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Research Paper

Ichthyofaunal study of Swkhestream, Ziro valley, Lower Subansiri, Arunachal Pradesh

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Abstract: Ziro valley is a beautiful valley lies in an altitude of 1573 m which is bordered by the Upper Subansiri District in the north east, East Kameng in the west, Tibet and China in the north and Assam in the south east. The exact topographic feature of this area is that, it is surrounded by the hills and ranges in all direction and in the middle of the valley a small river 'Keley' which flows from north to south along with its tributaries supplies sufficient water to the rice cultivation of the local people called 'Apatanis'. 'Swkhe' stream, a tributary of Keley River in Hong village joins with another stream that flow into Keley River harbours a good number of fish species most of which have high economic and food value. These fishes sometimes migrate through irrigation water, rain water into the paddy fields and thereafter grow in the nearby paddy fields. The present study of fish diversity of Swkhe stream of Ziro valley revealed17 species of fish under 14 different genera, 3 families and 2 orders. Cyprinidae was the most dominant family with 14 different species. *Chana* was recorded to be the most dominant genera with 3 different species.Species like *Aborichthyskempi, Neolissocheilus hexagonolep is* are near threatened. Documentations of *Neolissocheilus hexagonolep is* only once during the survey period depicts its urgent conservation in this part of Arunachal Pradesh. Moreover a detail investigation in the future may have the possibility of adding great number of fish species that are waiting to be introduced into ichthyofaunal list of the world.
Keywords: *Ichthyofaunal diversity, Swkhestream, paddy cum fish culture, Apatani tribe, Ziro valley, Arunachal Pradesh.*

INTRODUCTION:

Fish constitutes almost half of the total vertebrates in the world. They live in almost all conceivable aquatic habitats. They exhibit enormous diversity of size, shape and biology and in the habitats they occupy. Of the 39,900 species of vertebrates in the world estimated 21,423 extent species of fish under 4,044 genera, 445 families and 50 orders in the world, if these 84141 are freshwater species and 11650 are marine. India is one of the mega biodiversity countries in the world and occupies the 9th position in terms of freshwater mega biodiversity. Concomitantly, the north eastern region of

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India was identified as a biodiversity hotspot by the World Conservation Monitoring Centre. Roach (2005) notes that north east India form a part of two of the 34 biodiversity hotspots listed by Conservation International, the Himalayas and Indo-Burma. Arunachal Pradesh (AP) state is situated in the North-Eastern part of India between 26° 28' to 29° 30' N and 90° 30' to 97° 30´ E, with 83,743 km^2 total area. Almost 95 % of the streams and rivers in the state drain in to the mighty river Brahmaputra and the rest drain in to Irrawaddy river drainage of Chindwin basin. The state is also regarded as the type locality of more than 30 species of freshwater fishes in the world.

Lower Subansiriis one of the 16 administrative districts of Arunachal Pradesh. The district lies approximately between 92°40' and 94°21' E longitude and 26°55' and 28°21' N latitudes with it headquarter at Ziro (Fig 1). Ziro valley is a picturesque valley lies in an altitude of 1573 metre. This valley is bordered by the Upper Subansiri District in the north east, East Kameng in the west, Tibet and China in the north and Assam in the south east. Ziro is the headquarter town of Lower Subansiri district. The Ziro valley is famous for its beauty and the age-old paddy-cum-fish culture practice of the Apatani tribe, the main inhabitants of the area. Keley River and Pange River are the two main drainage systems of the Ziro valley area. 'Swkhe stream' is a tributary of Keley River in Hong village in Apataniplateau harbours a variety of fishes. Though considerable progress has been made in documenting the fish fauna of the state (Srivastava, 1966; Choudhury and Sen, 1977; Ghosh,1979; Ghosh and Lipton, 1982; Sen, 2003; Sen, 2006; Nath and Dey, 1997, 2000; Bagraet al.,2009) those from Lower Subansiri district seems to have been less explored. There is no detailed study of fish fauna of the district except for some scattered reports. Sen (1999) recorded only 8 species while Sen (2006) reported 21 species of fishes from the district. Lateron, Sinha (2015-16), recorded 120 species of fishes under 71 genera, 26 families and 7 orders from Lower Subansiri district of Arunachal Pradesh. However, the district seems to sustain much more numbers of fishes than what has been reported. Many parts of the Lower Subansiri District particularly the Ziro valley of Arunachal Pradesh is unapproachable and yet to survey. There may be possibility of harbouring great number of fish species waiting to be introduced into ichthyofaunal list of the world. Till now no such attempt has been made to document the fish fauna of Swkhe stream despite being a major tributary of Keley River. Thus, a sincere attempt has been made to study the present ichthyofaunal diversity of the Swkhe stream along with the traditional paddy cum fish culture practices of Apatani tribe through primary field surveys and available literatures.

MATERIALS AND METHODS

COLLECTION SITE: Random field surveys were conducted during October 2018 to April 2019 from various points from Swkhe stream (27^0 33'.61''N; 93^0 51'.38''E), Shilangaji (paddyfield) 27°34'45.3"N; 93°49'44.6"E, Jebyalembaaji (paddy field) 27`33'25.1"N; 93 50'08.8"E (Fig 2,3). Swkhe is a small stream in Hong village and it joins with other streams that flow into Keley River.

COLLECTION & PRESERVATION OF FISHES: The collection of fish samples were done using various type of net like cast net, different trap net like large conical trap (local name-Takhung), wide conical trap with handle in one side (local name -Taje), (Fig 3) , Pole and Linewith hook and also some traditional techniques were applied such as

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controlling the current of water flow, in this way fishes are confined to a restricted area and then they are collected manually with the help of local people. Fish specimens were collected twice in the month of October 2018, January, 2019 and April2019.The fishes were tagged with a number which was specific for each specimen of different species. Photographs of freshly collected fish were taken whenever required to record the colour of fish specimens .The freshly collected specimens were weighed and preserved immediately in 10 % formalin buffer solution in translucent bottles as described by Walsh and Meador (1998). Formalin buffer solution is prepared by adding three gram of borax per litre of 10% formalin solution and it neutralizes the p^H of the fixative regarding tissue shrinkage and preventing decalcification of tissue. A general rule is maintained not to have more than 40% of biomass per container of formalin during fixation. The specimens examined for the present study have been deposited in the university of Science and Technology Meghalaya, Museum of Fish (USTM-MF)

IDENTIFICATION:

Counts and measurements followed Kottelat (1990) and Lokeshwor (2014). Identification keys for specimens were based on Vishwanath *et al.* (2014). Morphometry measurements were made with a digital calliper to nearest 0.1mm. Measurement of body length, standard length, head length body depth all are done with a digital calliper and fin count, pores in lateral line and lateral line scales were also observed with the help of microscope under transmitted and reflected light. Images of fish specimen were captured by using Nikon D 700; under AF-S Micro Nikko 60mm 1:28G ED lens and other by Redmi note 3 mobiles.

MORPHOMETRIC ANALYSIS:

Total weight of the fish was measured in an electronic balance nearest to 0.1gm.The morphometric measurements were studied following in the manner as described by Lowe-McConnell (1975). Themorphometric characters were measured on the left side of each specimen. For precision, divider and measuring board having graduation in centimetre have been used.

RESULTS:

The present study of fish faunal diversity of the 'Swkhestream'along with different paddy fields at Ziro valley, Lower Subansiri district, Arunachal Pradesh revealed17 species of fish under 14 different genera, 3 families and 2 orders. Of the 17 species recorded Cyprinidaewas the most dominantfamilywith 11 species, followed by Channidae with 3 species, Cobitidae, Osphronemidae and Nemacheilidae each with 1 species respectively. The fish species recorded were *Cyprinus carpio*, *Labeo rohita*, *Catlacatla*, *Garragotyla*, *Danio rerio*, *Devarioa equipinnatus*, *Hypophthalmichthys molitrix*, *Pethia ticto*, *Pethia conchonius*, *Schizothorax richardsonii*, *Aborichthyskempi*, Lepidocephalichthys guntea, *Neolissocheilus hexagonolepis*, *Channagachua*, *Channa punctatus*, *Channastewartii*, *Trichogaster chuna* (Table 1). Percentage contribution of different families of fishes in Swkhestream revealed (Fig 4) that Cyprinidae as the dominant group (64.71%).Species like *Cyprinus carpio*, *Labeo rohita*, *Catla catla*, *Hypophthalmichthys molitrix* had been mostly recorded in the nearby integrated paddy cum fish culture farm of the Apatani tribe during the survey. During the survey *Channa* species were also recorded in the rice fields, which were caught by opening the outlet of bunds. While assessing the utility of the collected fish species, it was found that 13 among

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the total 17 species have ornamental value, of which,11 species identified as classified ornamental fish (COF) and 2 as non-classified ornamental fish (NCOF) and 4 species are identified as cultivable food fish (CFF) which are depicted in Table-2.

DISCUSSION:

From the present study it is found that many of the fish species are least concern and some are vulnerable, near threatened, which need proper revision and concern for their declining in population. The major threats of the stream are dumping of solid and liquid waste directly into the river. The useof toxic chemicals, dynamite and electric fishing equipmentsiscausing a major threat to the water body. The fish diversity of Swkhe stream is therefore declining. Species like *Danio rerio, Devarioaequipinnatus, Cyprinus carpio, Labeorohita, Hypophthalmichthys molitrix; Pethiaspp, Schizothoraxrichardsonii, Aborichthyskempi, Channapunctata, Channagachua, Channastewartii, and Trichogasterchuna* are important as food species and are therefore vulnerable for fishing. They inhabit both still and relatively fast-growing water. Species like *Channapunctatus, Channagachua, Danio rerio, Devarioaequipinnatus, Pethia*spp, *Schizothoraxrichardsonii, Aborichthyskempi, Nemacheilus* spp. Also have ornamental value. *Labeorohita, Cyprinus carpio, Hypophthalmichthys molitrix* collected during the survey may probably be introduced by the locals for paddy fish culture. Moreover, there are species like *Aborichthyskempi, Neolissocheilus hexagonolepis* that are near threatened. Of these two, documentations of *Neolissocheilus hexagonolepis* only once depict its urgent conservation in this part of Arunachal Pradesh. Fishing is considered as one of the primary occupationsbylocal people of Ziro valley. The fish, *Schizothorax* (Ngilyangngiyi) is considered sacred by Apatani people and is used in many religious rituals as sacrifice. Owing to its exploitation through fishing activities and the depleting water level in the 'Swkhe stream' which is located in Hong village, communities (BMC) formed by these local people for the conservation of such species has recently declared the area upstream to 'Sikhebo' as Community Conserved Area (CCA) on 5th June, 2011, under the GOI-UNDP Country Cooperation Framework (CCF-II) project, for conservation of aquatic bio resources. As a part of this, the community collectively planted trees on the river banks to create bunds and with the help of BMC distributed many *Schizothorax* fish species in the 'Sikhebo River' during Myoko and Murung festivals (local festivals of Apatani people). It is now prohibited to use fishing techniques which make use of chemicals, electric shock or exploitation.

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Table 1: **List of fishes recorded from the study area of Arunachal Pradesh (Threat Category of different fish species as per CAMP report, 1998)**

Family	Name of the species	Conservation status	Total catch
Cyprinidae	*Neolissocheilushexagonolepis*, (*Mc*Clelland, 1839)	NT	3
	Hypophthalmichthys molitrix (Valentines, 1844)	NE	8
	Cyprinus carpio (Linnaeus, 1758)	NE	25
	Pethiaconchonius (Hamilton, 1822)	LC	8
	Pethiaticto(Hamilton, 1822)	LC	5
	Schizothoraxrichardsonii (Gray, 1822)	VU	3
	Cirrihinusmrigala(*Hamilton, 1822)*	LC	20
	Labeorohita, (Hamilton,1822)	LRnt	10
	Garragotyla, (Gray, 1830)	NE	9
Cyprinidae	*Danio rerio*, (Hamilton,1822)	LC	5
	Devarioaequipinnatus(McClelland, 1839)	LC	7
Nemacheilidae	*Aborichthyskempi* Chaudhuri, 1913	NT	4
Cobitidae	*Lepidocephalichthysguntea* (Hamilton, 1822)	LC	10
Channidae	*Channapunctata* (Bloch, 1793)	LC	2
	Channagachua (Hamilton, 1822)	LC	4
	Channastewartii(Bloch, 1793)	LRnt	1
Osphronemidae	*Trichogasterchuna*, (Hamilton,1822)	Lc	3

Note: NE- Not Evaluated; LC- Least Concern; VU- Vulnerable; LRnt- Lower Risk near threaded; LRlc- Lower Risk least concern, NT- Near threatened

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Table 2: Economic value of different fish species.

S. No	Name of the species	Ecnomic value
1.	*Neolissocheilushexagonolepis* (*Mc*Clelland, 1839)	COF
2.	*Hypopthalmicthys molitrix* (Valenciennes, 1844)	CFF
3.	*Cyprinus carpio* (Linnaeus, 1758)	CFF
4.	*Pethiaconchonius* (Hamilton, 1822)	COF
5	*Pethiaticto*(Hamilton, 1822)	COF
6	*Schizothoraxrichardsoni*(Gray, 1822)	COF
7.	*Cirrhinusmrigala(Hamilton, 1822)*	CFF
8.	*Labeorohita*, (Hamilton,1822)	CFF
9.	*Garragotyla*(Gray, 1830)	COF
10.	*Daniorerio*,(Hamilton, 1822)	COF
11.	*Devarioaequipinnatus*, (McClelland,1839)	COF
12.	*Aborichthyskempi*, (Chaudhuri, 1913)	COF
13.	*Lepidocephalichthysguntea*, (Hamilton, 1822)	COF
14.	*Channapunctata*, (Bloch, 1793)	NCOF
15.	*Channagachua*, *(Hamilton, 1822)*	COF
16.	*Channastewartia* (Bloch, 1793)	NCOF
17.	*Trichogasterchuna*,(Hamilton,1822)	COF

Note: COF=Classified Ornamental Fish, NCOF=Non-Classified Ornamental Fish, CFF=Cultivable Food Fish.

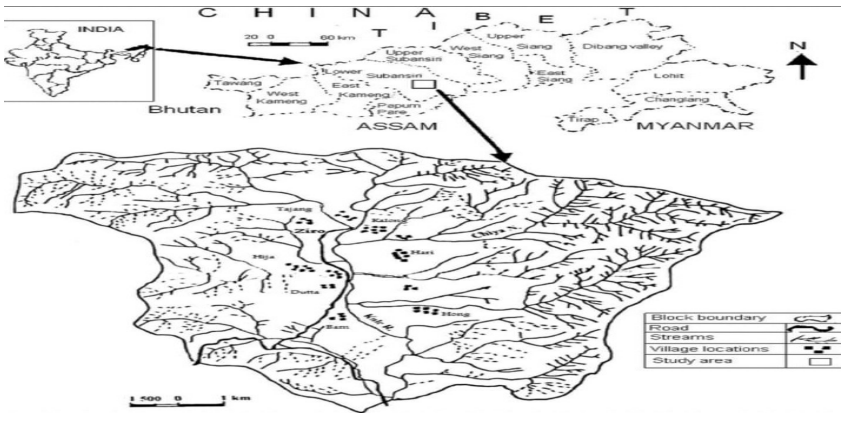

Fig1: Location map of Apatani plateau of Arunachal Pradesh, North-East India

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Fig.2. A view of collection site from different paddy field and the stream.

Fig. 3. A view of capture fishery and some catchments district, Arunachal Pradesh

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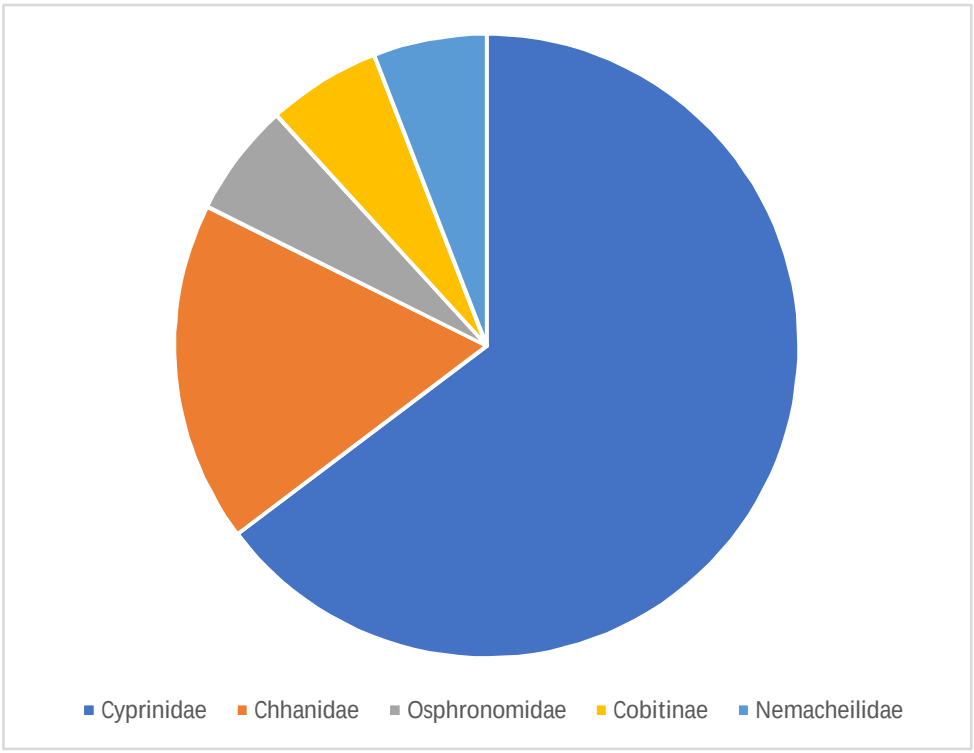
Fig 4: Percentage contribution of different families of fishes in Swkhestrem, LowerSubansiri district, Arunachal Pradesh.



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