

## Notes on the ichthyofaunal diversity of Anjaw district in eastern Arunachal Pradesh, India

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### Abstract

The present communication is the first report on the ichthyofaunal diversity of Anjaw, the easternmost district of India which is strategically located in the tri-junction of India, China and Myanmar. The results are based on a preliminary survey carried out during November-December 2014 mainly in the Lohit River and its tributaries. The study shows that a total of 47 species have been recorded belonging to 5 orders, 10 families and 31 genera. The order Cypriniformes with 34 species under 21 genera and 4 families is the largest representing order. At the family level, Cyprinidae with 16 species is the largest contributing family. Maximum diversity of 22 species has been recorded from the Tidding River. Thorough and systematic exploration of different drainages of the district covering the different seasons of the year may reveal the true ichthyodiversity of the district. The necessity of documenting the fish diversity of the district on priority basis in view of the anthropogenic pressure as well as developmental activities in the district is also highlighted.

**Keywords:** Biodiversity hotspot, Eastern Himalaya, Fish diversity, Game fishes, Strategic location.

### INTRODUCTION

The easternmost state of India, Arunachal Pradesh, is a biodiversity rich area by virtue of its distinctive geo-physical positioning in the transition zone between the Palearctic and the oriental biogeographic zones, in between the Eastern Himalaya and Indo-Burma global biodiversity hotspots and in between the Himalayas and the peninsular India. The landscape has representative elements from both the adjoining biogeographic zones/biodiversity hotspots/landscapes and has its own unique elements due to the simple ecological principle of 'edge effect'. Thus, the area has a unique and unmatched assemblage of biodiversity. Among the different faunal groups, ichthyofauna appears to be the most extensively studied group from the state. In fact, the earliest studies on fauna of the state was done on fishes by McClelland (1839) who reported 4 species of cyprinids from the Mishmi hills of present day Lower Dibang Valley District. The report of 21 species of fishes by Chaudhuri (1913) based on the

collections made during the Abor Expeditions of 1911-12 was the next contribution to the fish fauna of the state, with no record of studies on fishes in between for almost a century or so.

After a few years, Hora (1921a, b) made significant contributions to the fish systematics of the state. This was followed by several noteworthy contributions on fish systematics of the state such as those by Jayaram and Mazumdar (1964), Menon (1964), Srivastava (1966), Choudhury and Sen (1977), Sen (1985), Sen (1999) and many others. Though the systematic account of 131 fishes from Arunachal Pradesh by Nath and Dey (2000) which is considered to be the pioneering work on taxonomy of fishes from the state provides the drainage-wise distribution but does not mention about any localities of collection that falls under the present day Anjaw district. Thus, none of these studies provide any clue to the fish fauna of the present day Anjaw district.

In the detailed account of Pisces of Arunachal Pradesh, Sen (2006) also provided a district-wise distribution of fishes in the then districts of the state. However, it did not report the distribution of any fishes from Anjaw district though the district came into existence in the year 2004. One plausible reason may be the preparation of the manuscript before the creation of the district. However, it is apparent from the collection centres (see map in pg. 318) of Sen (2006) that no sampling was done in the present day Anjaw district. The present paper provides a preliminary report on the fish fauna of the Anjaw district in the eastern Arunachal Pradesh.

Anjaw district was carved out of the erstwhile Lohit district in the year 2004 with a geographic area of about 6190 sq. km. Geographically, the district is located approximately in between 27°55'30" North Latitude and 96° 20'53" East Longitude. Hawai, at an altitude of 1296 m above sea level, is the district headquarters, located on the bank of the Lohit River. "Hawai" in Kaman Mishmi dialect means "Pond". The Mishmi with several sub-tribes are the main inhabitants of the Anjaw District. There are seven administrative circles namely, Hayuliang, Hawai, Walong, Kibithoo, Changlagam, Manchal and Goillong. The district is bordered on the East by Myanmar, on the west by Lohit district of Arunachal Pradesh, on the north by China (Tibet) and on the South by Changlang district of Arunachal Pradesh and Myanmar. Because of its unique geophysical positioning in the trijunction of India, China and Myanmar, the district is of immense national strategic importance.

### STUDY AREA

The present study was undertaken in the Anjaw district, the easternmost district of the easternmost state of India. Arunachal Pradesh

is also known as the 'land of rising sun' because India sees its first sun rays in a village called Dong in this district. The terrain of the district is mainly hilly and rugged. The climate of the district is largely influenced by the nature of its terrain, it ranges from sub-tropical to temperate. The district falls in the heavy rainfall belt and it has plenty of surface water resources. The weather is characterized with a rainy summer and dry winter. Heavy rainfall is received during summer and occasional rainfall during winter. January and February are the driest months. The rainfall received during summer is under the spell of South-West monsoon. The onset of South-West monsoon occurs by the end of May or the first week of June and it withdraws by late September or early October. But, very often pre-monsoon showers are experienced during March to April/May; the region comes under the influence of equatorial westerly wind and receives precipitation with occasional thunder showers. Annual rainfall in the district varies from 3500 to 5500 mm (Anon, 2009).

The river system of the district is a part of the Brahmaputra River basin. Lohit is the principal river of the district and is the major North bank tributary of the Brahmaputra River. The Lohit originates from snowclad peaks of the Nimbout Chcumbouri Nechai Gongra Tirap Phasi ranges in eastern Tibet at an altitude of about 6,190 m where it is known *Zayal Nga Chu* or *Rongtu Chu* (Kansal and Arora, 2012). Flowing in the southeastern direction from its origin, it enters, it enters the Indian territory near Kahao village in the Kibitho circle of Anjaw district and here it is locally known as *Tellu* River. Afterwards, it passes through the heart of the district first in north-south direction then in east-west direction and finally enters the Lohit district near Parshuram Kund. On the way, Lohit is joined by many tributaries, major ones are

being Lam River, Tidding River, Dalai River, Karoti River, Dichu River, Lati River, Klung River, Dau River, Telua River, Ampani River and Sarti River; most of the rivers flowing in the south-westerly direction. Lohit travels a distance of about 111 km in the district (Kansal and Arora, 2012); it and its major tributaries are perennial. Even the streams of

the district are mostly perennial and maintain varying amount of base flow. The drainage pattern is generally dendritic to sub-parallel in nature and follows the geomorphological trends of the hills and mountains. In the hilly terrain, the rivers have deep narrow gorges along their courses.

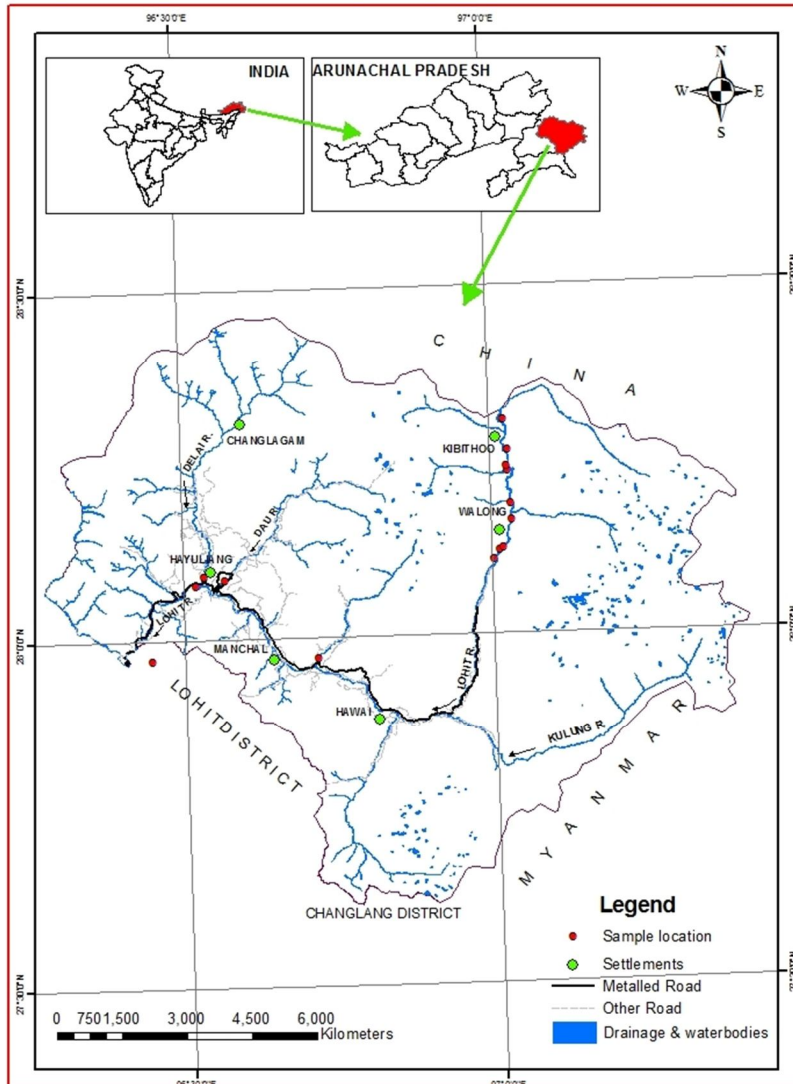


Figure 1: Map of Anjaw district, Arunachal Pradesh showing sampling sites

## METHODOLOGY

An extensive literature survey was carried out to find information on fishes from the Anjaw district. Fish sampling was carried out during November–December 2014 in different locations of the Lohit River and its tributaries as well as other stagnant water bodies in different parts of the district (Figure 1). Fishes were caught using different conventional methods like cast net, gill net and several types of traditional methods like diverting river water, baiting and similar others with the help of local fishermen. GPS readings of sampling sites were recorded in the fields. Fish sampling was done in 14 different sites comprising of Rivers, streams and lentic bodies in the altitudinal range of 400 to 1300 m (Table 1). The commonly occurring fishes were released

in to their natural habitat after identification and the remaining fish samples were fixed in 10% formalin and then preserved in 70% alcohol after washing with water. Fishes were identified following Talwar and Jhingran (1991), Nath and Dey (2000), Jayaram (2013) and Sen and Khyntiam (2014). The retained fishes were deposited in the National Zoological Collection of Zoological Survey of India, Arunachal Pradesh Regional centre, Itanagar. Table-2 lists the fishes recorded in the district along with their collection localities and conservation status (IUCN, 2021). Larger fishes caught as part of angling in different parts of the district was also observed and taken in to account in the present list. The classification of fishes in the list is following Fricke *et al.* (2021) and species under a genus are arranged in alphabetic sequence.

**Table 1: Details of fish sampling sites in Anjaw district, Arunachal Pradesh**

SN	Habitat	Locality	Latitude (in degree decimals)	Longitude (in degree decimals)	Altitude (m)
1.	Tidding river	Tezu-Hayuliang road	27.97207	96.39667	402
2.	Dalai river	Hayuliang	28.09108	96.53233	557
3.	Dau river	Hayuliang	28.08553	96.56648	575
4.	Lohit river	Hayuliang	28.07783	96.51958	495
5.	Hali nallah	Lautum	27.97162	96.71418	689
6.	Yapak nallah	Walong	28.10612	97.0031	1115
7.	Hot spring	Walong	28.16257	97.03233	1122
8.	Riverside Pond	Walong	28.12052	97.01325	1088
9.	Lohit river	Walong	28.12325	97.01827	1096
10.	Namti nallah	Namti	28.18571	97.03121	1189
11.	Karoti nallah	Kibitho	28.23305	97.0289	1284
12.	Fish pond	Dhanbari village	28.23982	97.02602	1271
13.	Kirthi nallah	Kibitho	28.26302	97.02998	1297
14.	Kahoo nallah	Kahoo village	28.30661	97.02420	1329

## RESULTS AND DISCUSSION

No substantial information on the fish fauna of Anjaw district could be found after a thorough perusal of the literature available in the public domain. Though Nath and Dey (2000) reported 46 species from the Lohit River, this cannot be taken into account as their sampling site on Lohit River was at Sunpura which is just 5 km from Tezu and is much far away from the boundary of Anjaw district. Capitalising on the 46 species reported by Nath and Dey (2000), later on Kansal and Arora (2012) reported the occurrence 74 fish species in the Lohit River basin. However, they did not do any sampling by themselves, so, considering of this data is also unjustified. Further, there was no record of fishes from Anjaw district in the comprehensive checklist of fishes of Arunachal Pradesh by Bagra et al. (2009) which emphasizes the non-exploration of the inaccessible border district. Even the recent compilation on the biodiversity of fishes in Arunachal Himalaya by Darshan et al. (2018) also did not record any fishes from Anjaw district.

A preliminary survey of the drainages of Anjaw district mainly Lohit River and its tributaries within the geographic boundary of the district revealed the presence of 47 species of fishes in the district (Table 2). These 47 species of fishes are classified under 5 orders, 10 families and 31 genera. The order Cypriniformes with 34 species under 21 genera and 4 families accounted for more than 70 per cent of the Anjaw fishes. This is followed by the order Siluriformes with 7 species under 6 genera and 3 families. The rest of the fishes comprised of Order Anabantiformes (3 spp.), order Perciformes (2 spp.) and the order Gobiformes (1 species). Family-wise, Cyprinidae comprising of carps and minnows (16 spp.) constituted almost one

third of the fishes of Anjaw district. The Snowtrout, *Schizothorax richardsonii* and the Chocolate Mahseer, *Neolissochilus hexagonolepis* are the most commonly occurring fishes and has been recorded from most of the sampling sites. The game fishes, Tor Mahseer and Golden Mahseer were recorded during angling activities mainly in the upper reaches of Lohit River. In the present study, maximum diversity of 22 species of fishes has been recorded from the Tidding River.

Most of the fishes (30 spp. accounting for 64%) of Anjaw district are coming under the Least Concern (LC) category of conservation as per the assessment criteria of International Union for Conservation of Nature and Natural Resources (IUCN) (Figure 2). Of the four nearly threatened species namely, *A. kempi*, *L. pangusia*, *B. bagarius* and *N. hexagonolepis*, the Chocolate Mahseer seems to be fairly common in the major drainages of the district. Again of the two vulnerable species, the snow trout, *S. richardsonii* was recorded from most of the lotic habitats of the district. Besides, data of four species are deficient and the threat status of five species is not evaluated yet.

The present diversity of fish reported from the district appears to be far more complete. A thorough exploration of the diverse lentic and lotic habitats of the district may reveal the presence of more species of fishes in the district given the prevalence of different habitats and occurrence of tropical to sub-alpine vegetation and climatic conditions. The faunal diversity including those of fishes of this strategically located district needs to be documented on a priority basis given the anticipated anthropogenic pressure exerted by the high militarization on both sides of the border. This is more critical in view of the rapid developmental activities being implemented on either side of the fence.

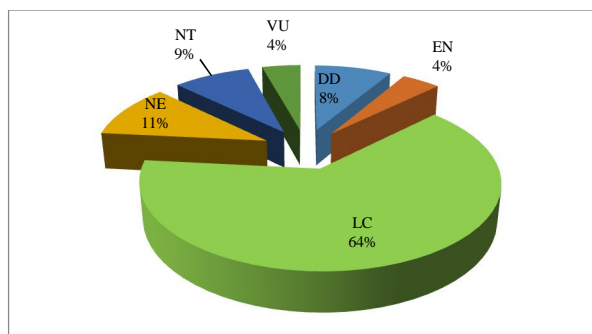


Figure 2: Threat status of the fishes recorded from Anjaw district as per IUCN

Table 2: Systematic list of fishes of Anjaw district, Arunachal Pradesh along with their collection localities and threat status

SN	Taxon	Habitats	Threat Status (IUCN)
	Class <b>Actinopteri</b>		
	Order <b>Cypriniformes</b>		
	Suborder <b>Cobitoidei</b>		
	Family <b>Botiidae</b> Berg 1940		
	Subfamily <b>Botiinae</b> Berg 1940		
	Genus <b>Botia</b> Gray 1831		
1.	<i>Botia dario</i> (Hamilton 1822)	Tidding R. at Tezu-Hayuliang Rd.	LC
2.	<i>Botia rostrata</i> Günther 1868	Tidding R. at Tezu-Hayuliang Rd.	VU
	Family <b>Nemacheilidae</b> Regan 1911		
	Genus <b>Aborichthys</b> Chaudhri, 1913		
3.	<i>Aborichthys kempi</i> Chaudhuri 1913	Tidding R. at Tezu-Hayuliang Rd.	NT
4.	<i>Aborichthys waikhomi</i> Kosygin , 2012	Kirthi nallah at Kibitho	NE
	Genus <b>Mustura</b> Kottelat 2018		
5.	<i>Mustura walongensis</i> (Tamang & Sinha 2016)	Lohit R. at Walong	NE
	Genus <b>Paracanthocobitis</b> Grant 2007		
6.	<i>Paracanthocobitis botia</i> (Hamilton	Yapak Nallah at Walong	LC

	1822)		
	Genus <i>Schistura</i> McClelland, 1839		
7.	<i>Schistura scaturigina</i> McClelland, 1839	Riverside Pond at Walong	LC
	Suborder <b>Cyprinoidei</b>		
	Family <b>Cyprinidae</b> Rafinesque 1815		
	Subfamily <b>Labeoninae</b> Bleeker 1859		
	Genus <i>Bangana</i> Hamilton 1822		
8.	<i>Bangana dero</i> (Hamilton 1822)	Tidding R. at Tezu-Hayuliang Rd.	LC
	Genus <i>Garra</i> Hamilton, 1822		
9.	<i>Garra annandalei</i> Hora 1921	Dau R. at Hayuliang	LC
10.	<i>Garra arupi</i> Nebeshwar, Vishwanath & Das 2009	Lohit R. at Hayuliang	NE
11.	<i>Garra gotyla</i> (Gray 1830)	Tidding R. at Tezu-Hayuliang Rd., Dalai R. at Hayuliang, Dau R. at Hayuliang	LC
12.	<i>Garra kempfi</i> (Hora, 1921)	Lohit R. at Walong	LC
13.	<i>Garra naganensis</i> Hora 1921	Hali Nallah at Lautum	LC
	Genus <i>Labeo</i> Cuvier 1816		
14.	<i>Labeo dyocheilus</i> (McClelland 1839)	Tidding R. at Tezu-Hayuliang Rd.	LC
15.	<i>Labeo pangusia</i> (Hamilton 1822)	Hali Nallah at Lautum	NT
	Genus <i>Tariqilabeo</i> Mirza & Saboohi 1990		
16.	<i>Tariqilabeo latius</i> (Hamilton 1822)	Tidding R. at Tezu-Hayuliang Rd.	LC
	Subfamily <b>Torinae</b> Karaman 1971		
	Genus <i>Neolissochilus</i> Rainboth 1985		
17.	<i>Neolissochilus hexagonolepis</i> (McClelland 1839)	Tidding R. at Tezu-Hayuliang Rd., Dalai R. at Hayuliang, Dau R. at Hayuliang, Lohit R. at Hayuliang, Hali Nallah at Lautum, Lohit R. at Walong	NT
	Genus <i>Tor</i> Gray 1834		
18.	<i>Tor putitora</i> (Hamilton 1822)	Tidding R. at Tezu-Hayuliang Rd., Lohit R. at Hayuliang, Hali Nallah at Lautum	EN

19.	<i>Tor tor</i> (Hamilton 1822)	Tidding R. at Tezu-Hayuliang Rd., Lohit R. at Hayuliang, Lohit R. at Walong	DD
	Subfamily <b>Smiliogastrinae</b> Bleeker 1863		
	Genus <i>Chagunius</i> Smith 1938		
20.	<i>Chagunius chagunio</i> (Hamilton 1822)	Tidding R. at Tezu-Hayuliang Rd.	LC
	Genus <i>Pethia</i> Pethiyagoda <i>et al.</i> , 2012		
21.	<i>Pethia ticto</i> (Hamilton 1822)	Tidding R. at Tezu-Hayuliang Rd., 12	LC
	Subfamily <b>Schizothoracinae</b> McClelland 1842		
	Genus <i>Schizothorax</i> Heckel, 1838		
22.	<i>Schizothorax progastus</i> (McClelland 1839)	Tidding R. at Tezu-Hayuliang Rd., Dalai R. at Hayuliang, Dau R. at Hayuliang	LC
23.	<i>Schizothorax richardsonii</i> (Gray, 1832)	Tidding R. at Tezu-Hayuliang Rd., Dalai R. at Hayuliang, Dau R. at Hayuliang, Lohit R. at Hayuliang, Hali Nallah at Lautum, Lohit R. at Walong	VU
	Family <b>Danionidae</b> Bleeker 1863		
	Subfamily <b>Chedrinae</b> Bleeker 1863		
	Genus <i>Barilius</i> Hamilton, 1822		
24.	<i>Barilius vagra</i> (Hamilton 1822)	Namti Nallah at Namti	LC
	Genus <i>Bengala</i> Gray 1834		
25.	<i>Bengala elanga</i> (Hamilton 1822)	Tidding R. at Tezu-Hayuliang Rd.	LC
	Genus <i>Cabdio</i> Hamilton 1822		
26.	<i>Cabdio morar</i> (Hamilton 1822)	Tidding R. at Tezu-Hayuliang Rd.	LC
	Genus <i>Opsarius</i> McClelland 1838		
27.	<i>Opsarius barna</i> (Hamilton 1822)	Tidding R. at Tezu-Hayuliang Rd.	LC
28.	<i>Opsarius bendelisis</i> (Hamilton 1807)	Tidding R. at Tezu-Hayuliang Rd.	LC
	Subfamily <b>Rasborinae</b> Günther 1868		
	Genus <i>Rasbora</i> Bleeker, 1860		



29.	<i>Rasbora daniconius</i> (Hamilton 1822)	Fish pond, Dhanbari Vill.	LC
30.	<i>Opsarius tileo</i> (Hamilton 1822)	Tidding R. at Tezu-Hayuliang Rd.	LC
	Subfamily <b>Danioninae</b> Bleeker 1863		
	Genus <i>Danio</i> Hamilton, 1822		
31.	<i>Danio dangila</i> (Hamilton 1822)	Lohit R. at Hayuliang	LC
32.	<i>Danio rerio</i> (Hamilton 1822)	Fish pond, Dhanbari Vill.	LC
	Genus <i>Devario</i> Heckel, 1853	Lohit R. at Hayuliang	
33.	<i>Devario aequipinnatus</i> (McClelland 1839)	Fish pond, Dhanbari Vill.	DD
34.	<i>Devario devario</i> (Hamilton 1822)	Tidding R. at Tezu-Hayuliang Rd.	LC
	Order <b>Siluriformes</b>		
	Suborder <b>Siluroidei</b>		
	Family <b>Bagridae</b> Bleeker 1858		
	Genus <i>Mystus</i> Scopoli 1777		
35.	<i>Mystus tengara</i> (Hamilton 1822)	Namti Nallah at Namti	LC
	Family <b>Amblycipitidae</b> Day 1873		
	Genus <i>Amblyceps</i> Blyth 1858		
36.	<i>Amblyceps arunachalensis</i> Nath & Dey 1989	Khao Nallah at Kahoo Vill.	EN
	Family <b>Sisoridae</b> Bleeker 1858		
	Subfamily <b>Sisorinae</b> Bleeker 1858		
	Genus <i>Bagarius</i> Bleeker 1853		
37.	<i>Bagarius bagarius</i> (Hamilton 1822)	Tidding R. at Tezu-Hayuliang Rd.	NT
	Genus <i>Glyptothorax</i> Blyth 1860		
38.	<i>Glyptothorax cavia</i> (Hamilton 1822)	Dalai R. at Hayuliang	LC
39.	<i>Glyptothorax pantherinus</i> Anganthoibi & Vishwanath 2013	Tidding R. at Tezu-Hayuliang Rd.	NE
	Subfamily <b>Glyptosterninae</b> Gill 1861		
	Genus <i>Creteuchiloglanis</i> Zhou, Li & Thomson 2011		
40.	<i>Creteuchiloglanis kamengensis</i>	Dau R. at Hayuliang	DD

	(Jayaram, 1966)		
	Genus <i>Pseudecheneis</i> Blyth 1860		
41.	<i>Pseudecheneis sulcata</i> (McClelland 1842)	Tidding R. at Tezu-Hayuliang Rd., Dalai R. at Hayuliang, Dau R. at Hayuliang	LC
	Order <b>Gobiiformes</b>		
	Family <b>Gobiidae</b> Cuvier 1816		
	Subfamily <b>Gobiinae</b> Cuvier 1816		
	Genus <i>Glossogobius</i> Gill 1859		
42.	<i>Glossogobius giuris</i> (Hamilton 1822)	Dau R. at Hayuliang	LC
	Order <b>Anabantiformes</b>		
	Suborder <b>Nandoidei</b>		
	Family <b>Badidae</b> Barlow, Liem & Wickler 1968		
	Genus <i>Badis</i> Bleeker 1853		
43.	<i>Badis assamensis</i> Ahl 1937	Tidding R. at Tezu-Hayuliang Rd.	DD
44.	<i>Badis badis</i> (Hamilton, 1822)	Tidding R. at Tezu-Hayuliang Rd., Hali Nallah at Lautum	LC
45.	<i>Badis singenensis</i> (Geetakumari & Kadu, 2011)	Karoti nallah at Kibitho	NE
	Order <b>Perciformes</b> *sedismutabilis*		
	Family <b>Ambassidae</b> Klunzinger 1870		
	Genus <i>Chanda</i> Hamilton, 1822		
46.	<i>Chanda nama</i> Hamilton 1822	Lohit R. at Hayuliang	LC
	Genus <i>Parambassis</i> Bleeker 1874		
47.	<i>Parambassis ranga</i> (Hamilton 1822)	Karoti nallah at Kibitho	LC

[LC: Least Concern; NT: Near Threatened; VU: Vulnerable; EN: Endangered; NE: Not Evaluated; DD: Data Deficient; R.: River]

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**Different fish collection localities in Anjaw district, Arunachal Pradesh, India**



Tidding River on the Tezu-Hayuliang road



Dalai River at Hayuliang



Confluence of Dau River with Lohit River at Hayuliang



Confluence of Dalai River with Lohit River at Hayuliang



Dau River at Hayuliang



Lohit River at Hayuliang



Hali Nallah at Lautum

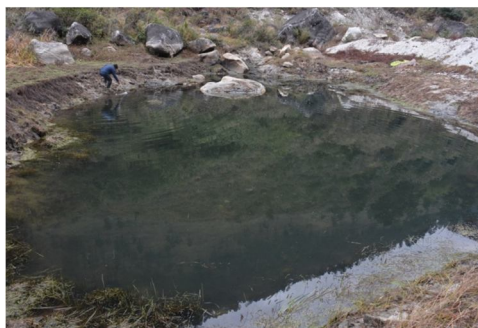


Yapak nallah near Walong

**Different fish collection localities in Anjaw district, Arunachal Pradesh, India**



Lohit River at Walong



Riverside pond at Walong



Karoti Nallah at Kibitho



Confluence of Namti nallah with Lohit River



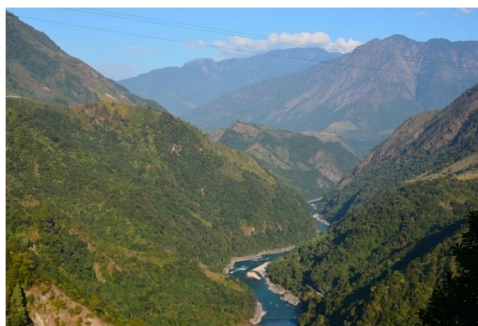
Lohit River at Kahoo



Fish pond at Dhanbari Village, Kibitho



Kahoo Nallah at Kahoo village



Lohit River at Hawaii