Explorer Research Article [Sharma *et al.*, 5(7): July, 2014:3651-3659]
CODEN (USA): IJPLCP **ISSN: 0976-7126**

INTERNATIONAL JOURNAL OF PHARMACY & LIFE SCIENCES
(Int. J. of Pharm. Life Sci.)

Biodiversity and Composition of Ornamental Fish Fauna inhabiting in Upper lake of Bhopal (M.P.)

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Abstract

The present study deals with "Biodiversity and Composition of Ornamental Fish Fauna Inhabiting in Upper Lake of Bhopal (M.P.)". Diversity studies were undertaken during February, 2011 to January, 2012. In the one year study period a total 56 species were recorded from lake and out of which, 36 fish species were showed the ornamental values. In total numbers of ornamental fishes, Order Cypriniformes was dominant with 15 species followed by Perciformes (12 species), Siluriformes (5 species), Synbranchiformes (2 species), Beloniformes and Osteoglossiformes (1 species each). Family Cyprinidae was dominant with 12 genera and genus Channa was dominant with 4 species. IUCN (2011) and CAMP (1998) conservation status of each fish was listed. Out of 36 species 2.78% of fish are vulnerable, 2.78% are near threatened, 2.78% are at endangered, 5.55% are at not evaluated, 2.78% are at data deficient and 83.33% are least concern as per IUCN (2011) status and 5.56% are endangered, 25% are vulnerable, 47.22% are at lower risk and near threatened, 8.33% are at lower risk and least concern and 13.89% are at not evaluated as per CAMP (1998) conservation status.

Key-Words: Biodiversity, Ornamental fish, Upper Lake, Conservation status, IUCN, CAMP

Introduction

Species diversity is a property of the population level; while the functional diversity concept is more strongly related to ecosystem stability and stresses, physical and chemical factors for determining population dynamic in the lentic ecosystem (Kar and Barbhuiy 2004). Ornamental fishes are characterized by a wide diversity of colours and colour patterns and success in the ornamental fish trade is very much dependent on the vibrant colour of the fish (Ramamoorthy, et. al, 2010). Ornamental fishes are attractive colourful fishes of various characteristics, which are kept as pets in confined space of an aquarium or a garden pool for fun and fancy. Ornamental fish is one of the important items among the various types of commercially important fishes marketed nationally and internationally and are popularly known as ''Aquarium Fishes'' as they are usually kept in glass aquarium. These living jewels need not always have bright colours, sometimes their peculiar characteristics such as body colour, morphology and mode of taking food etc. (Chakravartty, et. al, 2012).

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In spite of being a renewable resource, indiscriminate harvesting of ornamental fishes from the natural water bodies is likely to cause serious depletion, particularly of those species which are already under the threat of extinction or endangerment. Our country has a rich and unique biodiversity with a variety of indigenous ornamental fishes. But this resource has not been properly exploited. About 80% of ornamental fishes are from freshwaters and the rest from brackish and marine waters. There is need to survey the potentiality of water bodies including wetlands in providing these ornamental fish species. Wetlands are valuable ecosystems that act as nurseries and feeding grounds for many fish species including Ornamental fish. These wetlands are home to an amazingly diverse and unique group of ornamental fishes (Rao et. al, 2013).

Less attention has been paid to the diversity of ornamental fish and potentiality of wetlands as home for them, despite the fact that these wetlands are currently among our most ecologically threatened and susceptible to loss of biodiversity. Considering the importance, in the present study an attempt has been made with the following major objectives: (a) to bring out the richness of native ornamental fish diversity in

Upper Lake of Bhopal and (b) to assess the status of these fish as per CAMP, 1998 and IUCN, 2011 red list.

Study area: The Upper Lake of Bhopal is manmade reservoirs, along with its catchment area, as comprehensive systems constitute the extent of the Bhoj Wetland. The Upper Lake was created by Raja Bhoj, the King of Dhar in Central India, in the 11th century by constructing an earthen dam across the Kolans River. The Kolans was originally a tributary of the Halali River, which in turn joins Betwa River near Vidisha. Outflow from the Upper Lake which receives water mainly through the Kolans River drains into Kaliasot River and finds its way to Yamuna River through the Betwa River. The Upper Lake, in a linear east-west alignment, has a catchment area of 361 sq. km & at present a water spread area of 31 sq. km. The Upper Lake has a partial urban component in its catchment on the eastern end while the remainder is Rural.

Table 1: Morphometric & Meristic Characters of Upper Lake, Bhopal

Characteristics	Upper Lake
PERIOD OF CONSTRUCTION	11th Century A.D.
TYPE OF DAM	Earthen
LOCATION : Latitude	23°12' - 23°16' N
Longitude	77°18' - 77°23' E
CATCHMENT AREA (Sq.km.)	361
SUBMERGENCE AREA at FTL (Sq.km.)	36.54
FULL TANK LEVEL (MSL) (m)	508.65
DEAD STORAGE LEVEL (MSL) (m)	503.53
STORAGE CAPACITY (Million Cu. M.)	117.05
MAXIMUM DEPTH (m)	11.7
SOURCE OF WATER	Rain water
MAIN USE OF WATER	Potable water supply
INFLOW POINTS (Nos.)	31

Material and Methods

The fishes were collected mainly by using gill nets of different mesh sizes, which varied from 10 to 100 mm with the assistance of local fishermen. A discussion was made with the local fishermen to collect many types of information about fishes available in the Wetland. The collected specimens were preserved in 5-10% formalin according to the 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 were identified in laboratory using taxonomic keys of Jayaram (1981), Jhingran (1991) and Qureshi and Qureshi (1983).

Results and Discussion

The results of the present study revealed the occurrence of 36 ornamental fish species belong to 6 orders, 17 families and 30 genera. List of ornamental fish including their order, family, species and common name recorded in the present investigation was given in Table-1, Plate-1 and number and percent composition of families, genera and species under different orders are shown in Table 2 & Figs 1–3. Order Cypriniformes was dominant represented 15 species with 41.67% contribution of the total species followed by Perciformes 12 species with 33.33%, Siluriformes 5 species with 13.89%, Synbranchiformes 2 species with 5.55%, Beloniformes and Osteoglossiformes each with 1 species with 2.78%.

Out of 17 families recorded, family cyprinidae contributed 13 (36.11%) followed by Channidae 4 (11.11%), Bagridae, Mastacembelidae, Ambassidae and Osphronemidae 2 (5.55%), Nemacheilidae, Cobitidae, Siluridae, Heteropneustidae, Clariidae, Belonidae, Badidae, Nandidae, Gobiidae, Anabantidae and Notopteridae 1 species each (2.78%).

Out of 30 genera reported, cypriniformes contributed 46.67% i.e. 14 genera followed by Perciformes with 8 (26.67%), Siluriformes with 4 (13.33%), Synbranchiformes with 2 (6.67%), Beloniformes and Osteoglossiformes 1 species each (3.33%). Out of 30 genera, genus Channa was dominant with 4 species followed by Trichogaster, Mystus and Pethia with 2 species, Salmophasia, Cyprinus, Tor, Esomus, Laubuca, Rasbora, Amblypharyngodon, Osteobrama, Systomus, Puntius, Garra, Acanthocobitis, Lepidocephalichthys, Ompok, Heteropneustes, Clarias, Xenentodon, Mastacembelus, Macrognathus, Chanda, Parambassis, Badis, Nandas, Glossogobius, Anabas and Notopterus each with 1 species (Table-4 & Fig-3).

Conservation status of the ornamental fish from the Upper Lake, Bhopal is presented in Table-1 and percent occurrence of fish under CAMP and IUCN conservation status is given Table-5 and Fig-4. The status of fishes of India in Conservation Assessment and Management Programme (CAMP, 1998) were categorized into 10 different groups of fish viz., Extinct (EX), Extinct in the Wild (EW), Critically Endangered (CE), Endangered (EN), Vulnerable (VU), Lower risk near threatened (LRnt), Lower risk least concern (LRlc), Lower risk conservation dependent (LRcd), Data deficient (DD) and Not Evaluated (NE). Out of 36 species reported in the present study, as per CAMP

report status 5.56% species are endangered, 25% are vulnerable, 47.22% are at lower risk and near threatened, 8.33% are at lower risk and least concern and 13.89% are not evaluated; while 2.78% species are endangered, 2.78% are vulnerable, 2.78% are near threatened, 83.33% are at least concern, 2.78% are data deficient and 5.55% are not evaluated as per IUCN Red list category (Table-5, Fig-4).

Discussion: Wetlands conserve a rich variety of fish species which support to the commercial fisheries including ornamental fish. In present study order Cypriniformes was found to be the most dominant group among all other orders which is in accordance with the other studies (Kumar et. al, 2011; Jaiswal & Ahirrao, 2012). Out of 17 families, cyprinidae was the most dominant group. Many researchers reported the strong dominance of this family in their investigations. Sarwade and Khillare (2010) reported 60 species from Ujani wetland where cyprinidae was dominant with 36 species, Devi Prasad et al., (2009) reported 45 species from wetlands of Mysore where cyprinidae was dominant with 22 species, Das and Sabitry (2012) reported 62 ornamental fish species from the river island, Masuli, Assam where cyprinidae was more dominant with 20 species. Dua and Parkash (2009) reported 61 species from Harike wetland where cyprinidae was dominant with 27 species.

Tor putitora and *Ompok bimaculatus* are endangered, which were in danger of extinction and the population of these species are declining due the degradation of the habitats. *Ompok bimaculatus* by virtue of its size and flavour, is locally preferred and widely consumed. Population of these species has been suffering and declining slowly due to over exploitation, loss of habitat, siltation and pollution stress. *Cyprinus carpio, Systomus sarana, Garra gotyla, Mystus bleekeri, Mystus vittatus, Heteropneustes fossilis, Clarias batrachus, Mastacembelus armatus, Channa gachua* and *Anabas testudineus* are vulnerable in the lake due to several anthropogenic stresses include over exploitation, pollution and habitat degradation. All the recorded ornamental fish species have food value except a few species like *Trichogaster fasciata, Trichogaster lalius, Chanda nama, Parambassis ranga, Badis badis* and *Glossogobius giuris*. *Heteropneustes fossilis* is also quite common, and it is abundant in polluted areas because of its air breathing habit, it can withstand low oxygen levels.

Table 2: Diversity of Ornamental Fish Fauna found in Upper Lake, Bhopal

S.N.	Order	Family	Genus/ Species	Common Name	IUCN Status	CAMP status	Value
1	**Order: Cypriniformes**	**Family: Cyprinidae**	*Salmophasia bacaila (Hamilton, 1822)*	Large razorbelly minnow	LC	LRlc	OF
2	*Cyprinus carpio (Linnaeus, 1758)*			Common carp	VU	NE	HC, GF, OF
3	*Tor putitora (Hamilton, 1822)*			Putitor mahseer	EN	EN	C, GF, OF
4	*Esomus danricus (Hamilton, 1822)*			Flying barb	LC	LRnt	C, OF
5	*Laubuca laubuca (Hamilton, 1822)*			Indian glass barb	LC	LRlc	OF, C
6	*Rasbora daniconius (Hamilton, 1822)*			Slender rasbora	LC	LRnt	OF, C
7	*Amblypharyngodon mola (Hamilton, 1822)*			Mola carplet	LC	LRlc	OF
8	*Osteobrama cotio cotio (Hamilton, 1822)*			Cotio	LC	LRnt	OF
9	*Pethia ticto (Hamilton, 1822)*			Ticto barb	LC	LRnt	MC, C, OF
10	*Pethia conchonius (Hamilton, 1822)*			Rosy barb	LC	LRnt	MC, C, OF
11	*Systomus sarana (Hamilton, 1822)*			Olive barb	LC	VU	MC, OF
12	*Puntius sophore (Hamilton, 1822)*			Pool barb	LC	LRnt	OF
13	*Garra gotyla (stenorhynchus Jerdon, 1849)*			Patharchatta	LC	VU	OF, C
14	**Family: Nemacheilidae**		*Acanthocobitis botia (Hamilton, 1822)*	Mottled loach	LC	LRnt	OF, C
15	**Family: Cobitidae**		*Lepidocephalichthys guntea (Hamilton, 182*	Guntea loach	NE	LRnt	OF, C
16	**Order: Siluriformes**			Day's mystus	LC	VU	MC, C, OF

	Family: Bagridae *Mystus bleekeri (Day, 1877)*				
17	*Mystus vittatus (Bloch, 1794)*	Striped dwarf catfish	LC	VU	C, OF
18	**Family: Siluridae** *Ompok bimaculatus (Bloch, 1794)*	Butter catfish	NT	EN	C, A, OF
19	**Family: Heteropneustidae** Heteropneustes fossilis *(Bloch, 1794)*	Stinging catfish	LC	VU	OF
20	**Family: Clariidae** *Clarias batrachus (Linnaeus, 1758)*	Philippine catfish	LC	VU	OF
21	**Order: Beloniformes** **Family: Belonidae** *Xenentodon cancila (Hamilton, 1822)*	Freshwater garfish	LC	LRnt	OF
22	**Order: Synbranchiformes** **Family: Mastacembelidae** *Mastacembelus armatus (Lacepède, 1800)*	Zig-zag eel	LC	VU	OF
23	*Macrognathus aculeatus (Bloch, 1786)*	Lesser spiny eel	NE	LRnt	MC, C, OF
24	**Order: Perciformes** **Family: Ambassidae** *Chanda nama (Hamilton, 1822)*	Elongate glass-perchlet	LC	NE	MC, OF
25	*Parambassis ranga (Hamilton, 1822)*	Indian glassy fish	LC	NE	OF, C
26	**Family: Badidae** *Badis badis (Hamilton, 1822)*	Badis	LC	NE	OF, C
27	**Family: Nandidae** *Nandus nandus (Hamilton, 1822)*	Gangetic leaffish	LC	LRnt	OF, C
28	**Family: Gobiidae** *Glossogobius giuris (Hamilton, 1822)*	Tank goby	LC	LRnt	MC, A, C, OF
29	**Family: Osphronemidae** *Trichogaster fasciata (Bloch & Schneider, 1801)*	Banded gourami	LC	LRnt	MC, OF
30	*Trichogaster lalius (Hamilton, 1822)*	Dwarf gourami	LC	NE	MC, OF
31	**Family: Channidae** *Channa striata (Bloch, 1793)*	Striped snakehead	LC	LRnt	C, OF
32	*Channa gachua (Hamilton, 1822)*	Gachua	LC	VU	C, OF
33	*Channa marulius (Hamilton, 1822)*	Great snakehead	LC	LRnt	C, A, OF, GF
34	*Channa punctata (Bloch, 1793)*	Spotted snakehead	LC	LRnt	C, A, OF,
35	**Family: Anabantidae** *Anabas testudineus (Bloch, 1792)*	Climbing perch	DD	VU	OF, C
36	**Order: Osteoglossiformes** **Family: Notopteridae** *Notopterus notopterus (Pallas, 1769)*	Bronze feather back	LC	LRnt	C, A, OF

*C – Commercial, A - Aquaculture, OF - Ornamental Fish, GF - Game Fish, HC – Highly Commercial, MC - Minor Commercial, EN - Endangered, VU - Vulnerable, NT- Near Threatened, LRnt – Lower Risk near threatened, LRlc - Lower Risk least concern, LC - Least Concern, DD- Data Deficient, NE – Not evaluated.

Table 3: Number and percent composition of families, genera and species of ornamental fish under various orders

S.No.	Order	Families	Genus	Species	% of families in an order	% of genera in an order	% of species in an order
1	**Cypriniformes**	3	14	15	17.65	46.67	41.67
2	**Siluriformes**	4	4	5	23.53	13.33	13.89
3	**Beloniformes**	1	1	1	5.88	3.33	2.78
4	**Synbranchiformes**	1	2	2	5.88	6.67	5.55
5	**Perciformes**	7	8	12	41.18	26.67	33.33
6	**Osteoglossiformes**	1	1	1	5.88	3.33	2.78
		17	**30**	**36**	**100**	**100**	**100**

Table 4: Number of ornamental fish species reported from different genera in Upper Lake, Bhopal

S. No.	Genus	Number of species in genera
1	Channa	4
2	Trichogaster, Mystus and Pethia	2
3	Salmophasia, Cyprinus, Tor, Esomus, Laubuca, Rasbora, Amblypharyngodon, Osteobrama, Systomus, Puntius, Garra, Acanthocobitis, Lepidocephalichthys, Ompok, Heteropneustes, Clarias, Xenentodon, Mastacembelus, Macrognathus, Chanda, Parambassis, Badis, Nandas, Glossogobius, Anabas and Notopterus	1

Table -5: Percentage occurrence of ornamental fish species of Upper Lake under the conservation status CAMP (1998) and IUCN (2011)

Category		EN	VU	NT	LRnt	LRlc	LC	DD	NE
CAMP (1998)	**No of species**	2	9	-	17	3	-	-	5
	Percent Contribution	5.56%	25%	-	47.22%	8.33%	-	-	13.89%
IUCN (2011)	**No of species**	1	1	1	-	-	30	1	2
	Percent contribution	2.78%	2.78%	2.78%	-	-	83.33%	2.78%	5.55%

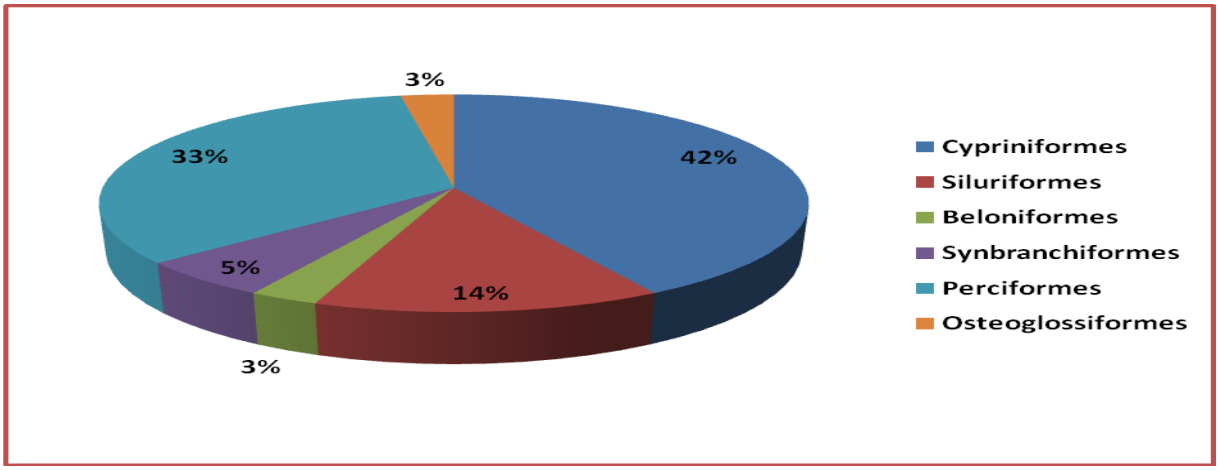


Fig. 1: Order wise Ornamental fish species % composition of Upper Lake

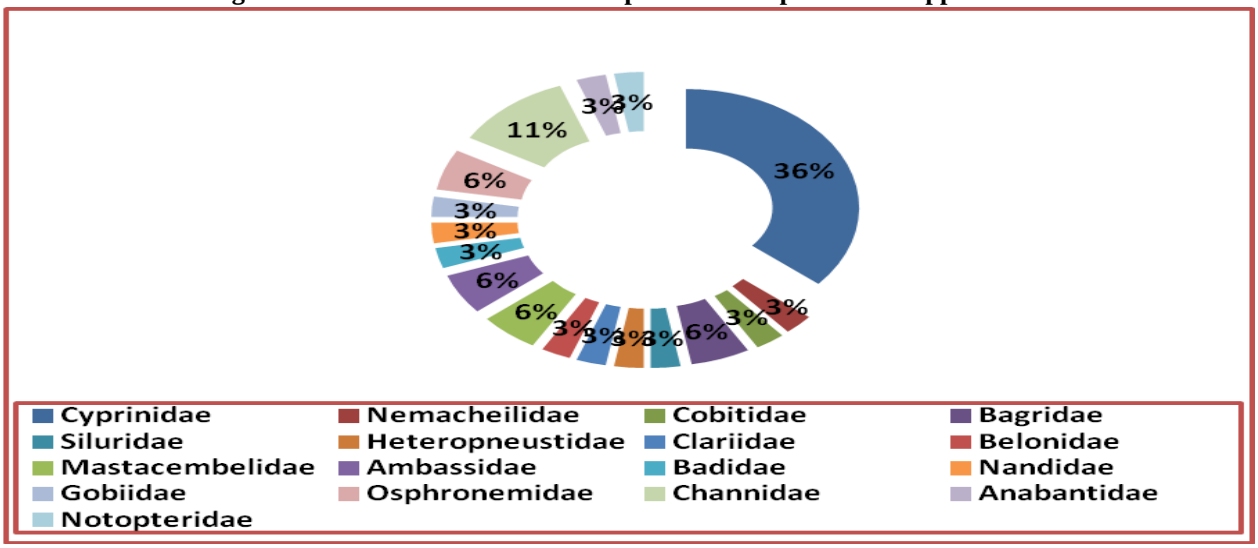


Fig. 2: Family wise Ornamental fish species % composition of Upper Lake, Bhopal

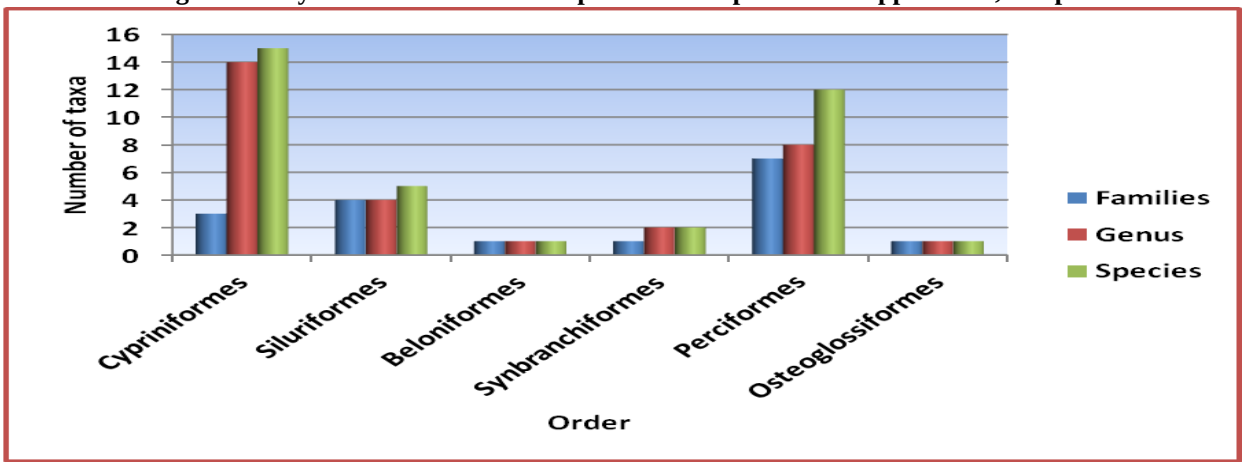


Fig. 3: Composition of different Ornamental Fish taxa recorded from Upper Lake, Bhopal

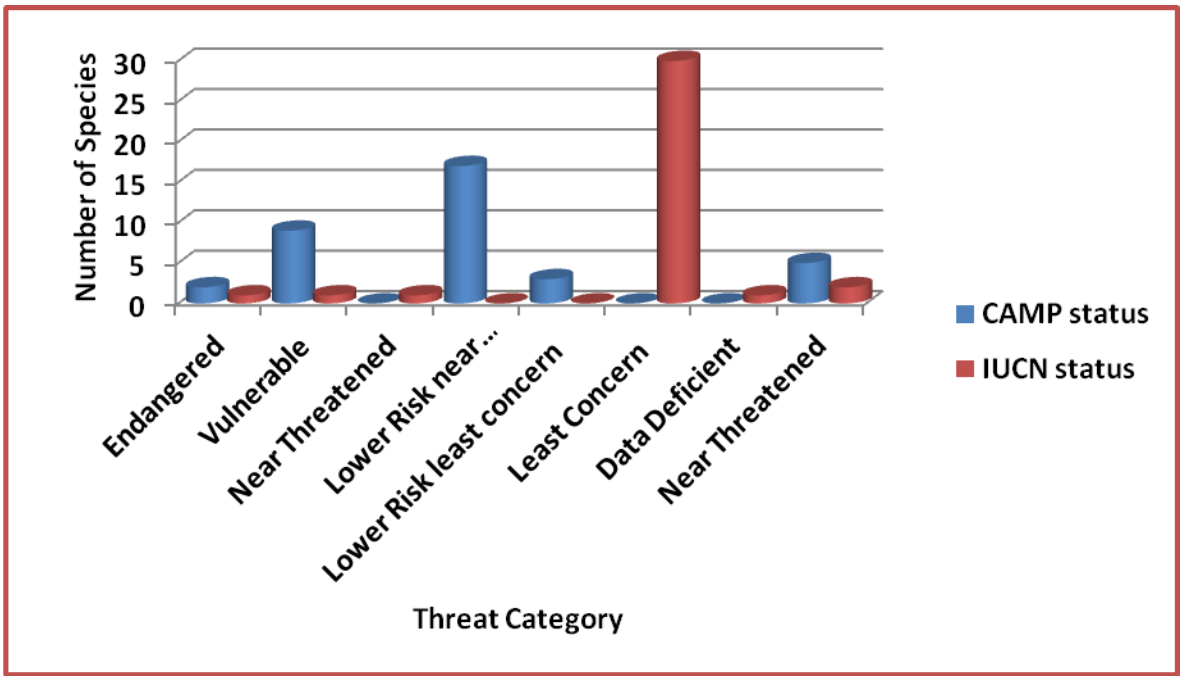
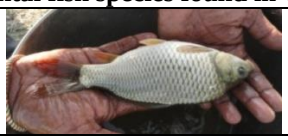


Fig. 4: Number of Species under various threat categories as per CAMP and IUCN

Plate - 1: List of Ornamental fish species found in Upper Lake, Bhopal

		
Salmophasia bacaila	*Cyprinus carpio*	*Tor putitora*
		
Esomus danricus	*Laubuca laubuca*	*Rasbora daniconius*
		
Amblypharyngodon mola	*Osteobrama cotio cotio*	*Pethia ticto*
		
Pethia conchonius	*Systomus sarana*	*Puntius sophore*
		
Garra gotyla	*Acanthocobitis botia*	*Lepidocephalichthys guntea*

		
Mystus bleekeri	*Mystus vittatus*	*Ompok bimaculatus*
		
Heteropneustes fossilis	*Clarias batrachus*	*Xenentodon cancila*
		
Mastacembelus armatus	*Macrognathus aculeatus*	*Chanda nama*
		
Parambassis ranga	*Badis badis*	*Nandus nandus*
		
Glossogobius giuris	*Trichogaster fasciata*	*Trichogaster lalius*
		
Channa striata	*Channa gachua*	*Channa punctata*
		
Channa marulius	*Anabas testudineus*	*Notopterus notopterus*

Conclusion

Nature is having a large number of ornamental fishes so a judicious exploitation of ornamental fishes from nature is required for sustainable development of the ornamental fishes. Upper Lake hosts a number of freshwater fish species including ornamental fish. However, the fish fauna of this lake especially ornamental fish are being threatened due to several anthropogenic activities including introduction of exotic fish species, habitat degradation, pollution, irrational fishing. The need of the hour is to protect the existing indigenous fish stock and steps for enhancing the quality of the culturable species rather than go in for indiscriminate introduction of exotic species. Due to some anthropogenic activities ornamental fish diversity of this freshwater wetland is in declining mode. To conserve this inherent treasure, a long term management plan should be adopted. Effective implementation of the regulations on mesh size and fishing gear is much needed to prevent over exploitation. Strict management measures with large public awareness would be essential to save the fish germplasm of this wetland and it's time to make proper policies and take necessary actions to improve conservation measures so that the future generations can get the fish live on the earth rather than the photographs in the literature. This study would serve as a frame of reference for future initiatives in studying fish biodiversity and conservation management.

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How to cite this article

Sharma R., Borana K., Gupta S.K., Pandey V. and Khan A. (2014). Biodiversity and Composition of Ornamental Fish Fauna inhabiting in Upper lake of Bhopal (M.P.). *Int. J. Pharm. Life Sci.*, 5(7):3651-3659.

Source of Support: Nil; Conflict of Interest: None declared

Received: 06.06.14; Revised: 19.06.14; Accepted:24.07.14