	*Barilius barna* (Hamilton 1822)	LC	F; O	APRCM
15.	*Barilius barila* (Hamilton 1822)	LC	F; O	Sen & Khynriam [25]
16.	*Barilius shacra* (Hamilton 1822)	LC	F	Nath & Dey [23]
17.	*Barilius tileo* (Hamilton 1822)	LC	F	APRCM
18.	*Barilius vagra* (Hamilton 1822)	LC	F; O	APRCM
19.	*Barilius dogarsinghi* Hora 1921	VU	F; O	Sen & Khynriam [25]
20.	*Raiamas bola* (Hamilton 1822)	LC	F; S	APRCM
21.	*Barilius arunachalensis* Nath *et al*. 2010 #	NEv	F	APRCM
22.	*Laubuca laubuca* (Hamilton 1822)	LC	F; O	APRCM
23.	*Chela cachius* (Hamilton 1822)	LC	O	APRCM
24.	*Esomus danricus* (Hamilton 1822)	LC	F; O	RGUMF
25.	*Danio dangila* (Hamilton 1822)	LC	F; O	APRCM
26.	*Danio rerio* (Hamilton 1822)	LC	F; O	APRCM
27.	*Devario aequipinnatus* (McClelland 1839)	LC	F; O	APRCM
28.	*Devario devario* (Hamilton 1822)	LC	F; O	APRCM
29.	*Devario acuticephala* (Hora 1921)	Vu	F; O	Sen & Khynriam [25]
30.	*Devario horai* (Barman 1983)#	EN	F; O	Sen & Khynriam [25]
31.	*Devario jayarami* (Barman 1984)	DD	F; O	Sen & Khynriam [25]
32.	*Rasbora daniconius* (Hamilton 1822)	LC	F; O	APRCM
33.	*Rasbora rasbora* (Hamilton 1822)	LC	F; O	Nath & Dey [23]]
34.	*Rasbora kobonensis* Chaudhuri 1913#	NEv	F	Menon [32]
35.	*Bengala elanga* (Hamilton 1822)	NEv	F; O	Nath & Dey [23]
36.	*Amblypharyngodon mola* (Hamilton 1822)	LC	F; O	APRCM
37.	*Cyprinus carpio* Linnaeus 1758	Vu	F; O	APRCM
38.	*Tor putitora* (Hamilton 1822)	EN	F; S	APRCM
39.	*Tor tor* (Hamilton 1822)	NT	F; S	APRCM
40.	*Tor progeneius* (McClelland 1839)	NT	F; S	Tesia & Bordoloi [22]
41.	*Neolissochilus hexastichus* (McClelland 1839)	NT	F; S	Chaudhuri [2]; Sen [8]
42.	*Neolissochilus hexagonolepis* (McClelland 1839)	NT	F; S	APRCM
43.	*Neolissochilus stevensonii* (Day 1970)	DD	F; S	Sen & Khynriam [25]
44.	*Neolissochilus dukai* (Day 1878)	DD	F; S	Sen & Khynriam [25]
45.	*Oreichthys cosuatis* (Hamilton 1822)	LC	O	APRCM
46.	*Osteobrama cotio* (Hamilton 1822)	LC	F	RGUMF
47.	*Osteochilus vittatus* (Valenciennes 1842)	LC	F	Sen & Khynriam [25]
48.	*Chagunius chagunio* (Hamilton 1822)	LC	F	APRCM
49.	*Puntius chola* (Hamilton 1822)	LC	F; O	APRCM
50.	*Puntius guganio* (Hamilton 1822)	LC	O	Sen [8]
51.	*Puntius sophore* (Hamilton 1822)	LC	F; O	APRCM
52.	*Puntius terio* Jha *et al*. 2013	LC	O	Jha *et al* [33]
53.	*Pethia conchonius* (Hamilton 1822)	LC	O; F.	APRCM
54.	*Pethia shalynius* (Yazdani & Talukdar 1975)	Vu	O	Sen [8]
55.	*Pethia ticto* (Hamilton 1822)	LC	F; O	APRCM
56.	*Systomus sarana* (Hamilton 1822)	LC	F	APRCM
57.	*Systomus clavatus* (McClelland 1845)	NEv	F; O	Ghosh & Lipton [31]
58.	*Semilpotus semiplotum* (McClelland 1839)	VU	F	APRCM
59.	*Cirrhinus cirrhosus* (Bloch 1795)	VU	F; S	Sen & Khynriam [25]
60.	*Cirrhinus mrigala* (Hamilton 1822)	LC	F	RGUMF
61.	*Cirrhinus reba* (Hamilton 1822)	LC	F	APRCM
62.	*Labeo calbasu* (Hamilton 1822)	LC	F	APRCM
63.	*Labeo bata* (Hamilton 1822)	LC	F	Nath & Dey [23]
64.	*Labeo boga* (Hamilton 1822)	LC	F	Nath & Dey [23]
65.	*Labeo gonius* (Hamilton 1822)	LC	F	APRCM
66.	*Labeo pangusia* (Hamilton 1822)	NT	F	APRCM
67.	*Labeo rohita* (Hamilton 1822)	LC	F	APRCM

68.	*Labeo dyocheilus* (McClelland 1839)	LC	F	Chaudhuri [2]
69.	*Bangana ariza* (Hamilton 1807)	LC	F	Sen & Khynriam [25]
70.	*Bangana dero* (Hamilton 1822)	LC	F	APRCM
71.	*Bangana devdevi* (Hora 1936)	LC	F	Nath & Dey [23];
72.	*Schizothorax plagiostomus* Heckel 1877	NEv		Chaudhuri [2]
73.	*Schizothorax richardsonii* (Gray 1832)	Vu	F; S	APRCM
74.	*Schizopygopsis stoliczkai* Steindachner 1866	NEv	F; S	Dutta & Sen [7]
75.	*Schizothorax esocinus* Heckel 1838	NEv	F; S	APRCM
76.	*Schizothorax progastus* (McClelland 1839)	LC	F; S	APRCM
77.	*Schizothorax molesworthii* (Chaudhuri 1913)	NEv	S	Chaudhuri [2]
78.	*Crossocheilus latius* (Hamilton 1822)	LC	F	APRCM
79.	*Crossocheilus burmanicus* Hora 1936	LC	F; O	Sen [8]
80.	*Garra lamta* (Hamilton 1822)	LC	F; O	Chaudhuri [2]
81.	*Garra gotyla* (Gray 1830)	LC	F	Nath & Dey [23]
82.	*Garra nasuta* (McClelland 1838)	LC	F; O	Sen & Khynriam [25]
83.	*Garra rupecula* (McClelland 1839)	NT	F; O	Sen & Khynriam [25]
84.	*Garra lissorhynchus* (McClelland 1842)	LC	F; O	APRCM
85.	*Garra mcclellandi* (Jerdon 1849)	LC	O	Nath & Dey [23]
86.	*Garra gravelyi* (Annandale 1919)	NT	F; O	Sen & Khynriam [25]
87.	*Garra kempi* Hora 1921	LC	F	APRCM
88.	*Garra annandalei* Hora 1921	LC	F	APRCM
89.	*Garra naganensis* Hora 1921	LC	F; O	Nath & Dey [23]
90.	*Garra arupi* Nebeshwar & Das, 2009#	NEv	F; O	APRCM
91.	*Garra kalpangi* Nebeshwar *et al*. 2012#	NEv	O	APRCM
92.	*Garra magnidiscus* Tamang, 2013#	NEv	F; O	APRCM
93.	*Garra arunachalensis* Nebeshwar & Vishwanath, 2013#	NEv	F; O	APRCM
94.	*Garra quadratirostris* Nebeshwar & Vishwanath, 2013	NEv	F; O	APRCM
95.	*Garra birostris* Nebeshwar & Vishwanath, 2013#	NEv	F; O	APRCM
96.	*Garra minimus* Arunachalam *et al*. 2013#	NEv	F; O	Arunachalam *et al* [17]
97.	*Garra alticaputus* Arunachalam *et al*. 2013#	NEv	F; O	Arunachalam *et al* [17]
98.	*Garra nigricauda* Arunachalam *et al*. 2013#	NEv	F; O	Arunachalam *et al* [17]
99.	*Garra kimini* Arunachalam *et al*. 2013#	NEv	F; O	Arunachalam *et al* [17]
100.	*Garra tamangi,* Gurumayum & Kosygin 2016	NEv	F; O	APRCM
	Family Psilorhynchidae			
101.	*Psilorhynchus balitora* (Hamilton 1822)	LC	O	APRCM
102.	*Psilorhynchus homaloptera* Hora & Mukerji 1935	LC	O	RGUMF
103.	*Psilorhynchus sucatio* (Hamilton 1822)	LC	O	Sen [8]
104.	*Psilorhynchus arunachalensis* (Nebeshwar *et al*. 2007)#	DD	O	APRCM
	Family Cobitidae			
105.	*Acantopsis choirorhynchos* (Bleeker 1854)	LC	O	Sen & Khynriam [25]
106.	*Pangio pangia* (Hamilton 1822)	LC	O	APRCM
107.	*Syncrossus berdmorei* (Blyth 1861)	NT	O	Sen & Khynriam [25]
108.	*Botia dario* (Hamilton 1822)	LC	S	APRCM
109.	*Botia rostrata* Gunther 1868	VU	S	APRCM
110.	*Lepidocephalichthys annandalei* Chaudhuri 1912	LC	F; O	APRCM
111.	*Lepidocephalichthys arunachalensis* (Dutta & Barman 1984)#	EN	O	APRCM
112.	*Lepidocephalichthys berdmorei* (Blyth 1960)	NEv	S	Tesia & Bordoloi [22]
113.	*Lepidocephalichthys goalparensis* Pillai & Yazdani 1976	LC	-	Nath & Dey [23]
114.	*Lepidocephalichthys guntea* (Hamilton 1822)	LC	F; S	APRCM
115.	*Canthophrys gongota* (Hamilton 1822)	LC	F; O	APRCM
	Family Balitoridae			
116.	*Balitora brucei* Gray 1830	NT	O	APRCM
117.	*Bhavania arunachalensis* Nath *et al*. 2007#	NEv	-	APRCM
	Family Nemacheilidae			
118.	*Schistura kangjupkhulensis* (Hora 1821)	EN	O	Sen [8]
119.	*Schistura savona* (Hamilton 1822)	LC	O	APRCM
120.	*Schistura rupecula* McClelland 1838	LC	O	APRCM
121.	*Schistura scaturigina* (McClelland 1839)	LC	O	APRCM
122.	*Schistura cincticauda* (Blyth 1860)	DD	O	Sen [8]
123.	*Schistura beavani* (Gunther 1868)	LC	O	Sen [34]
124.	*Schistura multifasciata* (Day 1878)	LC	O	Sen [8]
125.	*Schistura manipurensis* (Chaudhuri 1912)	NT	O	Nath & Dey [23]
126.	*Schistura prashadi* (Hora 1921)	Vu	O	Ghosh & Lipton [31]
127.	*Schistura sikmaiensis* (Hora 1921)	LC	O	APRCM
128.	*Schistura vinciguerrae* (Hora 1935)	LC	O	Tesia & Bordoloi [22]
129.	*Schistura devdevi* (Hora 1935)	NT	O	APRCM
130.	*Schistura nagaensis* (Menon 1987)	Vu	O	Sen & Khynriam [25]

131.	*Schistura tirapensis* Kottelat 1990	LC	O	Kottelat [35]
132.	*Nemacheilus corica* (Hamilton 1822)	LC	O	Sen [8]
133.	*Physoschistura dikrongensis* Lokeshwar & Vishwanath, 2012	NEv	-	RGUMF
134.	*Aborichthys kempi* Chaudhuri 1913	NT	O	APRCM
135.	*Aborichthys elongatus* Hora 1921	LC	O	APRCM
136.	*Aborichthys garoensis* Hora 1925	Vu	O	Ghosh & Lipton [31]
137.	*Aborichthys tikaderi* (Barman 1985)#	Vu	O	Barman [36]
138.	*Aborichthys rosammai* Sen 2009	NEv	-	Sen & Khynriam [25]
139.	*Aborichthys waikhomi* Kosygin 2012#	NEv	-	Kosygin [21]
140.	*Acanthocobitis botia* (Hamilton 1822)	LC	O	APRCM
141.	*Acanthocobitis pavonacea* (McClelland 1839)	NEv	-	Sen & Khynriam [25]
142.	*Acanthocobitis zonalternans* (Blyth 1860)	LC	O	Sen [8]
	Order SILURIFORMES			
	Family Bagridae			
143.	*Rita rita* (Hamilton 1822)	LC	F	Nath & Dey [23]
144.	*Batasio tengana* (Hamilton 1822)	LC	O	Nath & Dey [23]
145.	*Batasio batasio* (Hamilton 1822)	LC	O	Sen [8]
146.	*Batasio fasciolatus* Ng 2006	LC	F; O	RGUMF
147.	*Batasio merianiensis* (Chaudhuri 1913)	DD	-	APRCM
148.	*Chandramara chandramara* (Hamilton 1822)	LC	F; O	Sen [37]
149.	*Hemibagrus menoda* (Hamilton 1822)	LC	F	Sen & Khynriam [25]
150.	*Mystus vittatus* (Bloch 1794)	LC	F; O	APRCM
151.	*Mystus cavasius* (Hamilton 1822)	LC	F; O	APRCM
152.	*Mystus montanus* (Jerdon 1849)	LC	F; O	APRCM
153.	*Mystus bleekeri* (Day 1877)	LC	F; O	APRCM
154.	*Mystus dibrugarensis* (Chaudhuri 1913)	LC	-	Sen & Khynriam [25]
155.	*Sperata aor* (Hamilton 1822)	LC	F	APRCM
156.	*Sperata seenghala* (Sykes 1839)	LC	F	APRCM
	Family Siluridae			
157.	*Ompok bimaculatus* (Bloch 1794)	NT	F	RGUMF
158.	*Ompok pabda* (Hamilton 1822)	NT	F	APRCM
159.	*Ompok pabo* (Hamilton 1822)	NT	F	RGUMF
160.	*Wallago attu* (Bloch and Schneider 1801)	NT	F	APRCM
161.	*Pterocryptis indicus* (Dutta, Barman and Jayaram 1987)	DD	F	APRCM
162.	*Pterocryptis gangelica* Peters 1861	DD	F	APRCM
163.	*Pterocryptis torrentis* (Kobayakawa 1989)	NEv	F	Sen [8]
	Family Schilbeidae			
164.	*Clupisoma garua* (Hamilton 1822)	LC	F	Nath & Dey [23]
165.	*Ailia coila* (Hamilton 1822)	NT	F; O	APRCM
166.	*Neotropius atherinoides* (Bloch 1794)	LC	F	RGUMF
167.	*Eutropiichthys vacha* (Hamilton 1822)	LC	F; game	RGUMF
	Family Amblycipitidae			
168.	*Amblyceps mangois* (Hamilton 1822) Sen (1985)	NEv	O	APRCM
169.	*Amblyceps arunachalensis* Nath & Dey 1989#	NEv	O	APRCM
170.	*Amblyceps apangi* Nath & Dey 1989	LC	O	APRCM
171.	*Amblyceps waikhomi* Darshan *et al* 2016	NEv	O	APRCM
	Family Sisoridae			
172.	*Bagarius bagarius* (Hamilton 1822)	NT	F	APRCM
173.	*Creteuchiloglanis kamengensis* (Jayaram 1966)#	DD	O	APRCM
174.	*Creteuchiloglanis arunachalensis* Sinha & Tamang, 2014	NEv	O	APRCM
175.	*Creteuchiloglanis payjab* Darshan *et al*. 2014#	NEv	O	APRCM
176.	*Glyptosternon maculatum* (Regan, 1905)	LC	O	Sen & Khynriam [25]
177.	*Exostoma labiatum* (McClelland 1842)	LC	O	APRCM
178.	*Exostoma berdmorei* Blyth 1860	DD	O	Ghosh & Lipton [31]
179.	*Exostoma stuarti* (Hora 1923)	DD	O	Sen [8]
180.	*Exostoma tenuicaudata* Tamang, Sinha & Gurumayum, 2015	NEv	O	APRCM
181.	*Gagata cenia* (Hamilton 1822)	LC	O	RGUMF
182.	*Glyptothorax cavia* (Hamilton 1822)	LC	F; O	APRCM
183.	*Glyptothorax brevipinnis* Hora 1823	DD	O	APRCM
184.	*Glyptothorax pectinopterus* (McClelland1842)	LC	F; O	APRCM
185.	*Glyptothorax striatus* (McClelland 1842)	NT	F; O	Sen [8]
186.	*Glyptothorax platypogonides* (Bleeker 1855)	NEv	F; O	Sen [8]
187.	*Glyptothorax trilineatus* Blyth, 1860	LC	F; O	APRCM
188.	*Glyptothorax gracilis* (Gunther 1864)	DD	F; O	Talwar & Jhingran [38]
189.	*Glyptothorax conirostris* (Steindachner 1867)	DD	F	APRCM
190.	*Glyptothorax sinensis* (Regan 1908)	DD	O	Bagra *et al* [24]

191.	*Glyptothorax saisii* (Jenkins 1910)	Vu	O	Nath & Dey [23]
192.	*Glyptothorax annandalei* Hora 1923	LC	O	Talwar & Jhingran [38]
193.	*Glyptothorax indicus* Talwar 1991	LC	O	APRCM
194.	*Glyptothorax pantherinus* Anganthoibi & Vishwanath 2013	NEv	-	Anganthoibi & Vishwanath [39]
195.	*Glyptothorax telchitta* (Hamilton 1822)	LC	O	APRCM
196.	*Glyptothorax dikrongensis* Tamang *et al*. 2011#	NEv	-	APRCM
197.	*Gogangra viridescens* (Hamilton 1822)	LC	O	Bagra *et al* [24]
198.	*Nangra assamensis* Sen & Biswas 1994	LC	O	RGUMF
199.	*Oreoglanis setiger* Ng & Rainboth 2001	DD	O	RGUMF
200.	*Oreoglanis majusculus* Linthoingambi & Vishwanath, 2011#	NEv	O	RGUMF
201.	*Oreoglanis pangenensis* Sinha & Tamang 2015#	NEv	O	APRCM
202.	*Parachiloglanis hodgarti* (Hora 1923)	LC	O	APRCM
203.	*Pareuchiloglanis macrotrema* (Norman 1925)	DD	O	Sen & Khynriam [25]
204.	*Pseudecheneis sulcata* (McClelland 1842)	LC	O	APRCM
205.	*Pseudecheneis sirenica* Vishwanath & Darshan 2007#	Vu	F; O	RGUMF
206.	*Sisor rhabdophorus* Hamilton 1822	NEv	O	Nath & Dey [23]
207.	*Pseudolaguvia shawi* (Hora 1921)	LC	O	APRCM
208.	*Pseudolaguvia ribeiroi* (Hora 1921)	LC	O	Sen [8]
209.	*Pseudolaguvia ferula* Ng 2005	DD	O	Sen & Khynriam [25]
210.	*Pseudolaguvia viriosa* Ng & Tamang 2012#	NEv	O	APRCM
211.	*Pseudolaguvia magna* Tamang & Sinha 2014#	NEv	O	APRCM
212.	*Pseudolaguvia jiyaensis* Tamang & Sinha 2014#	NEv	O	APRCM
	Family Erethistidae			
213.	*Conta conta* (Hamilton 1822)	DD	O	APRCM
214.	*Conta pectinata* Ng 2005	DD	-	APRCM
215.	*Erethistes pussilus* Muller & Troschel 1849	NEv	O	APRCM
216.	*Erethistoides montana* Hora 1950	DD	O	Sen & Khynriam [25]
217.	*Erethistoides senkhiensis* Tamang *et al*. 2008#	NEv	-	APRCM
218.	*Hara jerdoni* Day 1870	LC	O	APRCM
219.	*Hara hara* (Hamilton 1822)	LC	O	RGUMF
	Order SYNGNATHIFORMES			
	Family Syngnathidae			
220.	*Doryichthys martensii* (Peters 1868)	LC	O	Jha & Chetri [40]
	Family Clariidae			
221.	*Clarias magur* (Linnaeus 1758)	LC	F	Sen & Khynriam [25]
	Family Heteropneustidae			
222.	*Heteropneustes fossilis* (Bloch 1794)	LC	F	APRCM
	Family Chacidae			
223.	*Chaca chaca* (Hamilton 1822)	LC	O	APRCM
	Family Olyridae			
224.	*Olyra longicaudata* McClelland 1842	LC	O	APRCM
225.	*Olyra kempi* Chaudhuri 1912	LC	O	Sen & Khynriam [25]
	Order SALMONIFORMES			
	Family Salmonidae			
226.	*Oncorhynchus mykiss* (Walbaum 1792)	NEv	F	RGUMF
	Order BELONIFORMES			
	Family Belonidae			
227.	*Xenentodon cancila* (Hamilton 1822)	LC	O	APRCM
	Order SYNBRANCHIFORMES			
	Family Synbranchidae			
228.	*Monopterus albus* (Zuiew 1793)	LC	F; O	Sen & Khynriam [25]
229.	*Monopterus cuchia* (Hamilton 1822	LC	F; O	APRCM
230.	*Monopterus hodgarti* (Chaudhuri 1913)#	DD	F	Sen & Khynriam [25]
	Family Mastacembelidae			
231.	*Macrognathus aculeatus* (Bloch 1786)	NEv	-	APRCM
232.	*Macrognathus aral* (Bloch & Schineider 1801)	LC	F	APRCM
233.	*Macrognathus pancalus* Hamilton 1822	LC	F; S; O	APRCM
234.	*Mastacembelus armatus* (Lacepede 1800)	LC	F; S; O	APRCM
	Family: Pillaiidae			
235.	*Pillaia indica* Yazdani, 1972	EN	O	Nath & Dey [23]
	Order PERCIFORMES			
	Family Chandidae			
236.	*Chanda nama* Hamilton 1822	LC	O	APRCM
237.	*Parambassis baculis* (Hamilton 1822)	LC	F; O	Nath & Dey [23]
238.	*Parambassis ranga* (Hamilton 1822)	LC	F; O	APRCM
239.	*Parambassis bistigmata* Geetakumari 2012	NEv	-	Sen & Khynriam [25]
	Family Nandidae			

240.	*Nandus nandus* (Hamilton 1822)	LC	O	APRCM
	Family: Badidae			
241.	*Badis assamensis* Ahl 1937	DD	O	APRCM
242.	*Badis badis* (Hamilton 1822)	LC	O	APRCM
243.	*Badis singenensis* Geetakumari & Kadu 2011#	NEv	O	APRCM
244.	*Badis triocellus* Khynriam & Sen 2011	NEv	O	Sen & Khynriam [25]
	Family Cichlidae			
245.	*Oreochromis mossambica* (Peters 1852)	NEv	O	APRCM
	Family Gobiidae			
246.	*Glossogobius giuris* (Hamilton 1822)	LC	F O	APRCM
	Family Anabantidae			
247.	*Anabas testudineus* (Bloch 1792)	DD	F; O	APRCM
	Family Belontidae			
248.	*Trichogaster chuna* (Hamilton 1822)	LC	O	RGUMF
249.	*Trichogaster fasciata* (Bloch & Schneider 1801)	LC	O	APRCM
250.	*Trichogaster labiosa* (Day 1877)	LC	O	RGUMF
	Family Channidae			
251.	*Channa marulius* (Hamilton 1822)	LC	F; O	APRCM
252.	*Channa stewartii* (Playfair 1867)	LC	F; O	Sen & Khynriam [25]
253.	*Channa punctata* (Bloch 1793)	LC	F; O	APRCM
254.	*Channa striata* (Bloch 1793)	LC	F O	APRCM
255.	*Channa gachua* (Hamilton 1822)	LC	F; O	APRCM
256.	*Channa barca* (Hamilton 1822)	DD	F; O	Vishwanath & Geetakumari [41]
257.	*Channa bleheri* Vierke 1991	NT	F; O	Vishwanath & Geetakumari [41]
258.	*Channa aurantimaculata* Musikasinthorn 2000	DD	F; O	Vishwanath & Geetakumari [41]
	Order TETRAODONTOFORMES			
	Family Tetraodontidae			
259.	*Tetraodon cutcutia* Hamilton 1822	LC	O	APRCM

Fishes presently endemic to Arunachal Pradesh

Abbreviation: **APRCM**-Arunachal Pradesh Regional Centre Museum; **RGUMF**-Rajiv Gandhi University Museum of Fishes; **ZSI**- Zoological Survey of India. F: Food; O: Ornamental, S: Sport, **EN**-Endangered; **NT**- Near Threatened; **VU**-Vulnerable; **LC**-Least Concern; **DD**- Data Deficient; **NEv**- Not Evaluated

Table 2: List of new species described from the State of Arunachal Pradesh.

Sl. No	Scientific name	Type Locality
1.	*Aborichthys cataracta* Arunachalam, Manickam, Punniyam & Mayden 2014	Ranga River, Upper Subanshri District.
2.	*Aborichthys kempi* Chaudhuri 1913#	Egar stream of Dihang River near Yembung, and Sirpo River near Renging, Abor Hills.
3.	*Aborichthys tikaderi* (Barman 1985) #	Namdapha Wildlife Sanctuary, Namdapha, Changlang.
4.	*Aborichthys verticauda* Arunachalam, Manickam, Punniyam & Mayden 2014	Ranga River, Lower Subanshri District.
5.	*Aborichthys waikhomi* Kosygin 2012*#	Noa-Dihing river, Namdapha, Changlang district.
6.	*Amblyceps apangi* Nath & Dey 1989	Dikrong River, Doimukh, Papum pare district.
7.	*Amblyceps arunachalensis* Nath & Dey 1989*	Dikrong River, Doimukh, Papum pare district.
8.	*Badis singenensis* Geetakumari & Kadu 2011	Singen River, East Siang district.
9.	*Barilius arunachalensis* Nath, Dam, Anil Kumar 2010	Agari River mouth, D'Ering Memorial Wildlife Sanctuary, near Pasighat, East Siang District.
10.	*Bhavania arunachalensis* Nath, Dam, Bhutia, Dey & Das, 2007* -	Noadhing River drainage near Namsai, about 30 kilometers from Tezu.
11.	*Creteuchiloglanis arunachalensis* Sinha & Tamang 2014*	Pange River, Lower Subansiri District.
12.	*Creteuchiloglanis kamengensis* (Jayaram 1966) #	Norgum River at Kalaktang, Kameng Frontier Division, NEFA.
13.	*Creteuchiloglanis payjab* Darshan *et al*. 2014*	Yomgo River, West Siang District.
14.	*Devario horai* (Barman, 1984) #	Namdapha River, Tirap District.
15.	*Erethistoides senkhiensis* Tamang *et al*. 2008	Senkhi stream, Itanagar, Papum Pare district.
16.	*Exostoma tenuicaudata* Tamang, Sinha & Gurumayum 2015	Ranga River, Upper Subanshri District.
17.	*Garra rupecula* (McClelland 1839)	Lareeh River, few mile beyond Bramacuna, in Mishmee [Mishmi] Hills.
18.	*Garra arupi* Nebeshwar *et al*. 2009	Deopani River at Roing, Lower Divang Valley.
19.	*Garra kalpangi* Nebeshwar *et al*. 2012	Deopani River at Roing, Lower Divang Valley.
20.	*Garra kempi* (Hora 1921)	Siyom River, below Damda, among the Abor Hills.
21.	*Garra magnidiscus* Tamang 2013*	Siang River, Upper Siang district.
22.	*Garra quadratirostris* Nebeshwar & Vishwanath 2013	Deopani River at Roing, Lower Divang Valley district; Mibung

		River at Boleng, East Siang district.
23.	*Garra minimus* Arunachalam *et al*. 2013	Ranga River, Lower Subanshri District, Arunachal Pradesh
24.	*Garra alticaputus* Arunachalam *et al*. 2013	Dikrong River, Ranga River, Lower Subanshri District.
25.	*Garra nigricauda* Arunachalam *et al*. 2013	Siang River, near Pasighat, East Siang district.
26.	*Garra kimini* Arunachalam *et al*. 2013	Ranga River, Lower Subanshri District.
27.	*Garra birostris* Nebeshwar & Vishwanath 2013	Dikrong River at Doimukh, Papum Pare district.
28.	*Garra arunachalensis* Nebeshwar & Vishwanath 2013	Deopani River at Roing, Lower Divang valley district.
29.	*Glyptothorax dikrongensis* Tamang & Chaudhry 2011 *	Dikrong River at Doimukh, Papum pare district.
30.	*Glyptothorax pantherinus* Anganthoibi & Vishwanath 2013	Noa Dehing River, Deban-Namdapha, Changlang district, Brahmaputra River basin.
31.	*Lepidocephalichthys arunachalensis* (Dutta & Barman 1984)	Namdapha River, Namdapha Wildlife Sanctuary, Tirap district.
32.	*Oreoglanis majusculus* Linthoingambi & Vishwanath, 2011	Kameng River at Rupa,West Kameng district.
33.	*Oreoglanis pangenensis* Sinha & Tamang, 2015*	Pange River, Aro-Lenching, Ziro, Lower Subansiri district.
34.	*Physochistura dikrongensis* Lokeshwar & Vishwanath 2012	Dikrong river at Doimukh, Papum pare district.
35.	*Pterocryptis indicus* (Dutta, Barman & Jayaram 1987) #	Hornbill Point, Namdapha River, Namdapha Wildlife Sanctuary, Changlang district.
36.	*Pseudecheneis sirenica* Vishwanath & Darshan 2007	Siren River, Upper Siang District.
37.	*Pseudolaguvia jiyaensis* Tamang & Sinha 2014*	Jiya stream, Roing, Lower Dibang Valley District.
38.	*Pseudolaguvia magna* Tamang & Sinha 2014*	Jiya stream, Roing, Lower Dibang Valley District.
39.	*Pseudolaguvia viriosa* Ng & Tamang 2012*	Sille River, East Siang district.
40.	*Psilorhynchus arunachalensis* (Nebeshwar, Bagra & Das 2007)	Dirang River at Dirang, West Kameng District.
41.	*Pterocryptis indicus* (Datta, Barman & Jayaram 1987)	Subansiri river below damsite, lower Subansiri district.
42.	*Badis triocellus* Khynriam & Sen 2011	Brahmaputra River, Kobo, Abor Hills.
43.	*Rasbora kobonensis* Chaudhuri 1913#	Riwa River at Manpong [Nampong], Tirap district.
44.	*Schistura tirapensis* Kottelat 1990	Upper Rottung, Abor Hills, East Siang district.
45.	*Monopterus hodgarti* (Chaudhuri 1913)	Upper Rotung, Abor Hills, East Siang district.
46.	*Amblyceps waikhomi* Darshan *et al.* 2016#	Noa Dehing River, Namsai district
47.	*Garra tamangi* Gurumayum & Kosygin 2016#	Dikrong river, Papum pare district

Type species housed in: #Zoological Survey of India, Kolkata * APRC, ZSI, Itranagar

Conclusion

The state has huge potential for fish resources. The state is also one of the best places to go for Fishing & Angling in India. A significance finding from this study is that out of 756 fresh water fish species reported from the entire country according to NBFGR database INDFISH [30], 259 fish species has been recorded in this state alone, which is more than one fourth of the total number of fish present in the country (27%). Within less than a decade 21 new fish species has discovered from this state reflecting biodiversity significance of the state. However the serious concern for the environmentalist is the presence of 5 fish species as endangered and 14 species as vulnerable and 22 species as near threatened category by IUCN Red list. Nowadays most biologists acknowledged the importance of biodiversity conservation since, they aware that habitat destruction is one of the most important factors for extinction of species. The present scenario in the state of Arunachal Pradesh is not exemption to it. Though included in the one of the biologically hot spot region of the world, the biological diversity of the state have suffered a lot because of anthropogenic activities. Thus, there is strong need for the conservation as well as exploration of this various fish resources available in this state. A detail literature analysis revealed that though lots of research works have already done on the fish taxonomy, proper documentation is still lacking as a result easy access to the information available becomes a constrains to researcher and policy planner. So the present research findings will be useful for scientific validations and updating of economic importance in bioprospecting aspects, biodiversity conservation and sustainable development to some extent.

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