



## FISH BIODIVERSITY OF TIGHRA RESERVOIR OF GWALIOR, MADHYA PRADESH, INDIA

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**Abstract-** In the present study on Tighra reservoir, 40 species of fishes belonging to 23 genera, 12 families and 6 orders were identified. The order Cypriniformes was found to be a major order with 55.0% percent contribution. Siluriformes with 20.0%, Perciformes with 15.0%, Synbranchiformes with 5.0% and Osteoglossiformes and Beloniformes with 1.5% contribution follow the sequence. According to CAFF (2006), out of 40 species of fish, two species of fish are under endangered, eight species of fish under vulnerable, twenty species under lower risk near threatened, three species under lower risk least concern and four species were reported to be data deficient. Conservation steps of fish fauna in the Tighra reservoir have also been suggested.

**Key words-** Fish diversity, IUCN status, Conservation, Tighra reservoir.

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### Introduction

Fish diversity depends on geographical position, varied aquatic ecological conditions, health of aquatic bodies, optimum exploitation of the commercial fish species, enforcement of laws, rules and regulations, and their implementation and fish habitat restoration programs. Rich biodiversity of any ecosystem is absolutely essential in order to maintain their stability for proper functioning of their food chains. Fish constitute almost half of the total number of vertebrates in the world 21,723 living species of fish out of 39,900 species of vertebrates are so far recorded [1]. In India, there are about 2,500 species of fishes, of which 930 freshwater and 1,570 marine, are estimated [2]. Fishes have been found to exhibit enormous diversity in their morphology, habitat and their biology. They live in almost all conceivable aquatic habitats. India is one of the megabiodiversity countries in the world and occupying ninth position in terms of freshwater biodiversity [3]. Fish diversity of undivided India and various Indian states has been described by [4-6] and many others.

Recently, the work on fish taxonomy in various Indian states has been conducted by [7-16] and others. Central India has diverse water resources such as streams, rivers, reservoirs, sub-terrain aquatic ecosystems, traditional lakes and domestic ponds that

harbor a wide variety of freshwater fishes. Study of fish fauna in Madhya Pradesh started with the work of [17] and was followed by [18-32]. Therefore, the present communication deals with the biodiversity of fish, their IUCN status and measures of conservation of Tighra reservoir.

### Materials and Methods

Tighra reservoir, constructed on Saank river in the year 1917 near Tighra village in Gwalior district, Madhya Pradesh, has been selected for the study. The catchment area of this reservoir is approximately 412.25 Sq km with maximum depth 18 m. Geographically, the Tighra reservoir lies on 78°01'30" E to 77°57'54" E longitude and 26°11'42" N to 26°14'08" N latitude. It is situated approximately 23 km west of Gwalior city at an altitude of 218.58 m from mean sea level (Figures 1, 2). Fishes were collected from the reservoir with the help of local fishermen by using different types of nets including gill net, cast net (Ghagara Jaal), dip net (Gamachha net) etc. Small fishes were preserved in 5% formalin solution, while large fishes were gutted for visceral preservation also. Systematic identification of the fishes was done with the help of standard keys prepared by [33, 8, 34, 1].



Fig. 1- Satellite image of Tighra reservoir (www.google.com)

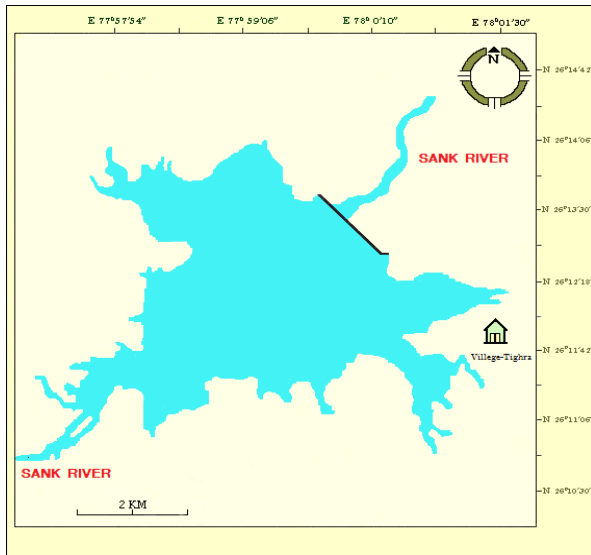


Fig. 2- Showing the location of Tighra reservoir, Gwalior

**Results**

In all 40 species of fishes belonging to 23 genera, 12 families and 6 orders were identified from Tighra reservoir. They are *Notopterus notopterus* under Osteoglossiformes, *Catla catla*, *Cirrhinus mrigala*, *C. reba*, *Cyprinus carpio*, *Labeo bata*, *L. boggut*, *L. calbasu*, *L. fimbriatus*, *L. gonius*, *L. rohita*, *Osteobrama cotio cotio*, *Puntius amphibius*, *P. conchonius*, *P. sarana sarana*, *P. sophore*, *P. ticto*, *Amblypharyngodon mola*, *Rasbora daniconius*, *Salmostoma bacaila*, *S. clupeoides*, *Garra gotyla gotyla*, and *Nemacheilus botia* under Cypriniformes, *Mystus cavasius*, *M. bleekeri*, *Sperata oar*, *S. seenghala*, *Ompok bimaculatus*, *Wallago attu*, *Clarias batrachus*, and *Heteropneustes fossilis* under Siluriformes, *Xenentodon cancila* under Beloniformes, *Mastacembelus armatus* and *M. pancalus* under Synbranchiformes, *Nandus nandus*, *Parambassis (Chanda) ranga*, and *Channa (Ophiocephalus) orientalis*, *C. (O.) marulius*, *C.(O.) punctatus* and *C. (O.) striatus* under Perciformes. A systematic list of fishes observed from the reservoir has been provided in Table 1 and Figure 3-42.



Fig. 3- *Notopterus notopterus*



Fig. 4- *Catla catla*



Fig. 5- *Cirrhinus mrigala*



Fig. 6- *Cirrhinus reba*



Fig. 7- *Cyprinus carpio*



Fig. 8- *Labeo boggut*



Fig. 9- *Labeo bata*



Fig. 10- *Labeo calbasu*



Fig. 11- *Labeo fimbriatus*



Fig. 12- *Labeo gonius*



Fig. 13- *Labeo rohita*



Fig. 14- *Osteobrama cotio cotio*



Fig. 15- *Puntius amphibius*



Fig. 16- *Puntius conchonius*



Fig. 17- *Puntius sarana sarana*



Fig. 18- *Puntius sophore*



Fig.19- *Puntius ticto*



Fig. 20- *Amblypharyngodon mola*



Fig. 21- *Rasbora daniconius*



Fig. 22- *Salmostoma bacaila*



Fig. 23- *Salmostoma clupeioides*



Fig. 24- *Garra gotyla gotyla*



Fig. 25- *Nemacheilus botia*



Fig. 26- *Mystus cavasius*



Fig. 27- *Mystus bleekeri*



Fig. 28- *Sperata oar*



Fig. 29- *Sperata seenghala*



Fig. 30- *Ompok bimaculatus*



Fig. 31- *Wallago attu*



Fig. 32- *Clarias batrachus*



Fig. 33- *Heteropneustes fossilis*



Fig. 34- *Xenentodon cancila*



Fig.35- *Mastacembelus armatus*



Fig.36- *Mastacembelus pancalus*



Fig. 37- *Nandus nandus*



Fig. 38- *Parambassis (C.) ranga*



Fig. 39- *Channa (O.) gachua*



Fig. 40- *Channa (O.) marulius*



Fig. 41- *Channa (O.) punctatus*



Fig. 42- *Channa (O.) striatus*

As far as the genera and families to different orders are concerned, order Cypriniformes consists of 11 genera (47.83%) under 2 families (16.67%), Siluriformes of 6 genera (26.09%) under 4 families (33.33%), Perciformes of 3 genera (13.04%) under 3 families (25.0%), Osteoglossiformes, Synbranchiformes and Beloniformes of single genus (4.35%) under single family each (8.33%) (Table 2 and Figure 43). Order Cypriniformes has been found to be a major order with 22 species and percent contribution of 55.0%. Siluriformes comes next with 8 species and percent contribution of 20.0%, Perciformes with 6 species and percent contribution of 15.0%, Synbranchiformes with 2 species and percent contribution of 5.0%, Osteoglossiformes and Beloniformes with 1 species each and percent contribution of 1.5% follow the order (Table 2 and Fig. 44).

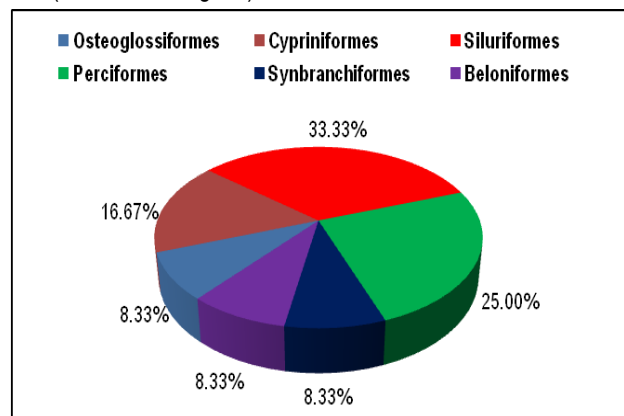


Fig. 43- Showing percent contribution of families to the orders

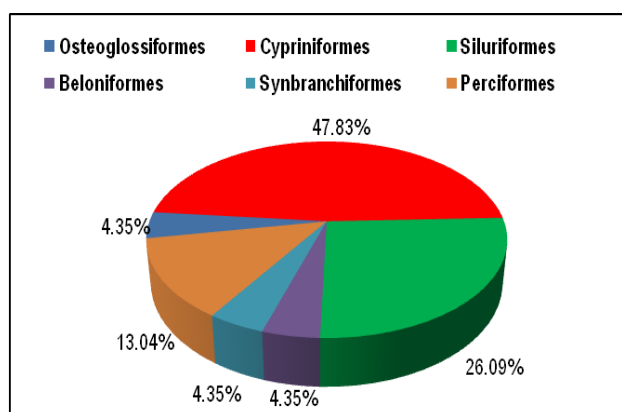


Fig. 44- Showing percent contribution of genera to the orders

Table 2- Number and percent composition of families, genera and species under various orders

S. No.	Order	Families	Genera	Species	% of families in an order	% of genera in an order	% of species in an order
1.	Cypriniformes	2	11	22	16.67	47.83	55.0
2.	Siluriformes	4	6	8	33.33	26.09	20.0
3.	Perciformes	3	3	6	25.0	13.04	15.0
4.	Beloniformes	1	1	1	8.33	4.35	2.50
5.	Osteoglossiformes	1	1	1	8.33	4.35	2.50
6.	Synbranchiformes	1	1	2	8.33	4.35	5.0

The generic composition of fishes belonging to different families shows that 10 genera under Cyprinidae contribute to 43.48%, 2 genera each under Bagridae and Siluridae contribute to 8.70% each, and 1 genus each under Notopteridae, Cobitidae, Clariidae, Heteropneustidae, Belonidae, Nandidae, Ambassidae and Channidae contribute to 4.35% each (Table 3). The species composition of fishes belonging to different families has revealed that 21 species are belonging to family Cyprinidae that made up to 52.50%; 4 species to family Bagridae that contributed 10.0%; 4 species belonging to family Channidae constituting 10.0%; 2 species each to families Siluridae and Mastacembelidae making to 5.0% and 1 species each to families Notopteridae, Cobitidae, Clariidae, Heteropneustidae, Belonidae, Nandidae and Ambassidae contributing 2.50% each of total fish species (Table 3).

Table 3- Number and percent composition of genera and species under various families

S. No.	Families	Genera	% contribution of genera to families	Species	% contribution of species to families
1.	Cyprinidae	10	43.48	21	52.50
2.	Bagridae	2	8.70	4	10.0
3.	Siluridae	2	8.70	2	5.0
4.	Cobitidae	1	4.35	1	2.50
5.	Notopteridae	1	4.35	1	2.50
6.	Clariidae	1	4.35	1	2.50
7.	Heteropneustidae	1	4.35	1	2.50
8.	Belonidae	1	4.35	1	2.50
9.	Mastacembelidae	1	4.35	2	5.0
10.	Nandidae	1	4.35	1	2.50
11.	Ambassidae	1	4.35	1	2.50
12.	Channidae	1	4.35	4	10.0

### Current Conservation Status

The biodiversity status of fishes in the Tighra reservoir of Gwalior is represented in Table 4 and Fig. (45). Out of 40 species of fish, 2 species of fish (*N. notopterus* and *O. bimaculatus*) are in endangered state with 5.41%, 8 fish species (*C. reba*, *P. sarana sarana*, *G. gotyla gotyla*, *M. bleekeri*, *C. batrachus*, *H. fossilis*, *M. armatus* and *C.(O.) marulius*) are in vulnerable state with contribution of 21.62%, 20 fish species (*C. mrigala*, *C. catla*, *Labeo boggut*, *L. bata*, *L. calbasu*, *L. fimbriatus*, *L. gonius*, *O. cotio cotio*, *P. conchoniuis*, *P. sophore*, *P. ticto*, *M. cavasius*, *S. oar*, *S. seenghala*, *W. attu*, *X. cancila*, *M. pancalus*, *N. nandus*, *C.(O.) punctatus* and *C. (O.) striatus*) are in near threatened state with contribution of 54.05%. However, 3 (8.11%) species of fish (*L. rohita*, *A. mola* and *R. daniconius*) have become in lower risk least concern, and 4 (10.81%) fish species (*P. amphibious*, *S. bacaila*, *S. clupeoides* and *C.(O.) gachua*) are in data deficient [35].

Table 4- Endangered (EN), Vulnerable (VU), Lower risk near threatened (LR-nt), Lower risk least concern (LR-lc), Data deficiency (DD) fish species in Tighra reservoir

S. No.	Fish species	IUCN Category
1.	<i>Notopterus notopterus</i> and <i>Ompok bimaculatus</i>	Endangered
2.	<i>Cirrhinus reba</i> , <i>Puntius sarana sarana</i> , <i>Garra gotyla gotyla</i> , <i>Mystus bleekeri</i> , <i>Clarias batrachus</i> , <i>Heteropneustes fossilis</i> , <i>Mastacembelus armatus</i> and <i>Channa (O.) marulius</i>	Vulnerable
3.	<i>Cirrhinus mrigala</i> , <i>Catla catla</i> , <i>Labeo boggut</i> , <i>Labeo bata</i> , <i>Labeo calbasu</i> , <i>Labeo fimbriatus</i> , <i>Labeo gonius</i> , <i>Osteobrama cotio cotio</i> , <i>Puntius conchoniuis</i> , <i>P. sophore</i> , <i>P. ticto</i> , <i>Mystus cavasius</i> , <i>Sperata oar</i> , <i>S. seenghala</i> , <i>Wallago attu</i> , <i>Xenentodon cancila</i> , <i>Mastacembelus pancalus</i> , <i>Nandus nandus</i> , <i>Channa (O.) punctatus</i> and <i>C. (O.) striatus</i>	Lower risk near threatened
4.	<i>Labeo rohita</i> , <i>Amblypharyngodon mola</i> and <i>Rasbora daniconius</i>	Lower risk least concern
5.	<i>Puntius amphibious</i> , <i>Salmostoma bacaila</i> , <i>S. clupeoides</i> and <i>Channa (O.) gachua</i>	Data deficient

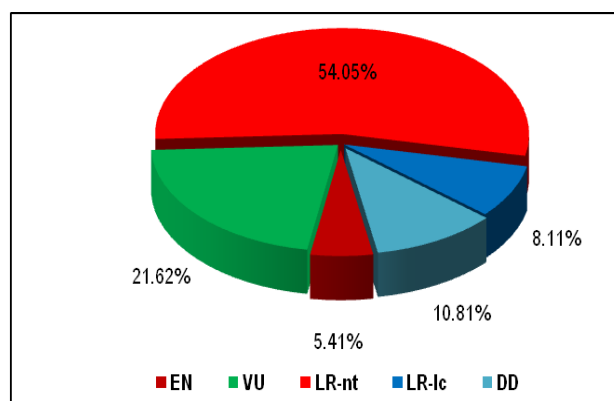


Fig. 45- Biodiversity status of fishes in Tighra reservoir

### Discussion

In and around Gwalior, the interest in fish fauna has been quite old. [19] studied fish fauna of Chambal river and reported 71 species of fishes from the river. In all 48 species belonging to the 9 different orders, 17 families and 34 genera were identified from Gwalior region by [21]. A total of 71 fish species were recorded

from Chambal division [36]. 46 species of fishes were recorded from Kunwari river of Chambal division [22]. In Kshipra river, 50 species of fish belonging to 7 orders and 33 genera recorded by [37]. In Gambhir dam, Ujjain, a total of 30 species of fishes were recorded which belonged to 6 orders, 10 families and 17 genera [24]. [26] have identified 55 species of fish belonging to 7 orders, 14 families in river Kshipra at Ujjain. [28] reported 73 species of fish belonging to 52 genera, 24 families and 11 orders from various water bodies of North Madhya Pradesh. [30] have studied fish and fisheries Ramsagar reservoir, Datia and recorded 42 fish species belonging to 28 genera, 15 families and 8 orders; order Cypriniformes with 21 species showed maximum species diversity while the minimum fish species diversity was shown by order Beloniformes and Synbranchiformes with only one species. [27] have studied the biodiversity of fishes from Sirpur lake of Indore, and reported 27 species belonging to 6 orders, 14 families and 22 genera. A total of 29 species were recorded belonging to four different orders viz., Cypriniformes, Perciformes, Ophiocephaliformes and Mastacembeleformes with a dominance of fish of order Cypriniformes in Mod sagar reservoir of Jhabua [31]. † Identified a total of 51 fish species belonging to 33 genera, 16 families and 7 different orders from Harsi reservoir in Gwalior. *Gagata sexualis* has also been reported first time in Gwalior region by him in this reservoir. Many authors have estimated the percentage composition of families among various orders. The maximum contribution is of family Cyprinidae which is up to 39.58% [36], up to 45.71% [21], up to 53.65% [38], up to 47.82% [22] have been reported. In Virla reservoir, Madhya Pradesh, the order Cypriniformes was contributing maximum percentage (65.51%) of species followed by four members of order Ophiocephaliformes (13.79%), two members of each Perciformes (6.90%) and Mastacembeleformes (6.90%) and one member of each Clupeiformes (3.45%) and Beloniformes with 3.45% [25]. Fish fauna of Ramsagar reservoir is also dominated by order Cypriniformes with 52.38% contribution [30]. In Betwa river, Cyprinidae family was also found most dominant with a contribution of 48% followed by Bagridae contributing 10% of the total fish species [32]. Order Cypriniformes was most dominant group with 62.30% followed by Siluriformes with 18.18%, Perciformes with 16.88%, Osteoglossiformes with 1.29% and Cyprinodontiformes with 1.29% share [39]. As regard to species belonging to different families, 25 species under Cyprinidae with 49.02%, 5 species under Bagiridae with 9.80%, 4 species under Channidae with 7.84%, 2 species each under Notopteridae, Siluridae, Sisoridae, and Mastacembelidae with 3.92% each and 1 species each under Clupeidae, Balitoridae Clupeidae, Schilbeidae, Clariidae, Heteropneustidae, Belonidae, Ambassidae and Gobiidae with 1.96% each have been observed in Harsi reservoir ††. Like other Indian water bodies, in Tighra reservoir also, order Cypriniformes was found to be a major order with percent contribution of 55.0%, followed by Siluriformes with 20.0%, Perciformes with 15.0%, Synbranchiformes with 5.0% and Osteoglossiformes and Beloniformes each with 1.5% percent contribution follow sequence.

The status of fishes of India in Conservation Assessment and Management Programme [40] were categorized in to 10 different groups of fish, viz., Extinct (EX), Extinct in the wild (EW), Critically Endangered (CE), Endangered (EN), Vulnerable (Vu), Lower risk near threatened (LR-nt), Lower risk least concern (LR-lc), Lower

risk conservation dependent (LR-cd), Data deficient (DD) and Not evaluated (NE). [41] have reported 9 species of endangered fish, 17 species of vulnerable fish, 26 species of lower risk near threatened, 5 species of fish as lower risk least concern and 1 species as critically endangered from wetlands of Punjab while, [42] reported 9 fish species in endangered state, 12 species of fish vulnerable, 21 species lower risk near threatened and 1 species as a critically endangered in the region of Western Ghats of India. In Tunga and Bhadra rivers, 20 species of fish were lower risk near threatened, 1 lower risk least concern, 10 vulnerable, 7 endangered, and 4 critically endangered reported by [39]. [43] were also identified 6 fish species as threatened, and 7 fish species as vulnerable in major wetlands of Mysore. [44] have reported three species as endangered, five species as vulnerable, eleven species as lower risk near threatened, and one species as lower risk least concern in Bhadra reservoir of Karanataka. In the present study, two species of fish under endangered, eight species of fish under of vulnerable, twenty species under the category of lower risk near threatened, three species under the category of lower risk least concern and four species were reported as data deficient.

In conclusion, it may be stated that Tighra reservoir harbors 40 species of fishes belonging to 23 genera, 12 families and 6 orders. Order Cypriniformes was found to be a major order with 22 species (55.0%). Out of 40 species of fish, 2 species of fish are under endangered, 8 species of fish under vulnerable, 22 species under lower risk near threatened, 3 species under lower risk least concern and 4 species were reported to be data deficient. *Cyprinus carpio* is an exotic species to the reservoir.

### Conservation Steps

It has been found during present investigations that the illegal fishing was widespread even during breeding season despite a ban by the state government. There should be more rigorous implementation of the ban and heavy fines should be imposed on the defaulters to stop illegal fishing. The conservation of fish fauna should be given a priority. A proper vigilance of the reservoir will be a welcome step towards conserving the fish fauna. Tighra reservoir may be declared as aquatic biodiversity reserve. Involvement of local people should be fostered for the conservation of the environment and fauna of the reservoir. For the biological control of weed, grass carps should be introduced to take care of excessive growth of weeds. Now when the reservoir is under the control of Madhya Pradesh Tourism Department and Madhya Pradesh Forest Department, a simple vigilance and watch will do a lot towards the conservation of fish in the reservoir. Brooders and if possible the seeds of endangered species may be transplanted in the late summer and early rainy season to replenish the stock.

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Table 1- Systematic list of fishes of Tighra reservoir

Class/Sub-class/ Order/Division/ Family/Sub-family	Taxonomic Nme	Local name	IUCN Category	
			CAMP (1998)	CAFF (2006)
Class	Actinopterygii			
Subclass	Neopterygii			
Division	Teleostei			
Order	Osteoglossiformes			
Sub-order	Notopteroidei			
Family	Notopteridae			
	1. Notopterus notopterus (Pallas)	Patola	LR-nt	EN
Sub-division	Euteleostei			
Superorder	Ostariophysi			
Order	Cypriniformes			

Table 1- Continue

Family	Cyprinidae			
Sub-family	Cyprininae			
	2. <i>Catla catla</i> (Hamilton-Buchanan)	Catla	VU	LR-nt
	3. <i>Cirrhinus mrigala</i> (Hamilton-Buchanan)	Mrigal	LR-nt	LR-nt
	4. <i>C. reba</i> (Hamilton-Buchanan)	Naren	VU	VU
	5. * <i>Cyprinus carpio</i> (Linnaeus)	Common carp		
	6. <i>Labeo boggut</i> (Sykes)		NE	LR-nt
	7. <i>L. bata</i> (Hamilton-Buchanan)	Bata	LR-nt	LR-nt
	8. <i>L. calbasu</i> (Hamilton-Buchanan)	Kriya	LR-nt	LR-nt
	9. <i>L. fimbriatus</i> (Bloch)	Cut rohu	LR-nt	LR-nt
	10. <i>L. gonius</i> (Hamilton-Buchanan)	Kursi	LR-nt	LR-nt
	11. <i>L. rohita</i> (Hamilton-Buchanan)	Rohu	LR-nt	LR-ic
	12. <i>Osteobrama cotio cotio</i> (Hamilton-Buchanan)	Gudgudi	LR-nt	LR-nt
	13. <i>Puntius amphibius</i> (Hamilton-Buchanan)	Khadia	NE	DD
	14. <i>P. conchoni</i> Hamilton-Buchanan)	Khadia	LR-nt	LR-nt
	15. <i>P. sarana sarana</i> (Hamilton-Buchanan)	Puthia	VU	VU
	16. <i>P. sophore</i> (Hamilton-Buchanan)	Khadia	LR-nt	LR-nt
	17. <i>P. ticto</i> (Hamilton-Buchanan)	Khadia	LR-nt	LR-nt
Sub-family	Rasborinae			
	18. <i>Amblypharyngodon mola</i> (Hamilton-Buchanan)	Dhawai	LR-ic	LR-ic
	19. <i>Rasbora daniconius</i> (Hamilton-Buchanan)	Zhanzara	NE	LR-ic
	20. <i>Salmostoma bacaila</i> (Hamilton-Buchanan)	Chilua	LR-ic	DD
	21. <i>Salmostoma clupeioides</i> (Bloch)	Silhani	LR-ic	DD
Sub-family	Garrinae			
	22. <i>Garra gotyla gotyla</i> (Gray)	Siltoka	VU	VU
Family	Cobitidae			
Sub-family	Cobitini			
	23. <i>Nemacheilus botia</i> (Hamilton)	Natwa		
Order	Siluriformes			
Family	Bagridae			
	24. <i>Mystus cavasius</i> (Hamilton-Buchanan)	Kitua	LR-nt	LR-nt
	25. <i>M. bleekeri</i> (Day)	Kirua	VU	VU
	26. <i>Sperata oar</i> (Hamilton-Buchanan)	Tengra	NE	LR-nt
	27. <i>S. seenghala</i> (Sykes)	Singhara	NE	LR-nt
Family	Siluridae			
	28. <i>Ompok bimaculatus</i> (Bloch)	Pauda	EN	EN
	29. <i>Wallago attu</i> (Bloch & Schneider)	Lonch	LR-nt	LR-nt
Family	Clariidae			
	30. <i>Clarias batrachus</i> (Linnaeus)	Mangur	VU	VU
Family	Heteropneustidae			
	31. <i>Heteropneustes fossilis</i> (Bloch)	Singhi	VU	VU
Series	Atherinomorpha			
Order	Beloniformes			
Suborder	Belonoidei			
Family	Belonidae			
	32. <i>Xenentodon cancila</i> (Hamilton-Buchanan)	Suja	LR-nt	LR-nt
Order	Synbranchiformes			
Sub-order	Mastacembeloidei			
Family	Mastacembelidae			
Sub-family	Mastacembelinae			
	33. <i>Mastacembelus amatus</i> (Lacepede)	Baam	NE	VU
	34. <i>M. pancalus</i> (Hamilton-Buchanan)	Baam	LR-nt	LR-nt
Order	Perciformes			
Sub-order	Percoidei			
Family	Nandidae			
Sub-family	Nandinae			
	35. <i>Nandus nandus</i> (Hamilton-Buchanan)	Dhebari	LR-nt	LR-nt
Family	Ambassidae			
	36. <i>Parambassis (C.) ranga</i> (Hamilton-Buchanan)	Chanda		
Sub-order	Chanoidei			
Family	Channidae			
	37. <i>Channa (O.) gachua</i> (Hamilton-Buchanan)	Sol	VU	DD
	38. <i>C.(O.) marulius</i> (Hamilton-Buchanan)	Sol	LR-nt	VU
	39. <i>C.(O.) punctatus</i> (Bloch)	Gilgonch	LR-nt	LR-nt
	40. <i>C.(O.) striatus</i> (Bloch)	Durkasol	LR-nt	LR-nt

EN=Endangered, Vu (Vulnerable), LR-nt= Lower risk near threatened, LR-ic (Lower risk least concern), NE (Not evaluate), DD (Data deficient), \*Exotic fish