



Indigenous Ornamental Fish Resources of Upper Brahmaputra Basin and Their Sustainable Utilization

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ABSTRACT

The upper Brahmaputra basin, a part of the global hotspots of freshwater fish biodiversity abounds in highly potential indigenous ornamental fishes typical of riverine, wetland as well as hill stream habitats. As many as 70 species of ornamental fishes belonging to 19 families have been recorded so far from this region that sustained by mighty river Brahmaputra, its tributaries, distributaries, a large number of floodplain wetlands (locally known as *beels*) and hill streams. Species like *Botia dario*, *Colisa fasciatus*, *Esomus danricus*, *Nandus nandus*, *Badis badis*, *Sisor rhabdophorus*, *Channa barca*, *Danio acquipinnatus*, *Chaca chaca*, etc. resident to such ecosystems possess high potentialities to become a good competitor in the tropical ornamental fish industry. Especially the weed-infested *beels* of this region offers a variety of microhabitats for many colourful fish species and can be considered as goldmines for indigenous ornamental fishes. Despite of such a rich natural endowments and vast potentiality, the present status of ornamental fisheries in upper Brahmaputra basin is still considered to be poor. Lack of awareness and ignorance among rural masses, deficiency of infrastructure, Govt. apathy and inefficient policies are the main underlying factors lagging behind the region in this highly promising sector. Moreover, wanton destruction of habitats, indiscriminate fishing through micro nets, poisoning, dynamiting electric fishing, etc. contribute substantially for a faster depletion of their natural stock and requires immediate and effective conservation steps. The present communication highlights on prospects of developing ornamental fisheries in this part of the globe in a sustainable way for the economic upliftment of the region.

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Key words: *Indigenous ornamental fish, upper Brahmaputra basin, conservation status, sustainable utilization*

1. INTRODUCTION

With changing values of the human societies in terms of modernization and development, “aquarium keeping” has become the most reputed hobby in present days and aesthetic value of ornamental fishes provides entertainment to the people of all ages, social and economic strata of the society. The Brahmaputra drainage system of Northeastern India, the seventh largest hydrographic basin in the world is a huge reservoir of fresh water fish germplasm and considered as a hot spot of fresh water fish biodiversity [1]. The upper Brahmaputra basin represents a mosaic of varying aquatic habitats including the mighty river Brahmaputra, its tributaries, distributaries, flood plain lakes (locally known as *beels*) and numerous muddy as well as torrential hill streams. These distinct habitats having high diversity in their biotic and abiotic characteristics harbour an astonishing variety of indigenous ornamental fishes. Most of these fish species possess enormous potential to become a good competitor in the tropical ornamental fish industry for their high aesthetic values

due to their attractive colouration pattern, graceful behaviour, peculiar body morphology and endemism. However, in recent times, severe erosion has been noticed in the natural fish stock especially the ornamental ones specific to this region. The major causes behind such an erosion includes wanton destruction of natural habitats and unsustainable mode of exploitation. Moreover, detailed and comprehensive information on present availability, distribution pattern, conservation status, etc. of ornamental fish diversity of the region is very few [2], [3], [4], [5], [6] which are very much essential for undertaking sustainable exploitation and effective conservation programmes of these important resources. The present communication dealt with diversity, frequency of present availability and current conservation status of the indigenous ornamental fish resources of the region and also highlights on prospects of sustainable utilization of these resources in order to derived economic benefits from them.

2. MATERIALS AND METHODS

2.1. Study area

The present investigation was carried out in the six districts of upper Assam viz., Tinsukia, Dibrugarh, Sivasagar, Jorhat, North Lakhimpur and Dhemaji districts of upper Assam and three districts of south eastern Arunachal Pradesh viz., Tirap, Changlang and Lohit (Figure-1) The major drainages of the study area are given in Figure-2.

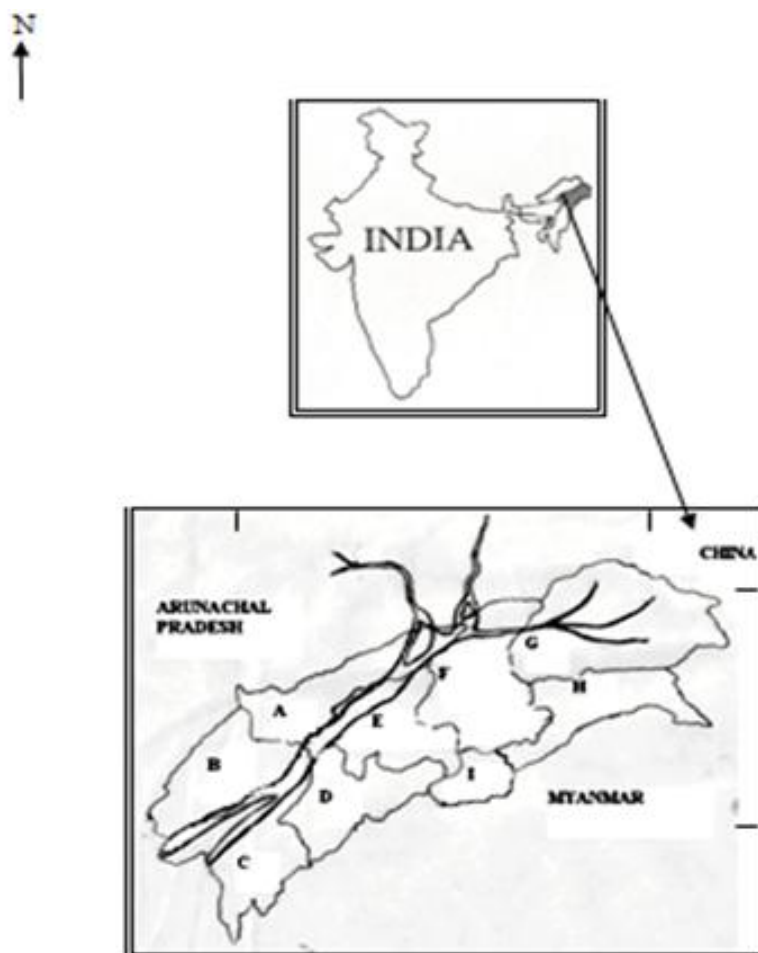


Figure-1: Map of the study area showing different surveyed districts

- | | | |
|--------------|--------------|--------------|
| A. Dhemaji | D. Sivasagar | G. Lohit |
| B. Lakhimpur | E. Dibrugarh | H. Changlang |
| C. Jorhat | F. Tinsukia | I. Tirap |

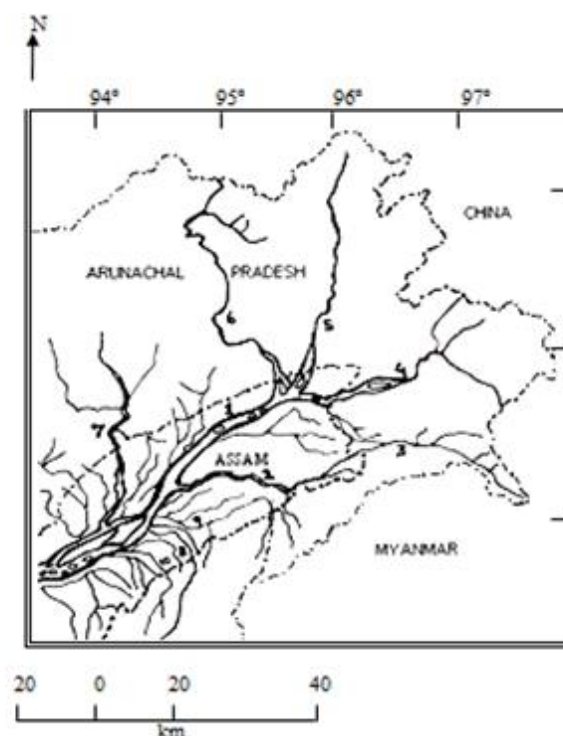


Figure-2: Map of the study area showing major drainages

1. Brahmaputra	2. Burhidihing	3. Noa-Dihing	4. Lohit	5. Dibang
6. Siang	7. Subansiri	8. Dikhow	9. Disang	10. Jhanji

2.2. Collection and identification of fish species

Random field surveys have been made in different lotic and lentic water bodies of the region in order to collect and record fish species. Different types of fishing nets of varying mesh sizes and indigenous fishing gears were employed for the purpose which was carried out between January' 2011 and December' 2014. The collected fish specimens were identified following [7].

2.3. Conservation status

The biodiversity conservation status of the identified fish species has been assigned following [8].

3. RESULT AND DISCUSSION

3.1: Diversity of ornamental fish species

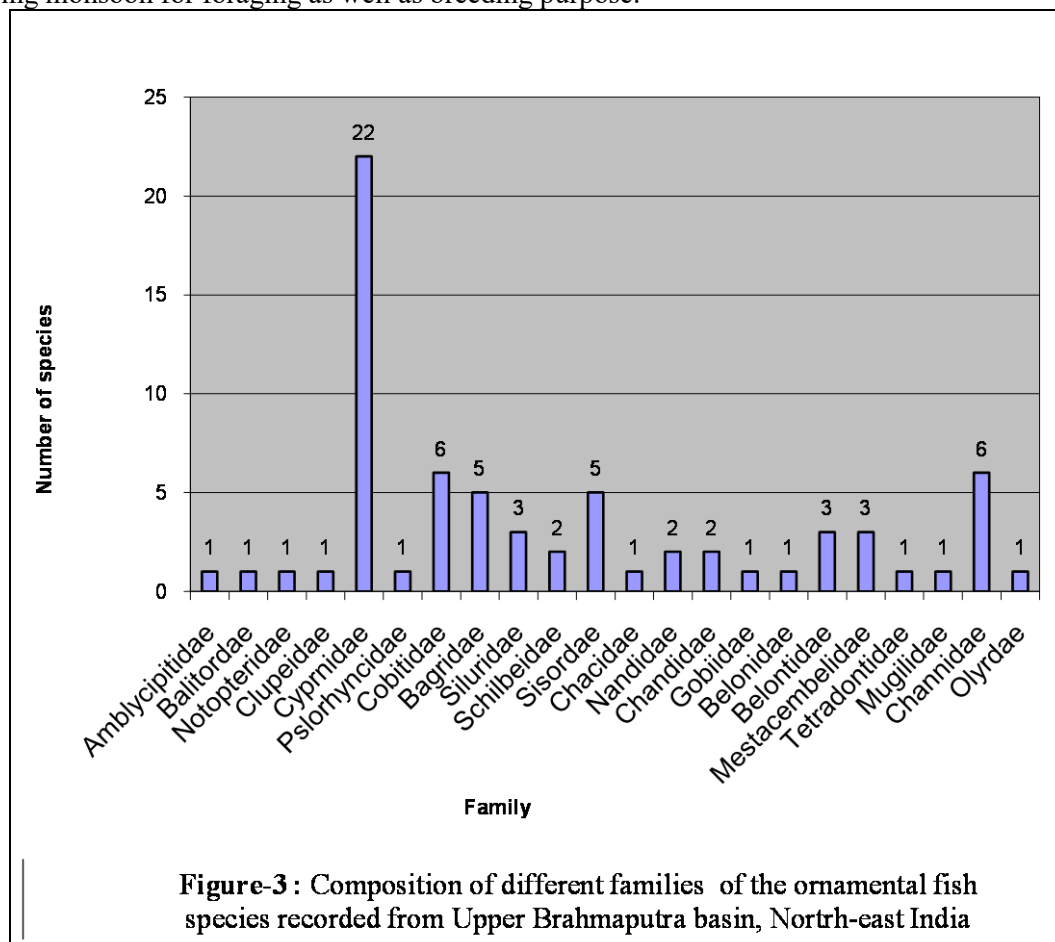
Altogether 70 species of ornamental fishes belonging to 46 genera and 22 families have been recorded so far from this region (Table-1). Among the families, cyprinids were found to be most dominant group with 22 species followed by cobitids and channids (6 spp. each) and bagrids and sisorids with 5 spp. each (Figure-3). *Botia spp.*, *Danio spp.*, *Colisa spp.* and *Channa spp.* are the most important ornamental fishes demanding higher price in the industry due to their attractive colouration pattern. On the other hand, *Sisor rhabdophorus*, *Chaca chaca*, *Nandus nandus*, *Tetradon cutcutia*, etc. of this region attract the aquarists for their uncommon body morphology. Moreover, it is widely believed that the region may have few more species yet to describe as a vast area are virtually not tapped due to its difficult terrains and inaccessible water resources as well.

3.2: Habitat preferences

Since the region is abounds in diverse type of aquatic habitats, the fish species recorded from the region have adapted to thrive well in a variety of microhabitats. According to [9] five major types of habitats exist in the Brahmaputra basin. They are fast flowing river, upstream pools, river meandering and confluence, flood plain lakes (*beels*) and open river. In addition to these, the low lying paddy fields, ponds and other seasonal water bodies are also preferred habitats for a good number of ornamental species.

The fish species of the genera *Amblyceps*, *Garra*, *Psilorhynchus*, *Erethistes*, *Olyra*, *Sisor*, etc. are the most promising hill stream ornamental species. These species usually preferred to live in the shallow torrential hill streams whereas species like *Raiamas bola*, *Barilius*, *Danio* are well adapted to live in upland pools. The highly weed infested *beels* of the region can be considered as gold mines for indigenous ornamental fish

species. These *beels* provides a variety of ecological niches to a good number of such fishes, most of which are characterized by bright colouration pattern. Certain murrels (*Channa spp.*), *Colisa spp.*, *Botia spp.*, etc. are important colourful fishes of the *beel*. Species like *Chaca chaca*, *Badis badis*, *Nandus nandus*, etc. are potential aquarium fish of wetlands (*beel*). On the other hand, genera like *Puntius*, *Notopterus*, *Mystus*, *Ompok*, *Amblypharyngodon*, *Xenentodon*, *Macrognaathus*, *Lepidocephalus*, *Chanda*, *Tetradon*, etc. are found in both *beels* as well as riverine habitats. Moreover, certain other forms like *Gudusia*, *Sicamugil*, *Ailia*, *Rita*, *Chela*, *Aspidoparia*, *Salmostoma*, *Ostreobrama*, etc. prefer to live in open rivers although they enter in the *beels* during monsoon for foraging as well as breeding purpose.



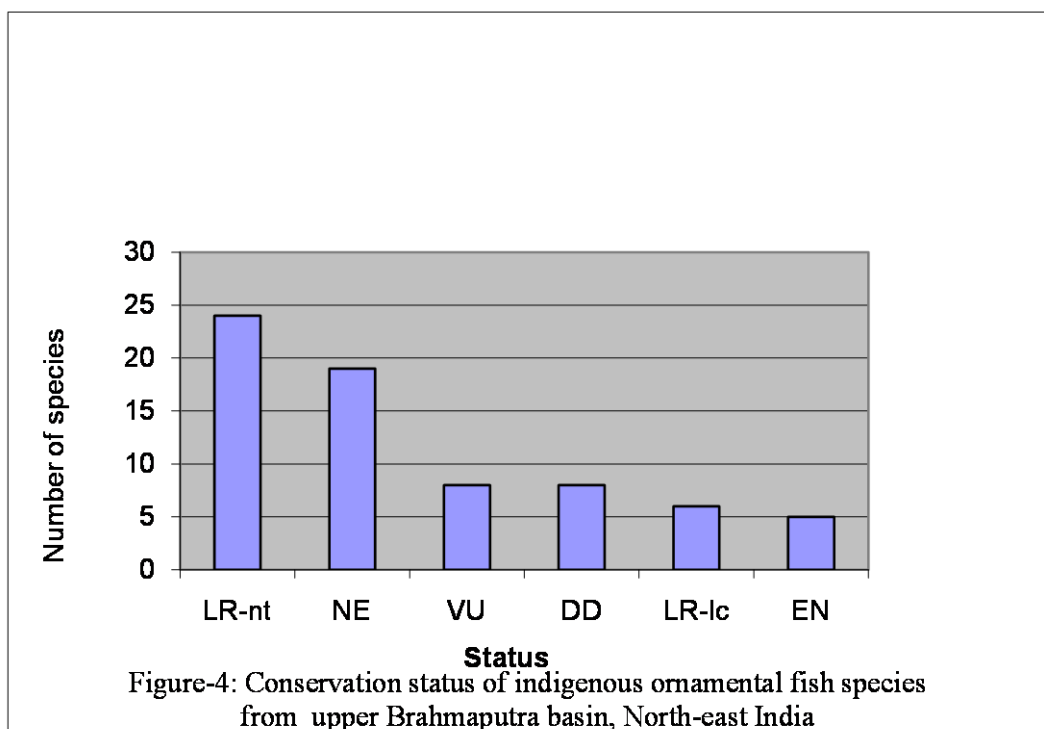
3.3: Frequency of abundance

Species belonging to genera like *Amblypharyngodon*, *Salmostoma*, *Lepidocephalus*, *Chanda*, *Colisa*, etc. are commonly available throughout the year. Genera like *Notopterus*, *Aspidoparia*, *Barilius*, *Garra*, *Botia*, *Mystus*, *Nandus*, *Chaca*, *Channa barca*, etc. are occasional as far as their availability is concerned. Again, *Sisor*, *Badis*, *Olyra*, *Ailia*, *Ompok*, *Oreochthys*, *Balitora*, etc. are among the rarely encountered species and their availability is restricted to particular seasons of the year.

3.4: Conservation status

As far as the conservation status of this diversified ichthyofauna is concerned, one third of the species belonged to lower risk near threatened (LR-nt) category, 19 species to not evaluated (NE) category, 8 species to data deficient (DD) category, 8 species to vulnerable (VU) category, 6 species to lower risk least concern (LR-lc) category whereas remaining 5 species falls under endangered (EN) category (Figure-4).

The ornamental fish industry has been identified as a powerful income and employment generator as it stimulates growth of a number of subsidiary industries besides being a foreign exchange earner. This region has immense capacity to develop profitable trade based on a good number of indigenous ornamental fish species having great export potential. Thus this industry stands out as promising sector in fisheries that can boost the social and economic upliftment of the rural masses.



3.5: Present scenario of ornamental fisheries in upper Brahmaputra basin

Despite of such a rich natural endowments and vast potentiality, the present state of ornamental fisheries in this region is considered to be very poor. Till now much headway has not been made in this sector of commercial fishery. Presently, these resources are exploited in an unorganized way by some unscrupulous traders, basically from outside this region. Few private commercial farms, mainly confined to certain pockets of urban localities have been operating in the region for sometime now. Their trade usually based on collection of certain target species like *Botia spp.*, *Colisa spp.*, *Channa spp.*, etc. from wild waters. This mode of exploitation contributes largely to the faster depletion of the natural stock of the aforesaid commercially important species.

3.6: Major constraints in developing ornamental fish industry

Lack of awareness among rural masses as well as ignorance of local people is the first and foremost important factor for such a poor state of this industry in this region. Risk factor and high running cost are the deterrent for adoption of ornamental fish culture practices at commercial scale by the traditional fish farmers. The fish farmers who are interested to adopt it also greatly circumscribed by factors like lack of basic infrastructure, proper transportation facilities and higher investment capital. Moreover, poor extension network and marketing channels also make farmers tardy in entering this venture. Government apathy and inadequate fishing policies are another setback for the industry. Besides, lack of coordination among various agencies in programme implementation and to certain extent lack of involvement and conservative attitude of a section of fishermen also hampered the progress of fisheries development activities.

Fish and their habitats throughout the valley and also in hilly regions under constant threat mainly due to steady increase in human interventions on aquatic resources. Destruction and alteration of habitats, over exploitation, unsustainable fishing (use banned fishing gears like micro nets, killing of gravids and juveniles) intentional poisoning and intentional liming of water bodies, dynamiting, electro fishing, etc. are responsible for rapid decline in natural fish stock. Compounding to it, agricultural run off containing residues of different pesticides, fertilizers and other harmful chemicals and leakage during crude oil exploration and transportation acts as a non point source of aquatic pollution and have pronounced adverse effects on the population of these commercially desirable fish species and left them unsecured in the severely disturbed wild habitats.

3.7: Strategy for sustainable development of ornamental fish industry

This part of the globe has a tremendous prospects and highly amenable for developing ornamental fisheries. One third of the species recorded from the wild waters of the region can be reared in confined water without much effort. The need of the hour is to make an integrated approach involving all the stakeholders, starting from fisher folk to the top-level policy makers or planners to manage these resources in sustainable way. This

will benefit generations to come besides preserving original fish germplasm in situ so as to provide a wider gene base for aquaculture practices. For sustainable utilization of these potential and untapped resources of the region, following suggestions are put forth-

- a) Mass awareness programmes should be launched to raise the awareness level of all stakeholders particularly fishermen communities regarding the value of the highly potential and untapped ornamental fish resources and the need to manage them in sustainable way.
- b) Acquisition and creation of a database of the diverse ichthyofauna of the region in general and ornamental fishes in particular as it will form the basis for formulation of various fisheries development programme and implementation of suitable action plans for the sustainable development of this much potential sector.
- c) Taking into consideration, the ever increasing demand of tropical ornamental fishes for both domestic as well as overseas market, greater emphasis should be given to evolve suitable technologies for the controlled breeding, seed production, mass production of live food, artificial feed formulation, and above all farming technologies for all the potential ornamental fish species of this region.
- d) Government should provide all sorts of extension support ranging from easy availability of loans and subsidies to marketing channels to the needy fishermen communities in order to motivate them to taking up this lucrative venture.
- e) Conservation measures for these aquatic jewels may be framed and employed to check the unauthorized collection as well as depletion of these native inhabitants. Strict enforcement of relevant existing laws or acts would also be helpful in augmentation of their sustainability.
- f) Culture based fisheries should be developed in the *beels* of the region in a co-operative basis to boost up the population of endangered fish species in their natural habitat.
- g) Regular monitoring of the health of aquatic ecosystems of the region should give priority to prevent them from further degradation, more especially in relation to pesticide pollution.

4. CONCLUSION

Thus, the so-called “Blue Revolution” is quite essential at present stage in the state for promotion of fisheries sector. Increasing technical, financial and extension support to the fishermen community and creation of much needed infrastructure facilities for the sustained exploitation of ornamental fish and other aquatic resources may play a significant role in the conservation of biodiversity as well as economic upliftment of this economically backward region of the country. If proper management policies are employed for their development with a view to promote the ornamental fish industry, social and economic upliftment of the rural masses and other people engaged in this venture can be assured.

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Table-1: Ornamental fish species recorded from upper Brahmaputra basin, their frequency of abundance and conservation status

FAMILY AND SPECIES	Frequency of	CAMP
Abundance Status		
I. AMBLYCIPITIDAE		
<i>Amblyceps longicaudata</i> (Ham-Buch)	+	LR-nt
II. BALITORIDAE		
<i>Balitora brucei</i> (Gray)	+	LR-nt
III. NOTOPTERIDAE		
<i>Notopterus notopterus</i> (Pallas)	++	LR-nt
IV. CLUPEIDAE		
<i>Gudusia chapra</i> (Ham-Buch)	++	LR-lc
V. CYPRINIDAE		
<i>Amblypharyngodon mola</i> (Ham-Buch)	+++	LR-lc
<i>Aspidoparia morar</i> (Ham-Buch)	++	LR-nt
<i>Barilius barila</i> (Ham-Buch)	++	LR-nt
<i>B. bendelisis</i> (Ham-Buch)	++	LR-nt
<i>B. barna</i> (Ham-Buch)	++	LR-nt
<i>B. tileo</i> (Ham-Buch)	++	LR-nt
<i>Chela laubuca</i> (Ham-Buch)	+++	LR-lc
<i>Danio devario</i> (Ham-Buch)	+++	LR-nt
<i>D. aequipinnatus</i> (McClelland)	++	NE
<i>Esomus danricus</i> (Ham-Buch)	++	LR-lc
<i>Rasbora doniconius</i> (Ham-Buch)	++	LR-nt
<i>R. elonga</i> (Ham-Buch)	++	DD
<i>Raiamas bola</i> (Ham-Buch)	++	DD
<i>Salmostama bacaila</i> (Ham-Buch)	+++	LR-lc
<i>Ostreobrama cotio</i> (Ham-Buch)	+++	LR-nt
<i>Puntius sophore</i> (Ham-Buch)	+++	LR-nt
<i>P. ticto</i> (Ham-Buch)	+++	LR-nt
<i>P. conchoni</i> (Ham-Buch)	+++	VU
<i>Garra gotyla gotyla</i> (Gray)	++	VU
<i>G. kemp</i> (Hora)	++	VU
<i>G. lissorhynchus</i> (McClelland)	++	VU
<i>Oreochthys sp.*</i>	+	NE
VI. PSILORHYNCHIDAE		
<i>Psilorhynchus balitora</i> (Ham)	++	NE
VII. COBITIDAE		
<i>Botia dario</i> (Ham)	++	NE
<i>B. rostrata</i> (Gunther)	++	NE
<i>B. berdmorei</i> (Blyth)	+	EN
<i>Acanthocobitis botia</i> (Ham-Buch)	+++	DD
<i>Lepidocephalus guntea</i> (Ham)	+++	NE
<i>Somileptus gongata</i> (Ham)	++	LR-nt
VIII. BAGRIDAE		
<i>Mystus cavasius</i> (Ham)	++	LR-nt
<i>M. vittatus</i> (Bloch)	++	VU
<i>M. bleekeri</i> (Day)	++	VU

<i>M. menoda</i> (Ham)	++	DD
<i>Rita rita</i> (Ham-Buch)	++	LR-nt

IX. SILURIDAE

<i>Ompok pabda</i> (Ham)	+	EN
<i>O. bimaculatus</i> (Bloch)	+	EN
<i>O. pabo</i> (Ham)	++	NE

X. SCHILBEIDAE

<i>Ailia coila</i> (Ham)	+	VU
<i>Pseudeutropius atherinoides</i> (Bloch)	++	EN

XI. SISORIDAE

<i>Gageta cenia</i> (Ham-Buch)	++	NE
<i>Sisor rhabdophorus</i> (Ham)	+	EN
<i>Erethistes pussilus</i> (Mull. & Troschel)	++	NE
<i>Glyptothorax telchitta</i> (Ham)	++	DD
<i>Nangra nangra</i> (Ham-Buch)	++	DD

XII. CHACIDAE

<i>Chaca chaca</i> (Ham-Buch)	++	NE
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XIII. NANDIDAE

<i>Nandus nandus</i> (Ham-Buch)	++	LR-nt
<i>Badis badis</i> (Ham-Buch)	+	NE

XIV. CHANDIDAE

<i>Chanda nama</i> (Ham)	+++	NE
<i>Parambassis ranga</i> (Ham)	+++	NE

XV. GOBIIDAE

<i>Glossogobius giuris</i> (Ham-Buch)	++	LR-nt
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XVI. BELONIDAE

<i>Xenentodon cancella</i> (Ham)	+++	LR-nt
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XVII. BELONTIDAE

<i>Colisa fasciatus</i> (Schneider)	+++	LR-nt
<i>C. sota</i> (Ham-Buch)	+++	NE
<i>C. lalia</i> (Ham-Buch)	+++	NE

XVIII. MASTACEMBELIDAE

<i>Macrogynathus pancalus</i> (Ham-Buch)	++	LR-nt
<i>M. aculeatus</i> (Bloch)	+++	DD
<i>Mastacembellus armatus</i> (Lecepede)	+++	NE

XIX. TETRADONTIDAE

<i>Tetradon cutcutia</i> (Ham-Buch)	++	LR-nt
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XX. MUGILIDAE

<i>Sicamugil cascasia</i> (Ham)	++	NE
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XXI. CHANNIDAE

<i>Channa barca</i> (Ham-Buch)	++	DD
<i>C. stewartii</i> (Playfair)	++	NE
<i>C. punctatatus</i> (Bloch)	+++	LR-nt

<i>C. striata</i> (Bloch)	+++	LR-lc
<i>C. orientalis</i> (Schneider)	++	VU
<i>C. marulius</i> (Ham-Buch)	++	LR-nt

XXII. OLYRIDAE

<i>Olyra longicaudata</i> (McClelland)	+	NE
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*- Newly reported species

CAMP status:

LR-lc: Lower risk least concern

EN: Endangered

LR-nt: Lower risk near threatened

VU: Vulnerable

DD: Data deficient

NE: Not evaluated

Frequency of abundance:

+++ : Common

++ : Occasional

+ : Rare