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A preliminary report on fish diversity of Poma river and its tributaries, Arunachal Pradesh, India

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Abstract
A total of 75 species of fishes belonging to 54 genera, 26 families and 10 orders has been recorded from the Poma River of Arunachal Pradesh and Assam. The order cypriniformes represented highest diversity with 40 species (53%), followed by Siluriformes with 16 species (21%), Anabantiformes with 9 species (12%), Synbranchiformes with 3 species (4%) and Perciformes with 2 species. Anguilliformes, Beloniformes, Gobiiformes and Cichliformes were very rarely seen in the study area represented by a single species each along with an exotic fish (*Oncorhynchus mykiss*) under order Salmoniformes. The fish fauna of Poma River is a mixture of endemic hill stream, threatened, exotic and widely distributed forms and consists of 3 Endangered (EN), 5 Near Threatened (NT), 3 Vulnerable (VU), 6 Data Deficient (DD) and 49 Least Concerned (LC) categories of IUCN. Nine species were not evaluated. In the present study a new species was also described, and assigned with the name *Channa pomanensis* referring to the type locality, Poma river.

Keywords: hill stream, plain fishes, Poma river, Arunachal Pradesh, Brahmaputra river system

Introduction
The Eastern Himalayan region has been identified as one of the 18 mega-biodiversity 'hotspot' areas of the world (Myers *et al.*) [1] in which the state Arunachal Pradesh occupies larger part (60.93%) covering 83,743 km2, situated between 26° 28' to 29° 30' N and 90° 30' to 97° 30´ E. The state with its diverse physiographic features and varied watershed pattern has led a rewarding platform for ichthyological studies. On account of the undulating topography of this area gives rise to large number of torrential hill streams, rivulets, rivers and lakes, which lead to big rivers, eventually mostly drain into the mighty River Brahmaputra in Assam and some part in Irrawaddy river drainage. The state is bordered by the plains of Assam in the South; hence the region is enriched with fish fauna of both hill stream and plain forms. With the efforts and contribution made by several authors conducting surveys as well as literature consultation, the present fish fauna of the state raised to 259 species by 2016) [2] from the previous reports of 131, 213, 225 species by Nath and Dey (2000) [3], Bagra *et al.* (2009) [4], Sen and Khynriam (2014) [5].

A good amount of contributions to the fish fauna of the state have been made, however accounts of species compositions of many water bodies still remain undocumented. Keeping in view this in mind, an extensive survey has been made in one of the rivers "Poma" which is situated about 10 km western part of the capital town (Itanagar) in Papumpare district of Arunachal Pradesh. The river is feed by many unnamed small streams and rivulets coming from both directions mainly in the hills of Arunachal Pradesh. The river origins beyond Poma water supply tank somewhere about 15 km from Poma village, Papumpare district (Fig. A, B & C). The river passes flowing through the hilly and forested area along the water supply pipeline route, entering through Poma and Jotte villages (semi-urban area) and meet with Papum river near Basar nalloh. Further, passes southwards through dense forest and valleys in a zig-zag way which comes out in the plain border areas at Ramghat and then to Assam at Boroighat, Sonitpur district, which finally confluence with mighty Brahmaputra at Botiamari. Poma river is known as Boroi river in Assam and the river is selected for the present study in view of different habitat composition within Arunachal Pradesh with full of boulder, pebbles, cobles and sands in one part and merely sandy habitat in Assam of the same river on the other part.

Materials and Methods

To investigate the fish diversity of Poma river and its tributaries, regular local surveys were conducted from 11.09.2015 to 10.03.2017 that includes 15 samplings covering 31 different sites along the Poma river and its tributaries. Collection was made from more than 31 different sites, major samplings points are as follows: Poma river at Poma and Jotte villages and its small tributaries Rakap river at Rakap village and Moing drain. Further site selection extended towards upstream about 8-10 km within the forested valleys at Mopung-Mekha near Poma water supply tank. Further samplings were also conducted western part about 7-8 km in one of the major tributary *i.e* Papum river at Basarnalloh and Longdung (Fig A, B and C). In order to analyze the fish composition in extreme lower elevation region, samplings were further extended to the boundary of Arunachal and Assam at Ramghat and also at Boroighat, Sonitpur district in Assam. Collections of fishes were made using cast and scoop nets. Live photographs of the collected fishes were taken in the collection site and preserved in 5% formalin initially. In the laboratory fishes were sorted out based on order and unidentified registration number were initially given changing to 10% formalin solution. Later the specimens were examined and identified following literatures of Talwar and Jhingran, (1991) [6]; Jayaram, (2012) [7]; Sen & Khynriam (2014) [5], thereafter labeled with detail information giving identified registration number and systematically arranged in the museum. The IUCN status of each species was confirmed following The IUCN Red List of Threatened Species, Version 2016-3 [8].

Results and Discussion

A total of 75 species of fishes belonging to 54 genera, 26 families and 10 orders has been recorded from the river (Table 1 & 2). Out of which eight species were reported by Bagra *et al.* (2009), which are marked with an asterisk symbol. The order Cypriniformes represents highest diversity with 40 species (53%) with seven families representing the order. Siluriformes was represented by 16 species (21%) under 7 families. Anabantiformes was represented by 9 species (12%) under 5 families and Synbranchiformes was represented with 3 species (4%) under one family and two genera. Other groups such as Perciformes with 2 species. Anguilliformes, Beloniformes, Gobiiformes and Cichliformes were represented by a single species under single family and single genera. An exotic fish (*Oncorhynchus mykiss*) under the Order Salmoniformes, introduced in the state for fisheries purpose was also reported. Among the families, Cyprinidae was found to be the dominant group represented by 19 species, followed by Danionidae with 13 species and Sisoridae with 7 species. Badidae was represented by 4 species under single genus. Whereas Mastacembelidae and Cobitidae were represented by three species each. Botiidae, Nemacheilidae, Bagridae, Amblycipitidae, Siluridae, Channidae, Ambassidae, were represented by 2 species each. Remaining, thirteen families, viz., Anguillidae, Balitoridae, Psilorhynchidae, Horabagridae, Clariidae, Heteropneustidae, Salmonidae, Gobiidae, Belonidae, Anabantidae, Osphronemida, Nandidae Cichlidae were represented by single species each. Dominance of Cyprinidae in fish fauna of hill streams of Arunachal Pradesh were also reported by Dam, 2013 [9]; Sinha and Tamng, 2015 [10]; Bagra and Das, 2010 [11] and Sen, 1999 [12]. The fish fauna of the river consists of 3 Endangered (EN), 5 Near Threatened (NT), 3 Vulnerable (VU), 6 Data Deficient (DD) and 49 Least Concerned (LC) categories as per IUCN conservation status. The remaining 9 species are not yet evaluated (NE). During the study, a new species of the genus *Channa* was described from the study site and assigned the name as *Channa pomanensis* Gurumayum and Tamang 2016 [13] after the name of the river 'Poma'. One fish species of *Glyptothorax* was also reported in this study which is under the process of description as new to science.

The fish population of the river is gradually decreasing in the last decade as per the information gathered from the local people and fisherman of the Poma village and Basar nalloh, probably due to urbanization and increasing number of fisherman leading to frequent fishing. Moreover, the fishing activities were intensified with the introduction of modern fishing gears and techniques like arrow shooting, using chemicals and blasting in remote areas. In view of the existing practices there is urgent need to take up certain conservation approach to control the drastic decline of fish population.

Table 1: Details of taxonomic classification of fish species of Poma river

Sl no.	Order	Family	Genus	Species	Total species
1.	Anguilliformes	Anguillidae	1	1	1
2.	Cypriniformes	Botiidae	1	2	40
3.		Cobitidae	2	3	
4.		Balitoridae	1	1	
5.		Nemacheilidae	2	2	
6.		Psilorhynchidae	1	1	
7.		Cyprinidae	13	19	
8.		Danionidae	10	12	
9.	Siluriformes	Horabagridae	1	1	16
10.		Bagridae	2	2	
11.		Amblycipitidae	1	2	
12.		Sisoridae	4	7	
13.		Siluridae	2	2	
14.		Clariidae	1	1	
15.		Heteropneustidae	1	1	
16.	Salmoniformes	Salmonidae	1	1	1
17.	Gobiiformes	Gobiidae	1	1	1
18.	Beloniformes	Belonidae	1	1	1
19.	Synbranchiformes	Mastacembelidae	2	3	3
20.	Anabantiformes	Anabantidae	1	1	9

21.		Osphronemida	1	1	
22.		Channidae	1	2	
23.		Nandidae	1	1	
24.		Badidae	1	4	
25.	Cichliformes	Cichlidae	1	1	1
26.	Perciformes	Ambassidae	1	2	2
Total	10	26	55	75	75

Table 2: List of voucher specimens, collected from Poma river and its tributaries, deposited in the APRC, ZSI museums, Itanagar and Rajiv Gandhi University, Arunachal Pradesh.

Sl no	Regn. No. of voucher specimens	Family	Species	IUCN status
1.	ZSI/V/APRC/P-1489	Ambassidae	*Parambassis baculis* (Hamilton 1822)	LC
2.	ZSI/V/APRC/P-1432	Ambassidae	*Parambassis ranga* (Hamilton, 1822)	LC
3.	ZSI/V/APRC/P-1314	Amblycipitidae	*Amblyceps apangi* (Nath & Dey, 1989)	LC
4.	ZSI/V/APRC/P-1319	Amblycipitidae	*Amblyceps arunachalensis* (Nath & Dey, 1989)	EN
5.	ZSI/V/APRC/P-1664	Anabantidae	*Anabas testudineus* (bloch 1792)	LC
6.	ZSI/V/APRC/P-1095	Anguillidae	*Anguilla bengalensis* (Gray 1831)	NT
7.	ZSI/V/APRC/P-1807	Badidae	*Badis assamensis* AHL, 1937	DD
8.	ZSI/V/APRC/P-1450	Badidae	*Badis badis* (Hamilton, 1822)	LC
9.	ZSI/V/APRC/P-1516	Badidae	*Badis singenensis* Geetakumari & Kadu, 2011	NE
10	ZSI/V/APRC/P-1506	Badidae	*Badis triocellus* Khynriam & Sen, 2013	NE
11	ZSI/V/APRC/P-1502	Bagridae	*Mystus bleekeri* Day, 1877	LC
12	ZSI/V/APRC/P-1523	Bagridae	*Sperata aor* (Hamilton 1822)	LC
13	ZSI/V/APRC/P-1163	Balitoridae	*Balitora brucei* Gray, 1830	NT
14	ZSI/V/APRC/P-1437	Belonidae	*Xenentodon cancila* (Hamilton, 1822)	LC
15	ZSI/V/APRC/P-1425	Botiidae	*Botia histronica* (Blyth, 1861)	LC
16	ZSI/V/APRC/P-1396	Botiidae	*Botia rostrata* (Gunther, 1868)	VU
17	ZSI/V/APRC/P-1308	Channidae	*Channa pomanensis* Gurumayum & Tamang, 2016	NE
18	ZSI/V/APRC/P-1500	Channidae	*Channa punctata* (Bloch, 1793)	LC
19	RGUMF-0153	Cichlidae	*Oreochromis mossambicus* (Peters 1852)*	VU
20	ZSI/V/APRC/P-1662	Clariidae	*Clarias magur* (Linnaeus 1758)	EN
21	ZSI/V/APRC/P-1434	Cobitidae	*Canthophrys gongota* (Hamilton, 1822)	LC
22	ZSI/V/APRC/P-1429	Cobitidae	*Lepidocephalichthys annandalei* (Chaudhuri, 1912)	LC
23	ZSI/V/APRC/P-1503	Cobitidae	*Lepidocephalichthys guntea* (Hamilton, 1822)	LC
24	ZSI/V/APRC/P-1497	Cyprinidae	*Bangana dero* (Hamilton, 1822)	LC
25	ZSI/V/APRC/P-1160	Cyprinidae	*Chagunius chagunio* (Hamilton, 1822)	LC
26	ZSI/V/APRC/P-1661	Cyprinidae	*Cirrhinus mrigala* (Hamilton, 1822)	LC
27	ZSI/V/APRC/P-1144	Cyprinidae	*Garra annandalei* (Hora, 1921)	LC
28	ZSI/V/APRC/P-1272	Cyprinidae	*Garra arupi* Nebeshwar, Vishwanath & Ds 2009	NE
29	ZSI/V/APRC/P-1149	Cyprinidae	*Garra birostris* Nebeshwar & Vishwanath, 2013	NE
30	ZSI/APRC/P-1176	Cyprinidae	*Garra tamangi* Gurumayum & Kosygin, 2016	NE
31	ZSI/V/APRC/P-1438	Cyprinidae	*Labeo gonius* (Hamilton, 1822)	LC
32	ZSI/V/APRC/P-1150	Cyprinidae	*Labeo pangusia* (Hamilton, 1822)	NT
33	ZSI/V/APRC/P-1257	Cyprinidae	*Neolissochilus hexagonolepis* (McClelland, 1839)	NT
34	ZSI/V/APRC/P-1443	Cyprinidae	*Oreichthys crenuchoides* Schaefer, 2009	DD
35	RGUMF-0042	Cyprinidae	*Osteobrama cotio*(Hamilton, 1822)*	LC
36	RGUMF-0047	Cyprinidae	*Pethia conchonius* (Hamilton 1822) *	LC
37	ZSI/V/APRC/P-1305	Cyprinidae	*Pethia ticto* (Hamilton, 1822)	LC
38	ZSI/V/APRC/P-1439	Cyprinidae	*Puntius sophore* (Hamilton, 1822)	LC
39	RGUMF-0050	Cyprinidae	*Systomus sarana* (Hamilton 1822) *	LC
40	ZSI/V/APRC/P-1258	Cyprinidae	*Tariqilabeo latius* (Hamilton, 1822)	LC
41	ZSI/V/APRC/P-1146	Cyprinidae	*Tor putitora* (Hamilton, 1822)	EN
42	ZSI/V/APRC/P-1540	Cyprinidae	*Tor tor* (Hamilton, 1822)	DD
43	ZSI/V/APRC/P-1486	Danionidae	*Amblypharyngodon mola* (Hamilton, 1822)	LC
44	ZSI/V/APRC/P-1145	Danionidae	*Barilius vagra* (Hamilton 1822)	LC
45	ZSI/V/APRC/P-1493	Danionidae	*Cabdio morar* (Hamilton, 1822)	LC
46	ZSI/V/APRC/P-1302	Danionidae	*Danio dangila* (Hamilton, 1822)	LC
47	ZSI/V/APRC/P-1517	Danionidae	*Danio rerio* (Hamilton, 1822)	LC
48	ZSI/V/APRC/P-1303	Danionidae	*Devario aequipinnatus* (McClelland, 1839)	LC
49	ZSI/V/APRC/P-1262	Danionidae	*Devario devario* (Hamilton, 1822)	LC
50	ZSI/V/APRC/P-1448	Danionidae	*Esomus danrica* (Hamilton, 1822)	LC
51	RGUMF-0168	Danionidae	*Laubuca laubuca* (Hamilton, 1822)*	LC
52	ZSI/V/APRC/P-1142	Danionidae	*Opsarius barna* (Hamilton, 1822)	LC
53	ZSI/V/APRC/P-1141	Danionidae	*Opsarius bendelisis* (Hamilton, 1807)	LC
54	RGUMF-0019	Danionidae	*Raiamas bola* (Hamilton 1822) *	LC
55	ZSI/V/APRC/P-1449	Gobiidae	*Glossogobius giuris* (Hamilton, 1822	LC
56	ZSI/V/APRC/P-1453	Heteropneustidae	*Heteropneustes fossilis* (Bloch, 1794)	LC
57	ZSI/V/APRC/P-1527	Mastacembelidae	*Macrognathus aral* (Bloch and Schneider, 1801)	LC

58	ZSI/V/APRC/P-1435	Mastacembelidae	*Macrognathus pancalus* (Hamilton, 1822)	LC
59	ZSI/V/APRC/P-1457	Mastacembelidae	*Mastacembelus armatus* (Lacepede, 1800)	LC
60	RGUMF-0181	Nandidae	*Nandus nandus* (Hamilton 1822)*	LC
61	ZSI/V/APRC/P-1263	Nemacheilidae	*Aborichthys kempi* (Chaudhuri, 1913)	NT
62	ZSI/V/APRC/P-1173	Nemacheilidae	*Paraacanthocobitis botia* (Hamilton, 1822)	LC
63	ZSI/V/APRC/P-1525	Osphronemidae	*Trichogaster fasciata* Bloch & Schneider, 1801	LC
64	ZSI/V/APRC/P-1147	Psilorhynchidae	*Psilorhynchus balitora* (Hamilton, 1822)	LC
65	RGUMF-0166	Salmonidae	*Oncorhynchus mykiss* (Walbaum 1792)*	NE
66	ZSI/V/APRC/P-1491	Schilbeidae	*Pachypterus atherinoides* Rafinesque, 1818	LC
67	ZSI/V/APRC/P-1524	Siluridae	*Pterocryptis indicus* (Datta, Barman & Jayaram, 1987)	DD
68	ZSI/V/APRC/P-1522	Siluridae	*Wallago attu* Bloch & Schneider, 1801	VU
69	ZSI/V/APRC/P-1312	Sisoridae	*Erethistoides senkhiensis* (Tamang *et al*, 2008)	DD
70	ZSI/V/APRC/P-1526	Sisoridae	*Erethistoides sicula* Ng, 2005	DD
71	ZSI/V/APRC/P-1454	Sisoridae	*Gagata cenia* (Hamilton, 1822)	LC
72	ZSI/V/APRC/P-1455	Sisoridae	*Glyptothorax botius* (Hamilton, 1822)	LC
73	ZSI/V/APRC/P-1452	Sisoridae	*Glyptothorax dikrongensis* Tamang & Chaudhry, 2011	NE
74	ZSI/V/APRC/P-1433	Sisoridae	*Glyptothorax sp.*	NE
75	ZSI/V/APRC/P-1311	Sisoridae	*Pseudolaguvia shawi* (Hora, 1921)	LC

* species consulted from Bagra *et al*., 2009

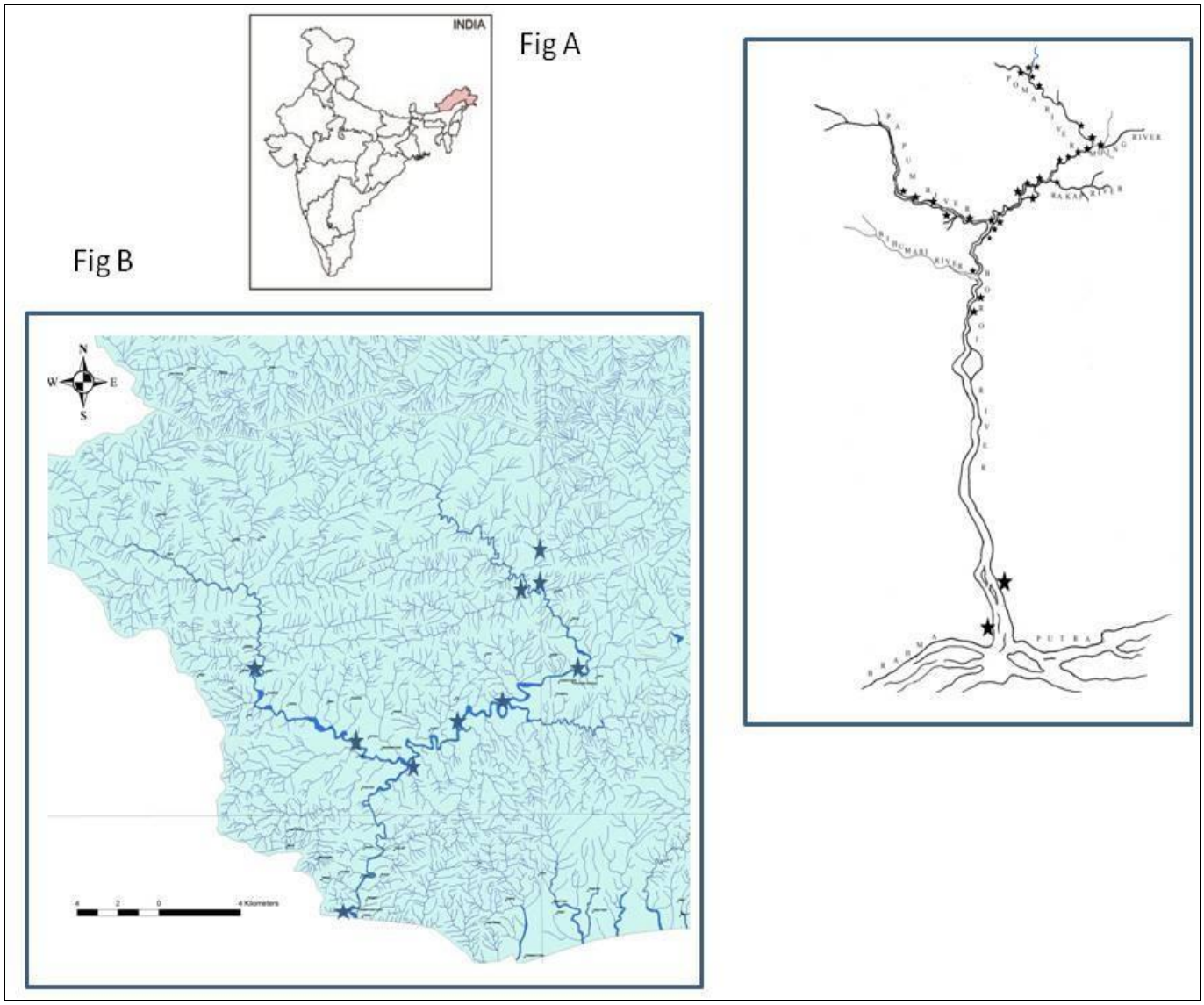

Fig A: Map of India highlighting Arunachal Pradesh
Fig B: Drainage map of Poma river and its tributaries along with major sampling sites inside Arunachal Pradesh.
Fig C: Sampling locations at Poma river and its tributaries

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