



**A study on Diversity of Indigenous Ornamental Fish Species available in
Howrah District of West Bengal, India.**

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Abstract

This current work, based on an extensive field survey and fish sampling conducted over a period of 12 months, illustrated the status and availability of different indigenous ornamental fish species available in the district of Howrah, West Bengal. A total of 58 species from 39 genera, 25 families and 7 orders were reported. The survey result showed that among the total fish species collected, Order Cypriniformes held a major portion of the Howrah district's fish fauna. Fish of the Family Cyprinidae was the most abundant (28% of the total fish species), followed by the Family Channidae (7%) and Bagridae (7%). 60% of the fishes were exclusively freshwater species, followed by fresh and brackish water species which constituted of 35% of the total fish species collected. The present study revealed that the percentage of fish under the threatened category is almost up to 30% i.e. 9% endangered and 21% vulnerable of the total collected fish species while status of 22% was yet to be evaluated. Among these 58 collected fish species, 27 species can be regarded as classified aquarium fishes and the rest 31 species as non-classified aquarium fishes. Many of these species have been reported to have good domestic as well as export market since few years, so these indigenous ornamental fish resource can be gainfully utilized to capture not only the ornamental fish markets of our country but also the world trade in near future.

Keywords – Indigenous ornamental fish, aquarium fishes, export market, world trade.

I. INTRODUCTION

Ornamental fishes are attractive and colourful species of fishes with peaceful nature of various characteristics, which are kept as pets in confined space of an aquarium or a garden pool for fun and fancy [1, 2, 3]. Keeping ornamental fish as the pet is one of the most popular hobbies in the present day world next to photography [4, 5, 6, 1].

The ever-increasing demand for aquarium fishes gradually paved the avenue towards global trade of ornamental fishes [1] and it is now an important trade at the end of the 20th century [2]. Trade in ornamental fish is a multi-million dollar business with more than one hundred countries involved [7]. The annual World trade of ornamental fish is valued at about US\$ 700 million [8, 9]. Lion's share of the world export trade is contributed by Asian countries, which comes to nearly more than 60% of the total export [10, 11, 12, 13]. The top ten exporting countries from Asia in 2002 were Singapore, Malaysia, Indonesia, China, Japan, Philippines, Srilanka, Thailand and India [14].

India's contribution to global aquaria trade is worth a mere 10 crore rupees [15] while we have great potential to increase the level of exports to about US\$ 30 million (about Rs. 110 crores) every year [16]. An estimate carried out by Marine Products Export Development Authority of India shows that there are one million fish hobbyists in India. The internal trade is estimated to be about U.S. \$ 3.26 million and the export trade is in the vicinity of U.S. \$ 0.38 million [17]. Presently ornamental fish keeping hobby has been gaining popularity in various states of India [18] and the annual growth rate of this trade in domestic market is 20% [11, 13, 19]. Two parallel marketing procedures exist for exotic and native fish. In the case of exotic species, more than 99% is consumed by the domestic market and a few species like gold fish and angelfish are exported [17]. On the other hand, 90% of native ornamental species are collected and reared to meet export demand [17].

West Bengal is a pioneering state in respect of ornamental fish breeding and fish production. It contributed 90% of earnings from export of ornamental fishes from India in 2001-2002 [9]. A rich diversity of species and favorable climate, cheap labour and easy distribution has made West Bengal suitable for ornamental fish culture. With Kolkata as a distribution and export center the adjoining districts have become the major ornamental fish-producing zones of India. About 90% of Indian exports go from Kolkata followed by 8% from Mumbai and 2% from Chennai [17]. Among the indigenous fish resources of this state, many are unsuitable for conventional farming but could be gainfully utilized as ornamental fishes due to their attractive colouration, movement, behaviour etc. These fishes were previously regarded as trash fishes but in recent times they have been regarded as with the potential to be used as ornamental fishes. They are known as indigenous ornamental fishes of West Bengal. These ornamental fishes have now gained popularity and also have high market demand both in and outside the country [2].

In respect to the ornamental fish trade of West Bengal, Kolkata is the main landing center where ornamental fishes from different districts of this state and also from nearby states (mostly from the North-Eastern Region) used to be gathered and then being exported to other countries and also supplied to different other states of the country. The largest wholesale market of Eastern India, the Galiff Street market is also located at Kolkata [17]. The main activities of ornamental fish collection (in case of indigenous ornamental fish trade) and culture (in case of exotic ornamental fish trade) of this state is centered on three main districts; North-24-Paraganas, South-24-Paraganas and Howrah.

Howrah is a district with good amount of water resources; Damodar river is flowing through its north-west part while Rupnarayan River on west and south-west and Bhagirathi-Hooghly River on east and south-east side. Along with this, number of waterbodies is there in Howrah which holds good number of indigenous fish resources. Many of the indigenous ornamental fish species have been reported earlier in whole sale ornamental fish markets of Howrah like *Colisa sota*, *Channa punctatus*, *Nandus nandus*, *Channa marulius*, *Colisa fasciatus*, *Pseudambassis ranga*, *Amblypharyngodon mola*, *Macrogathus pancalus*, *Lepidocephalichthys guntea* etc [20] and many have found its way into the Galiff street market too. These indigenous ornamental fishes are actually coming from the collection by fishermen in different parts Howrah. Earlier no such work was carried out to study the indigenous ornamental fish resources of this district. So, the present work was designed to get in-depth information on the available indigenous ornamental fish resources of Howrah.

II. MATERIALS AND METHOD

A. Survey site Howrah:

The Howrah district lies between 22°48' N and 22°12' N latitudes and between 88°23' E and 87°50' E longitudes. The district is bounded by the Hooghly River and the North 24 Paraganas and South 24 Paraganas districts on the east, on the north by the Hooghly district, and on the south by Midnapore East district. On the west Howrah district is bordered by the Ghatal sub-division of Midnapore West district, and partly by the Arambagh sub-division of Hooghly district to the north-west, and the Tamluk sub-division of Midnapore East district to the south-west. Boundaries of the district are naturally determined by Rupnarayan River on west and south-west, and by Bhagirathi-Hooghly River on east and south-east side. On north side, the boundary is an artificial one except for Bally Canal on north-east and Damodar River on north-west. Annual normal rainfall is 1461 millimeter per year. Annual maximum temperature varies between 32-39 °C, whereas minimum temperature varies between 8-10 °C.

B. Experimental work:

The survey work was conducted for 12 months duration from June, 2013 to June, 2014. During this survey period fishes were collected from different selected localities [Bagnan (22°46'67N, 87°98'33E); Amta (22°58'33 N, 88°01'67 E); Deulti (22°26'N, 87°56'E); Uluberiya (22°29'3.10"N, 88°01'59.95"E); Shyampur (22°17'N, 88°1'E); Bauria (22°29'N, 88°10'E); Andul

(22°58'6N, 88°23'6E); Sankrail (22°34'N, 88°14'E); Shibpur (23°65'5N, 88°50'4E); Domjur (22°38'27N, 88°13'13 E); Ramrajatala (22°36'N, 88°18'E); Ichhapur (22°75'8N, 88°63'E); Kadamtala (22°59'N, 88°33'E); Dasnagar (20°59'N, 78°96'29E); Liluah (22°35'N, 88°23'E)] (**Figure:1**) with the help of local fishermen using different types of nets namely gill nets, cast nets and dragnets and also fish specimens were collected from different local fish markets and distribution centers ('Arot') in Howrah. During the survey period, collection was also made from Damodar, Hooghly and Rupnarayan river. Interactive discussions were also made with the fishermen to get some more information regarding the current availability status of collected specimens. Immediately after collection, photographs were taken prior to preservation with 8% formalin. Fishes were preserved in formalin jars depending on their size; smaller fishes were directly placed in the formalin solution, while larger fishes were given an incision on the abdomen before they were fixed. The fishes collected and fixed were labeled giving serial numbers, exact locality from where collected, date of the collection etc. The local names of collected fish specimens used in this region were also labeled. Collected specimens were identified following standard books on taxonomy [21, 22, 23]. Identifications were confirmed by Zoological Survey of India, Kolkata.

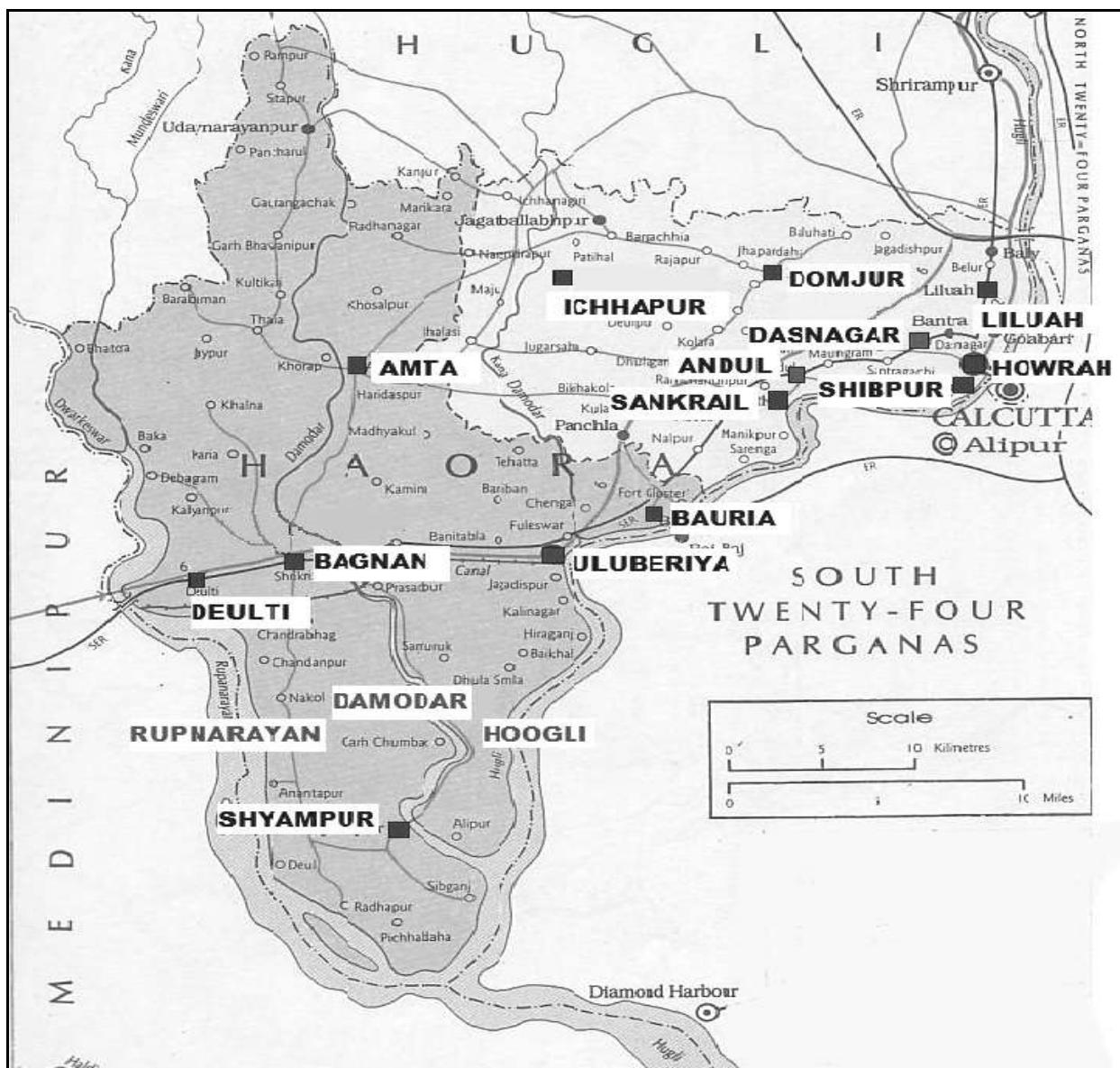


Figure 1: Survey site: Howrah District, West Bengal.

■ - Denotes to the 15 sites surveyed and the three main water resources have also been indicated here i.e. Damodar, Rupnarayan and Hoogli.

III. RESULTS AND DISCUSSION:

During our survey period a total of 58 fish species belonging to 7 orders, 25 families and 39 genera were collected (**Table: 1**). Cyprinidae was the most dominant family with 16 representative species followed by Channidae and Bagridae with 4 representative species each (**Figure: 2**).

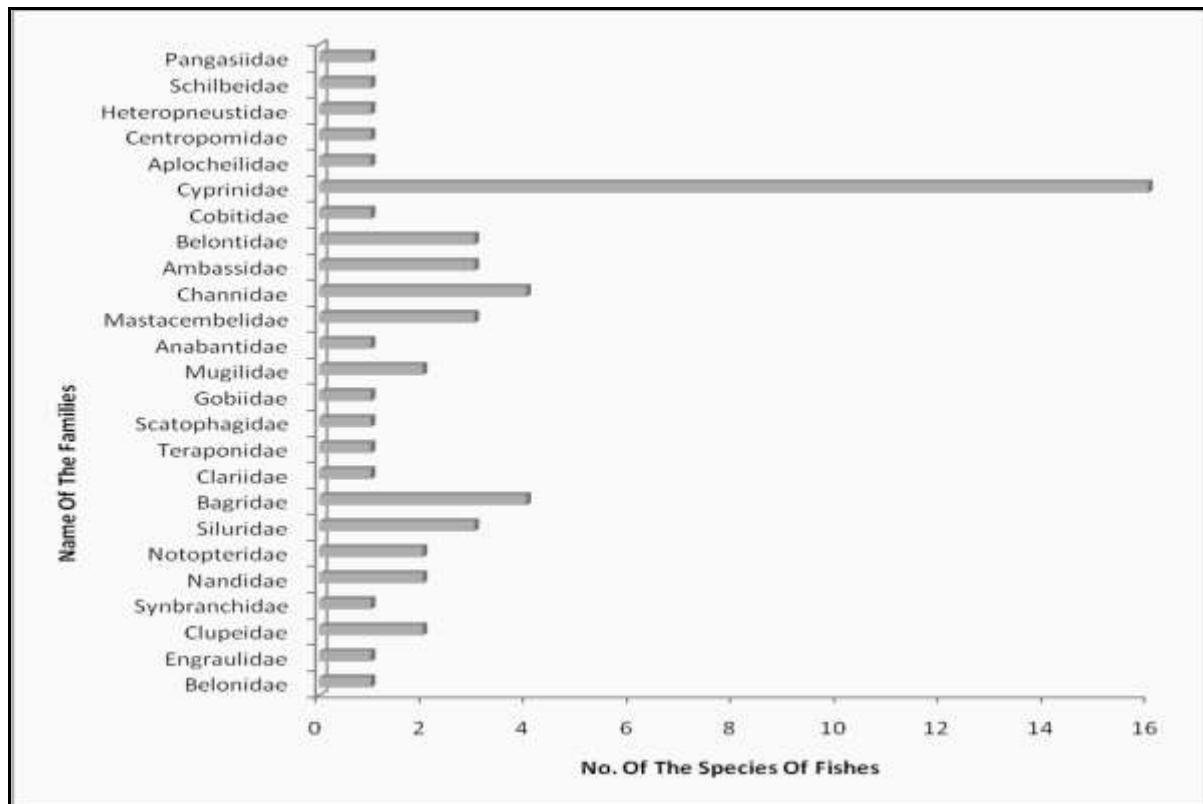


Figure 2: Number of represented species under different families in the total collected fish specimens.

Among the collected fish species, 35 fishes were exclusively freshwater species, 20 were fresh and brackish water species, 1 was exclusively brackish water species and rest 1 was freshwater, brackish water and marine species (**Table: 1**). Availability status of the Indigenous Ornamental Fishes in different places surveyed in Howrah has also been represented (**Table: 2**).

The indigenous ornamental fishes of West Bengal have been categorized into two categories- Classified and Non-classified aquarium fishes [17]. Among these 58 collected fish species, 27 species like *Amblypharyngodon mola*, *Salmostoma phulo*, *Puntius sophore*, *Puntius terio*, *Puntius ticto*, *Colisa lalia*, *Chanda nama*, *Colisa fasciatus*, *Mystus tengara* etc can be kept into aquarium throughout their life span due to their small size and thus can be regarded as classified aquarium fishes. On the other hand, rest 31 species like *Lepidocephalichthys guntea*, *Anabas testudineus*, *Labeo bata*, *Labeo calbasu*, *Catla catla*, *Notopterus chitala* etc can be kept in the aquarium only during their juvenile stages and thus can be regarded as non-classified aquarium fishes.

It was found that the percentage of fish under the threatened category is almost up to 30% of the total fish species collected. More precisely, 5 species out of the total 58 fish species were endangered and 12 species were vulnerable. Among these collected fish species, 20 species are grouped under Low risk nearly threatened (LRnt) category and 8 species under Low risk least concern (LRlc) category. Further, the status of the rest 13 species was yet to be evaluated and these were clustered under not evaluated (NE) category (**Figure: 3**).

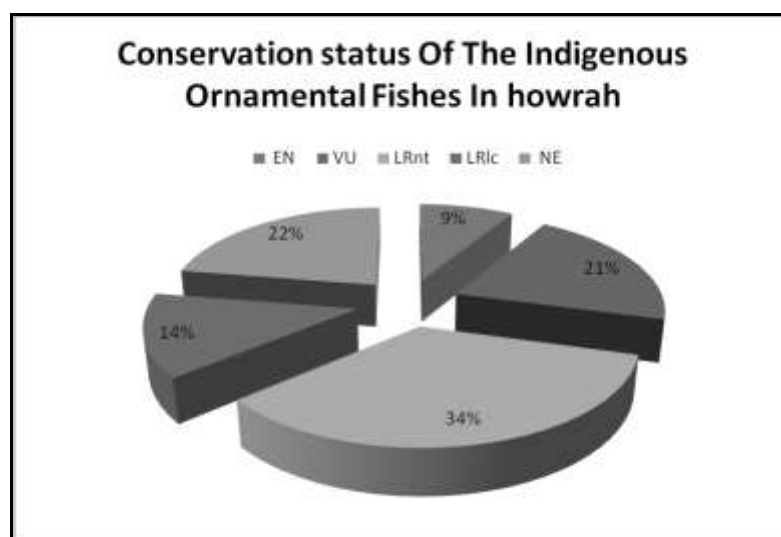


Figure 3: Conservation status of the different fish specimens collected. 9% endangered (EN) category; 21% vulnerable (VU) category; 34% Low risk nearly threatened (LRnt) category; 14% Low risk least concern (LRlc) category and 22% not evaluated (NE) category.

Among these collected fish species, *Colisa fasciatus*, *Colisa lalia*, *Colisa sota*, *Mystus vittatus*, *Notopterus notopterus*, *Macroglyphus pancalus*, *Lepidocephalichthys guntea*, *Chanda nama*, *Pseudambassis ranga*, *Scatophagus argus* etc. have been reported to have good domestic market demand since few years [17] and many of them like *Mastacembelus armatus*, *Colisa fasciatus*, *Chanda ranga*, *Amblypharyngodon mola*, *Channa orientalis*, *Channa punctatus*, *Nandus nandus*, *Lepidocephalichthys guntea* etc. have reported to have good export market [2]. So, these indigenous ornamental fishes can be gainfully utilized to capture the ornamental fish markets of our country, which are at present dominated by the exotic species and many of them could be utilized to capture the world trade also as it's the natural tendency where fish hobbyists throughout the world used to look for new varieties and on this issue, indigenous ornamental fishes of West Bengal could be a good solution. On the other hand, in Indian domestic ornamental fish market, demand is higher than that of the supply as the numbers of farms available till now is really not sufficient to meet the demand [17]. In this case, indigenous ornamental fishes could come up as it has gradually started to get the popularity among the domestic aquarists.

But along with these positive sides, a matter of serious concern is also related to the business with indigenous ornamental fish trade. As this business is totally dependent on the collection of ornamental fish species from wild, so unscrupulous collection from the wild could lead to depletion of the wild stock and thus could minimize the longevity of the trade too. Many of the fish species are becoming vulnerable in the state due to degradation of water bodies, pollution, over fishing of juveniles etc. The survey revealed that the habitats and breeding grounds of these valuable fishes are under threat due to the application of toxicants to prepare the water bodies for the sake of scientific composite fish culture after eradicating the weed fishes, some of which are also potential indigenous ornamental fishes. Populations of many fish species were abundant in natural habitat, even before one or two decades, but in recent times many of them have become threatened. Therefore, detail knowledge about their conservation status is really essential. Based on this information, suitable strategies could be under taken for their effective conservation which will help in the sustainable management of the indigenous ornamental fish trade of West Bengal.

Apart from the collection of the indigenous ornamental fishes from the wild, to sustain this trade, captive breeding and rearing of the indigenous ornamental fish should be tried. Already captive breeding of some of the indigenous ornamental fishes like *Mystus tengara*, *Nandus nandus*, *Notopterus chitala*, *Ompok bimaculatus* etc have been tried successfully [2, 24, 25]. On the other hand, captive culture needs detail information on the biology of the fish species mainly the feeding and breeding biology. So, detail information on the biology of the fish species should be studied.

Table 1: List of the Indigenous Ornamental Fishes collected during the survey period in Howrah.
F: Freshwater; B: Brackish Water; M: Marine; CA: Classified Aquarium Fish; NCA: Non-Classified Aquarium Fish

ORDER	FAMILY	SCIENTIFIC NAME	COMMON NAME	LOCAL NAME	REMARK
Cypriniformes	Cyprinidae	<i>Amblypharyngodon mola</i> (Ham-Buch)	Mola carplet	Maurala, Mowa	F, CA
		<i>Catla catla</i> (Ham-Buch)	Catla	Catla	F, NCA
		<i>Chela laubuca</i> (Ham-Buch)	Indian glass-barb	Layubuka, Dankena	F, CA
		<i>Cirrhinus mrigala</i> (Ham-Buch)	Mrigal	Mrigal, Mrigala	F, NCA
		<i>Esomus danricus</i> (Ham-Buch)	Flying barb	Dadhikha, Danrika	F; CA
		<i>Labeo bata</i> (Ham-Buch)	Bata labeo	Bhanganbata, Bata	F; NCA
		<i>Labeo calbasu</i> (Ham-Buch)	Kalbasu, Black rohu	Kalbasu, Kalbose	F; NCA
		<i>Labeo rohita</i> (Ham-Buch)	Rohu	Rahu, Rui, Ruee	F; NCA
		<i>Puntius chola</i> (Ham-Buch)	Swamp barb, Chola barb	Kerrundi	F; CA
		<i>Puntius conchoniis</i> (Ham-Buch)	Rosy barb, Red barb	Kunchon-pungti	F; CA
		<i>Puntius sarana sarana</i> (Ham-Buch)	Olive barb	Swarna-punti, Kurti	F; NCA
		<i>Puntius sophore</i> (Ham-Buch)	Spot fin swamp barb	Punti	F; CA
		<i>Puntius terio</i> (Ham-Buch)	One-spot barb	Teri-pungti	F; CA
		<i>Puntius ticto</i> (Ham-Buch)	Ticto barb, Two-spot barb	Teet-punti	F; CA
		<i>Salmostoma bacaila</i> (Ham-Buch)	Large razor belly minnow	Jellahri, Gangchela	F; CA
<i>Salmostoma phulo</i> (Ham-Buch)	Fine scale razor belly minnow	Phul-chela	F; CA		
	Cobitidae	<i>Lepidocephalichthys guntea</i> (Ham-Buch)	Guntea loach	Guntel	F; CA
Perciformes	Anabantidae	<i>Anabas testudineus</i> (Bloch)	Climbing perch	Koi	F,B; NCA
	Channidae	<i>Channa marulius</i> (Ham-Buch)	Giant snakehead	Sal, Gajal	F, NCA
		<i>Channa orientalis</i> (Bloch and Schneider)	Asiatic snakehead	Cheng	F, CA
		<i>Channa punctatus</i> (Bloch)	Spotted snakehead	Taki, Lata	F, NCA
		<i>Channa striatus</i> (Bloch)	Banded snakehead	Shol	F, NCA
	Gobiidae	<i>Glossogobius giuris</i> (Ham-Buch)	Tank goby	Bele	F,B,M; NCA
	Belontiidae	<i>Colisa fasciatus</i> (Schneider)	Giant Gourami	Khalisha, Cheli	F,B; CA
		<i>Colisa lalia</i> (Ham-Buch)	Dwarf Gourami	Khalisha	F; CA
		<i>Colisa sota</i> (Ham-Buch)	Sunset Gourami	Chuna Khalisha	F; CA
	Ambassidae	<i>Chanda nama</i> (Ham-Buch)	Elongate glass Perchlet	Chanda	F,B; CA
<i>Pseudambassis ranga</i> (Ham-Buch)		Indian glassy fish	Ranga-chanda	F,B; CA	
<i>Pseudambassis lala</i> (Ham-Buch)		High fin glassy Perchlet	Lal-chanda	F,B; CA	

Table 1: continued...

ORDER	FAMILY	SCIENTIFIC NAME	COMMON NAME	LOCAL NAME	REMARK
Perciformes	Mastacembelidae	<i>Mastacembelus armatus</i> (Lacepede)	Tire-track Spinyeel	Bam, Bami	F,B; NCA
		<i>Macragnathus aral</i> (Bloch and Schneider)	One-stripe Spinyeel	Golchi	F,B; NCA
		<i>Macragnathus pancalus</i> (Ham-Buch)	Striped Spinyeel	Turi, Pangkal	F,B; CA
	Mugilidae	<i>Liza parsia</i> (Ham-Buch)	Goldspot mullet	Parsia, Tarui	B; NCA
		<i>Rhinomugil corsula</i> (Ham-Buch)	Corsula mullet	Corsula, Elanga	F,B; NCA
	Scatophagidae	<i>Scatophagus argus</i> (Linnaeus)	Spotted scat	Paira chanda	F,B; NCA
	Nandidae	<i>Badis badis</i> (Ham-Buch)	Badis	Botkoi, Bhedo	F; CA
<i>Nandus nandus</i> (Ham-Buch)		Mottled Nandus	Bheda, Nadosh	F,B; CA	
Teraponidae	<i>Terapon jarbua</i> (Forsskal)	Jarbua Terapon	Kath Koi	F,B; NCA	
Centropomidae	<i>Lates calcarifer</i> (Bloch)	Barramundi	Bhetki	B; NCA	
Siluriformes	Clariidae	<i>Clarias batrachus</i> (Linnaeus)	Magur	Magur, Mahgur	F,B; NCA
	Heteropneustidae	<i>Heteropneustes fossilis</i> (Bloch)	Stinging catfish	Singhi	F,B; NCA
	Bagridae	<i>Aorichthys aor</i> (Ham-Buch)	Long-whiskered catfish	Aar, Aar-tengara	F; NCA
		<i>Mystus cavasius</i> (Ham-Buch)	Gangetic Mystus	Kabasi-tengra	F,B; NCA
		<i>Mystus tengara</i> (Ham-Buch)	Tengara Mystus	Tengara	F; CA
		<i>Mystus vittatus</i> (Ham-Buch)	Striped dwarf catfish	Tengra	F; CA
	Schilbeidae	<i>Ailia coila</i> (Ham-Buch)	Gangetic ailia	Kojoli, Kajri	F; NCA
Siluridae	<i>Ompok bimaculatus</i> (Bloch)	Indian butter-catfish	Puffta	F; NCA	
	<i>Ompok pabda</i> (Ham-Buch)	Pabdah catfish	Pabda, Pabo, Pava	F; CA	
	<i>Wallago attu</i> (Schneider)	Boal	Bayali, Boal	F; NCA	
Pangasiidae	<i>Pangasius pangasius</i> (Ham-Buch)	Pungas	Pungas, Pangra	F,B; NCA	
Clupeiformes	Clupeidae	<i>Gonialosa manmina</i> (Ham-Buch)	Ganges river gizzard shad	Khoira	F; CA
		<i>Gudusia chapra</i> (Ham-Buch)	Indian river shad	Khira, Khoira	F; CA
	Engraulidae	<i>Setipinna phasa</i> (Ham-Buch)	Gangetic hairfin anchovy	Phasa	F,B; NCA
Osteoglossiformes	Notopteridae	<i>Notopterus chitala</i> (Ham-Buch)	Humped feather-back	Chitala, Chital	F,B; NCA
		<i>Notopterus notopterus</i> (Pallas)	Grey feather back	Phulo, Pholui	F,B; NCA
Synbranchiformes	Synbranchidae	<i>Monopterusuchia</i> (Ham-Buch)	Cuchia, Gangetic mud eel	Kunche, Cuchia	F,B; NCA
Cyprinodontiformes	Aplocheilidae	<i>Aplocheilus panchax</i> (Ham-Buch)	Panchax minnow	Trichoke	F; CA
	Belonidae	<i>Xenentodon cancila</i> (Ham-Buch)	Freshwater garfish	Kankley, Bakmachh	F; NCA

Table 2: Availability status of the Indigenous Ornamental Fishes in different places surveyed in Howrah.

++ = Abundant; + = Present; - = Absent

1 = Bagnan, 2 = Amta, 3 = Deulti, 4 = Uluberiya, 5 = Shyampur, 6 = Bauria, 7 = Andul, 8 = Sankrail, 9 = Shibpur, 10 = Domjur, 11 = Ramrajatala, 12 = Ichhapur, 13 = Kadamtala, 14 = Dasnagar, 15 = Liluah

SCIENTIFIC NAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Amblypharyngodon mola</i> (Ham-Buch)	++	++	+	+	+	+	-	+	++	+	++	+	+	+	+
<i>Catla catla</i> (Ham-Buch)	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
<i>Chela laubuca</i> (Ham-Buch)	+	++	-	-	-	-	-	+	-	+	+	-	+	-	-
<i>Cirrhinus mrigala</i> (Ham-Buch)	++	++	+	+	+	++	+	+	+	+	++	+	+	+	+
<i>Esomus danricus</i> (Ham-Buch)	+	+	-	-	-	-	-	+	-	-	+	-	-	-	-
<i>Labeo bata</i> (Ham-Buch)	++	++	+	+	++	+	+	++	++	++	++	++	++	++	++
<i>Labeo calbasu</i> (Ham-Buch)	+	+	+	+	+	+	++	+	++	+	++	+	++	+	+
<i>Labeo rohita</i> (Ham-Buch)	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
<i>Puntius chola</i> (Ham-Buch)	+	++	+	-	-	-	+	-	-	-	+	-	-	-	-
<i>Puntius conchoni</i> (Ham-Buch)	++	++	+	-	-	-	+	-	+	+	++	+	+	-	-
<i>Puntius sarana sarana</i> (Ham-Buch)	+	+	+	-	-	+	+	+	+	+	++	+	+	+	+
<i>Puntius sophore</i> (Ham-Buch)	++	++	+	++	+	+	+	+	++	+	++	+	++	+	+
<i>Puntius terio</i> (Ham-Buch)	+	+	-	-	-	-	+	-	-	-	+	-	-	-	-
<i>Puntius ticto</i> (Ham-Buch)	+	+	+	-	-	-	+	+	+	+	+	-	-	+	-
<i>Salmostoma bacaila</i> (Ham-Buch)	+	+	-	-	-	-	+	-	+	-	+	+	-	+	+
<i>Salmostoma phulo</i> (Ham-Buch)	+	+	+	+	+	+	+	-	+	+	++	+	+	++	+
<i>Lepidocephalichthys guntea</i> (Ham-Buch)	+	+	-	-	-	+	-	+	-	-	+	-	-	-	-
<i>Anabas testudineus</i> (Bloch)	+	++	+	-	+	+	-	+	+	+	+	+	+	+	+
<i>Channa marulius</i> (Ham-Buch)	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+
<i>Channa orientalis</i> (Bloch and Schneider)	-	-	-	-	-	-	-	-	+	-	+	-	+	-	-
<i>Channa striatus</i> (Bloch)	-	-	-	+	-	-	-	-	-	-	+	-	-	-	+

Table 2: continued...

SCIENTIFIC NAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Glossogobius giuris</i> (Ham-Buch)	+	+	-	+	+	-	-	+	+	+	+	-	+	+	+
<i>Colisa fasciatus</i> (Schneider)	+	++	+	-	++	+	+	+	++	+	++	++	+	+	+
<i>Colisa lalia</i> (Ham-Buch)	++	+	-	-	-	+	+	-	+	+	+	-	-	+	-
<i>Colisa sota</i> (Ham-Buch)	+	+	-	-	-	-	-	-	+	-	+	-	-	-	+
<i>Chanda nama</i> (Ham-Buch)	+	+	-	+	-	-	-	-	+	-	+	-	+	-	-
<i>Pseudambassis ranga</i> (Ham-Buch)	++	++	+	-	-	+	-	-	++	-	++	-	+	+	+
<i>Pseudambassis lala</i> (Ham-Buch)	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Mastacembelus armatus</i> (Lacepede)	+	+	+	-	+	+	-	+	+	+	+	-	+	+	+
<i>Macrogathus aral</i> (Bloch and Schneider)	+	+	+	-	-	-	-	-	+	-	+	+	+	+	+
<i>Macrogathus pancalus</i> (Ham-Buch)	+	+	-	+	+	+	+	-	+	+	++	+	+	+	+
<i>Liza parsia</i> (Ham-Buch)	-	-	-	-	-	-	-	-	+	-	+	+	+	+	+
<i>Rhinomugil corsula</i> (Ham-Buch)	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+
<i>Scatophagus argus</i> (Linnaeus)	-	-	-	-	-	-	-	-	+	-	+	+	+	+	+
<i>Badis badis</i> (Ham-Buch)	+	+	+	-	-	-	-	-	-	-	+	-	-	-	-
<i>Nandus nandus</i> (Ham-Buch)	+	+	-	+	-	-	+	-	-	-	+	-	+	-	-
<i>Terapon jarbua</i> (Forsskal)	-	-	-	-	-	-	-	-	+	-	+	-	+	+	-
<i>Lates calcarifer</i> (Bloch)	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+
<i>Clarias batrachus</i> (Linnaeus)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Heteropneustes fossilis</i> (Bloch)	+	++	+	+	+	+	+	+	+	+	++	+	+	+	+
<i>Aorichthys aor</i> (Ham-Buch)	-	-	-	-	-	-	-	+	+	-	+	+	+	+	+
<i>Mystus cavasius</i> (Ham-Buch)	+	+	-	-	-	-	-	-	-	-	+	-	-	+	-

Table 2: continued...

SCIENTIFIC NAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Mystus tengara</i> (Ham-Buch)	+	++	+	-	-	+	-	-	+	-	++	+	+	+	-
<i>Mystus vittatus</i> (Ham-Buch)	+	+	-	-	-	-	-	-	-	-	+	-	-	+	-
<i>Ailia coila</i> (Ham-Buch)	+	+	-	+	+	+	-	-	+	+	++	-	+	+	+
<i>Ompok bimaculatus</i> (Bloch)	+	++	+	-	++	+	+	++	+	++	+	+	-	++	+
<i>Ompok pabda</i> (Ham-Buch)	+	+	-	+	-	-	+	-	+	-	-	+	-	-	-
<i>Wallago attu</i> (Schneider)	+	+	+	-	-	+	-	+	+	+	+	+	+	+	+
<i>Pangasius pangasius</i> (Ham-Buch)	-	-	+	-	-	-	-	-	+	-	+	+	+	+	+
<i>Gonialosa manmina</i> (Ham-Buch)	-	-	-	-	-	-	-	-	+	+	+	+	-	+	+
<i>Gudusia chapra</i> (Ham-Buch)	+	+	-	+	-	+	-	+	++	+	++	+	++	+	-
<i>Setipinna phasa</i> (Ham-Buch)	-	-	-	-	-	-	-	-	+	-	++	+	+	+	+
<i>Notopterus chitala</i> (Ham-Buch)	-	-	-	-	-	-	-	-	+	-	+	-	+	-	-
<i>Notopterus notopterus</i> (Pallas)	++	++	+	-	+	+	+	+	++	+	++	+	+	+	+
<i>Monopterus cuchia</i> (Ham-Buch)	+	+	-	-	-	-	-	-	-	-	+	-	-	-	-
<i>Aplocheilus panchax</i> (Ham-Buch)	++	++	+	++	+	-	-	-	-	-	++	-	-	-	-
<i>Xenentodon cancila</i> (Ham-Buch)	+	+	+	-	+	+	-	+	+	+	++	+	+	+	+

IV. CONCLUSION

So, in a nut shell to ensure the sustainability of the indigenous ornamental fish trade, the following major steps have to be taken-

- 1) A continuous survey work regarding the availability of these fish species should be maintained to get the accurate view about the stock in nature.
- 2) To keep the sustainable supply, captive breeding and seed raising of these fishes should be promoted.
- 3) Indiscriminate exploitation of the brooders and juveniles in the wild leads to stock depletion, which should be controlled by the legislative actions. These will ensure the protection of these species from over exploitation.
- 4) Most of these species are becoming vulnerable in West Bengal due to pollution and over fishing. Considerable number of species has become endangered and even some of them are even rare in West Bengal. Therefore, proper strategy for the conservation of these biotic resources, especially for the endangered and threatened species is needed.
- 5) The biology of these fishes especially feeding and breeding biology should be studied properly. This will help for proper rearing of these fishes during captive breeding and culture.
- 6) Other than these species, there may be some more fishes available which have the potential to become the indigenous ornamental fishes; that should be identified.
- 7) Provision of better extension support in the form of technology, finance and marketing to needy fishermen, particularly with regards to the unemployed to motivate them to adopt ornamental fish production as a business should be provided.
- 8) Training and registration of indigenous ornamental fish collectors, breeders, exporters for legislation and control of trade should be done.

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