



## ORIGINAL ARTICLE

# Ornamental Fish Diversity of Lake Kolleru, the only Ramsar site in Andhra Pradesh, India

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### ABSTRACT

Ornamental fish diversity of Lake Kolleru, a freshwater wetland of International importance and the only Ramsar site designated from Andhra Pradesh was studied from January, 2011 to December, 2011. In the one year study period fifty eight species of ornamental fish were recorded. Order cypriniformes was dominant with 17 species followed by siluriformes, perciformes and mugiliformes each with 10 species, cyprinodontiformes and mastacembeliformes each with 3 species, anguilliformes with 2 species and osteoglossiformes, elopiformes and tetraodontiformes each with 1 species. Family cyprinidae was dominant with 10 genera and genus *Puntius* was dominant with 7 species. IUCN (2011) and CAMP (1988) conservation status of each fish was listed. Out of 58 species 5.17% of fish are vulnerable, 5.17% are near threatened, 6.89% are at lower risk and near threatened, 1.72% are at lower risk and least concern, 51.72% are least concern as per IUCN (2011) status and 6.89% are endangered, 17.24% are vulnerable, 31.03% are at lower risk and near threatened, 3.44% are at lower risk and least concern as per CAMP (1998) conservation status.

**KEY WORDS:** Ornamental fish, Lake Kolleru, Biodiversity, Conservation status, IUCN, CAMP.

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### INTRODUCTION

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 [1]. In India, the scientific and technological advancements have led to an increased demand for freshwater aquarium fishes in the recent years and this has opened a new avenue for developing a lucrative and money spinning. 400 species of ornamental fishes belonging to 175 genera and 50 families are reported in Indian waters [2]. 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 [3]. These fish are exported to 27 countries, which amounted to 2568 Mt (0.86% of the total marine export) in terms of quantity and US\$14 million (0.50% of total marine export) in terms of value [4]. The entire supply of Indian ornamental fish is primarily dependent on wild catch (85%) and a few artificially bred varieties (15%) of exotic fish [5].

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.

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: (1) to bring out the richness of ornamental fish diversity and (2) to assess the status of these fish as per [6] and [7].

**MATERIALS AND METHODS****STUDY AREA**

Lake Kolleru (16° 39' and 16° 65' N & 81° 13' and 81° 21' E), a large shallow freshwater habitat, is the sole Ramsar-designated wetland in Andhra Pradesh, India [8] [9]. It serves as a natural flood balancing reservoir between two major deltas of the Krishna and Godavari Rivers [10] and a source of water for domestic use and irrigation [11]. It also supports a substantial fishery [8]. The lake was notified as a wildlife sanctuary in November, 1999 under India's Wildlife Protection Act, 1972 and designated as a wetland of international importance in November, 2002 under the International Ramsar Convention.

**SAMPLING**

Fishes were collected from different localities for the period of one year i.e. from January, 2011 to December, 2011 with the help of local fishermen using different types of nets namely gill nets, cast nets and drag nets. Fish were also collected from local fish markets in and around Lake Kolleru. Immediately photographs were taken prior to preservation in 10% formalin [12] [13] [14]. Fishes were brought to the laboratory and fixed in this solution in separate jars according to their size. Smaller fish were directly placed in the formalin solution while the larger fish were given an incision on the abdomen and removed the gut content before they were preserved. The fishes collected and fixed were labelled giving serial numbers, date of collection, exact locality from where collected. Identification was done based on keys for fishes of the Indian subcontinent [15] [16] [17] [18] and classification was carried out on lines of [19] [20] [21] [15]. Identification of the species was done mainly on the basis of colour pattern, specific spots or marks on the body surface, shape of the body, structure of various fins etc. and also with the help of taxonomic expertise from the Regional station of the Zoological Survey of India at Hyderabad.

**RESULTS**

The results of the present study revealed the occurrence of fifty eight ornamental fish species belong to 10 orders, 26 families and 40 genera. List of ornamental fish including their order, family, species and common name recorded in the present investigation was given in Table 1 and number and percent composition of families, genera and species under different orders are shown in Table 2 & Figs 1 – 4. Order cypriniformes was dominant represented 17 species with 29.31% contribution of the total species followed by siluriformes, perciformes and mugiliformes each with 10 (17.24%) species, cyprinodontiformes and mastacembeliformes each with 3 (5.17%) species, anguilliformes with 2 (3.44%) species and osteoglossiformes, elopiformes and tetraodontiformes each with 1 (1.72%) species. Out of 26 families recorded, order perciformes contributed 6 (23.07%) families followed by siluriformes and mugiliformes each with 5 (19.23%), cyprinodontiformes with 3 (11.53%), anguilliformes with 2 (7.69%) and osteoglossiformes, elopiformes, cypriniformes, mastacembeliformes and tetraodontiformes each with 1 (3.84%) species. Out of 40 genera reported, cypriniformes contributed 25% i.e. 10 genera followed by perciformes with 9 (22.5%), mugiliformes with 6 (15%), siluriformes with 5 (12.5%), cyprinodontiformes with 3 (7.5%), anguilliformes and mastacembeliformes each with 2 (5%) and osteoglossiformes, elopiformes and tetraodontiformes each with 1 (2.5%) genera. Out of 40 genera, genus *Puntius* was dominant with 7 species followed by *Mystus* with 4 species, *Ompok*, *Colisa* and *Channa* each with 3 species, *Macrogonathus*, *Etroplus* and *Chela* each with 2 species while all the remaining genera each with 1 species (Table 3).

Conservation status of the ornamental fish from the Lake is presented in Table 1 and percent occurrence of fish under CAMP and IUCN conservation status is given Table 4 and Fig. 5. The status of fishes of India in Conservation Assessment and Management Programme [6] 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 58 species reported in the present study, 6.89% species are endangered, 17.24% are vulnerable, 31.03% are at lower risk and near threatened, 3.44% are at lower risk and least concern, data deficient for 1.72% species and 39.65% are not evaluated while 5.17% are vulnerable, 5.17% are near threatened, 6.89% are at lower risk and near threatened, 1.72% are at lower risk and least concern, data deficient for 3.44% species and 25.86% are not evaluated as per IUCN Red list category (2011).

**Table 1:** List of Ornamental fishes recorded from Lake Kolleru and their conservation status as per IUCN (2011) and CAMP (1998)

Order	Family	Species	Common Name	IUCN Status	CAMP Status
Osteoglossiformes	Notopteridae	<i>Notopterus notopterus</i>	Grey feather back	LC	LRnt
Elopiformes	Megalopidae	<i>Megalops cyprinoides</i>	Indo-Pacific Tarpon	DD	NE
Anguilliformes	Anguillidae	<i>Anguilla bengalensis</i>	Indian Long fin eel	LC	EN
	Moringuidae	<i>Moringua raitaborua</i>	Purple spaghetti eel	NE	NE
Cypriniformes	Cyprinidae	<i>Cirrhinus reba</i>	Reba carp	VU	VU
		<i>Cyprinus carpio</i>	Common carp	NE	NE
		<i>Labeo calbasu</i>	Black rohu	LRnt	LRnt
		<i>Osteobrama cotio</i>	Cotio	NE	LRnt
		<i>Puntius chola</i>	Swamp barb	LC	VU
		<i>Puntius conchonius</i>	Rosy barb	LC	LRnt
		<i>Puntius gelius</i>	Golden dwarf barb	LC	NE
		<i>Puntius sarana</i>	Olive barb	LC	VU
		<i>Puntius sophore</i>	Spot fin swamp barb	LC	LRnt
		<i>Puntius terio</i>	One spot barb	LC	LRnt
		<i>Puntius ticto</i>	Two spot / Fire fin barb	LC	LRnt
		<i>Chela cachius</i>	Silver hatchet chela	LC	NE
		<i>Chela laubuca</i>	Indian glass barb	LC	LRlc
		<i>Salmostoma phulo</i>	Fine scale razor belly minnow	NE	NE
		<i>Amblypharyngodon mola</i>	Pale/Mola carplet	LC	LRlc
		<i>Esomus danricus</i>	Flying barb	LC	LRnt
		<i>Rasbora daniconius</i>	Black line rasbora	NE	LRnt
Siluriformes	Bagridae	<i>Mystus bleekeri</i>	Day's mystus	LC	VU
		<i>Mystus cavasius</i>	Gangetic mystus	LC	LRnt
		<i>Mystus gulio</i>	Long whiskered catfish	NE	NE
		<i>Mystus vittatus</i>	Striped dwarf catfish	LC	VU
	Siluridae	<i>Ompok bimaculatus</i>	Indian butter fish	NT	EN
		<i>Ompok pabda</i>	Butter catfish	NT	EN
		<i>Ompok pabo</i>	Pabdah fish	NT	NE
	Schilbeidae	<i>Pseudeutropius atherinoides</i>	Indian potasi	NE	EN
Clariidae	<i>Clarias batrachus</i>	Walking catfish/Magur	VU	VU	
Heteropneustidae	<i>Heteropneustes fossilis</i>	Stinging catfish	VU	VU	
Cyprinodontiformes	Belontiidae	<i>Xenentodon cancila</i>	Freshwater garfish	LC	LRnt
	Oryziidae	<i>Oryzias dancena</i>	Indian rice fish	LC	NE
	Aplocheilidae	<i>Aplocheilus panchax</i>	Panchax minnow	LC	DD
Perciformes	Ambassidae	<i>Chanda nama</i>	Elongate glass perchlet	LC	NE
		<i>Parambassis ranga</i>	Indian glassy fish	LC	NE
		<i>Terapon jarbua</i>	Tiger perch	LC	NE
	Lutjanidae	<i>Lutjanus johni</i>	John's snapper	NE	NE
	Scatophagidae	<i>Scatophagus argus</i>	Spotted scat	LC	NE
	Nandidae	<i>Nandus nandus</i>	Mottled nandus	LRnt	LRnt
		<i>Badis badis</i>	Dwarf chameleon fish	LC	NE
	Cichlidae	<i>Etroplus maculatus</i>	Ornate chromid	LC	NE
		<i>Etroplus suratensis</i>	Green chromid	LC	NE
		<i>Oreochromis mossambica</i>	Mozambique tilapia	NE	NE
Mugiliformes	Mugilidae	<i>Mugil cephalus</i>	Grey / Flat head mullet	LC	NE
	Gobiidae	<i>Glossogobius giuris</i>	Tank/Bar-eyed goby	LC	LRnt
		<i>Stigmatogobius sadanundio</i>	Knight Goby	NE	NE
	Anabantidae	<i>Anabas testudineus</i>	Climbing perch	DD	VU
	Belontiidae	<i>Colisa fasciatus</i>	Banded gaurami	LRnt	LRnt
		<i>Colisa labiosus</i>	Thick lip aurami	NE	NE
		<i>Colisa lalia</i>	Dwarf gaurami	NE	NE
	Channidae	<i>Channa gachua</i>	Dwarf snakehead	LC	VU
		<i>Channa punctatus</i>	Spotted snakehead	LRnt	LRnt
		<i>Channa striatus</i>	Banded snakehead	LRlc	LRnt
	Mastacembeliformes	Mastacembelidae	<i>Macrognathus aral</i>	One striped spiny eel	LC
<i>Macrognathus pancalus</i>			Barred spiny eel	NE	LRnt
<i>Mastacembelus armatus</i>			Zig zag spiny eel	NE	VU
Tetraodontiformes	Tetraodontidae	<i>Tetraodon cutcutia</i>	Puffer fish	NE	LRnt

\* EN – Endangered; VU – Vulnerable; LRnt – Lower risk near threatened; LRlc – Lower risk least concern, LC – Least Concern, DD – Data deficient; NE – Not evaluated

**Table 2:** Number and percent composition of families, genera and species of ornamental fish under various orders

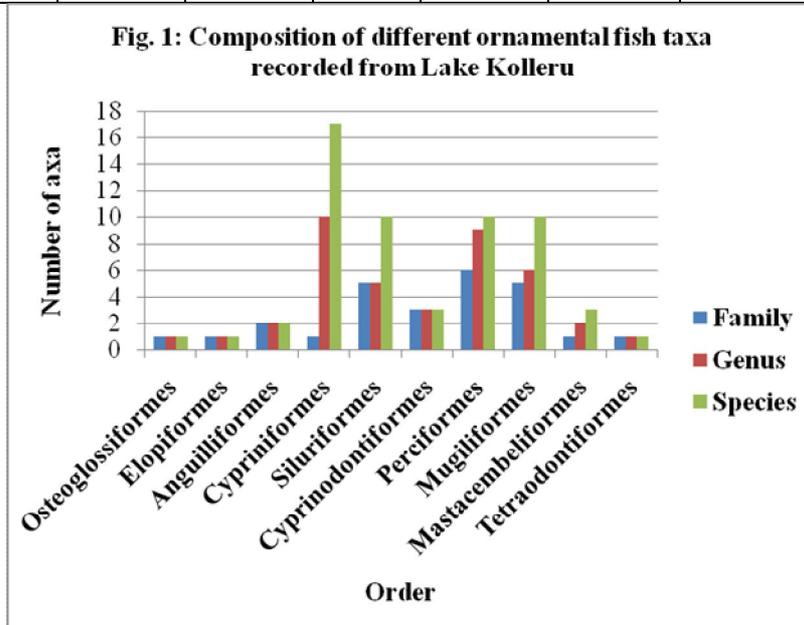
S.No	Order	Families	Genus	Species	% of families in an order	% of genera in an order	% of species in an order
1	Osteoglossiformes	1	1	1	3.84	2.5	1.72
2	Elopiiformes	1	1	1	3.84	2.5	1.72
3	Anguilliformes	2	2	2	7.69	5	3.44
4	Cypriniformes	1	10	17	3.84	25	29.31
5	Siluriformes	5	5	10	19.23	12.5	17.24
6	Cyprinodontiformes	3	3	3	11.53	7.5	5.17
7	Perciformes	6	9	10	23.07	22.5	17.24
8	Mugiliformes	5	6	10	19.23	15	17.24
9	Mastacembeliformes	1	2	3	3.84	5	5.17
10	Tetraodontiformes	1	1	1	3.84	2.5	1.72
<b>Total</b>		<b>26</b>	<b>40</b>	<b>58</b>			

**Table 3:** Number of ornamental fish species reported from different genera in Lake Kolleru

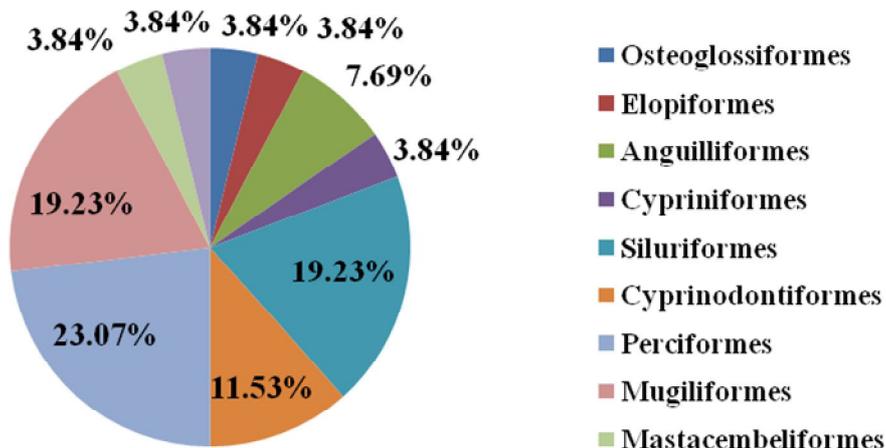
S.No	Genus	Number of species in Genera
1	<i>Puntius</i>	7
2	<i>Mysus</i>	4
3	<i>Ompok, Colisa and Channa</i>	3
4	<i>Macrogathus, Etroplus and Chela</i>	2
5	<i>Notopterus, Megalops, Anguilla, Moringua, Cirrhinus, Cyprinus, Labeo, Osteobrama, Salmostoma, Amblypharyngodon, Esomus, Rasbora, Pseudotroplus, Clarias, Heteropneustes, Xenentodon, Oryzias, Aplocheilus, Chanda, Parambassis, Terapon, Lutjanus, Scatophagus, Nandus, Badis, Oreochromis, Mugil, Glossogobius, Stigmatogobius, Anabas, Mastacembelus and Tetraodon</i>	1

**Table 4:** Percentage occurrence of ornamental fish species of Lake Kolleru under the conservation status CAMP (1998) and IUCN (2011)

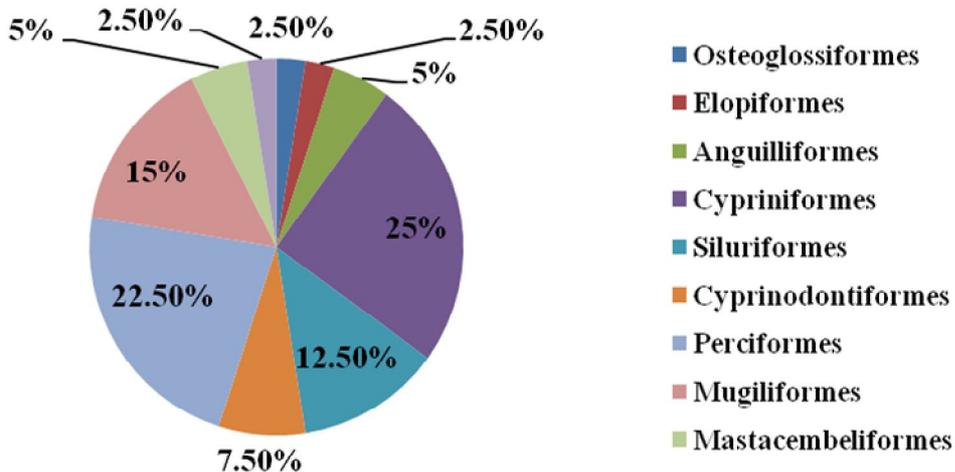
Category		EN	VU	NT	LRnt	LRlc	LC	DD	NE
CAMP (1998)	No of species	4	10	-	18	2	-	1	23
	Percent contribution	6.89%	17.24%	-	31.03%	3.44%	-	1.72%	39.65%
IUCN (2011)	No of species	-	3	3	4	1	30	2	15
	Percent contribution	-	5.17%	5.17%	6.89%	1.72%	51.72%	3.44%	25.86%



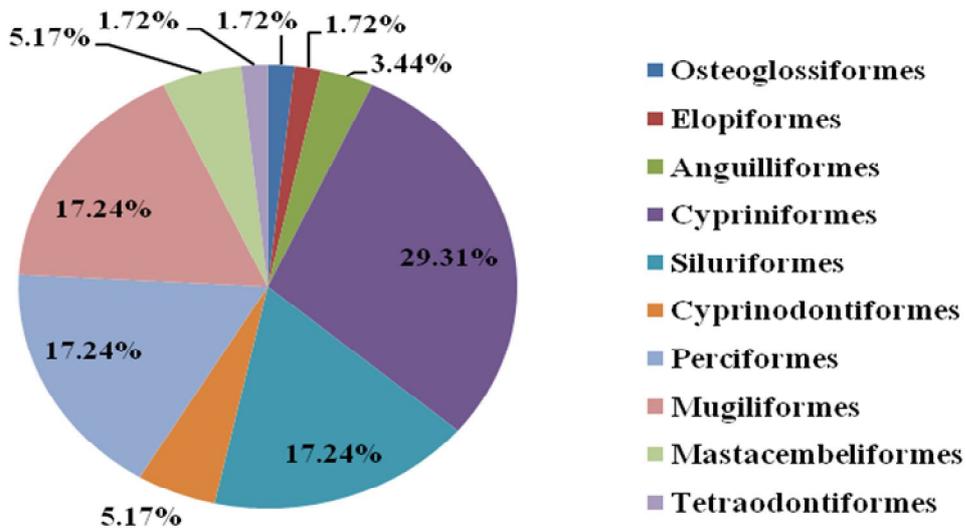
**Fig. 2: Percentage contribution of families to the Orders**

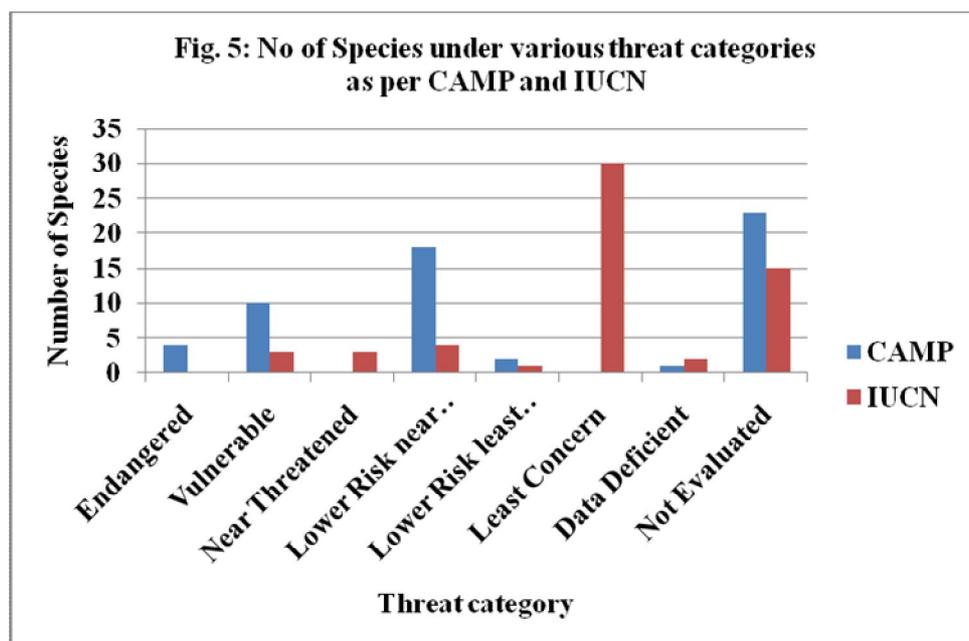


**Fig. 3: Percentage contribution of genera to the Orders**



**Fig. 4: Percent contribution of species to the Orders**





## DISCUSSION

It is essential to study the distribution and the diversity of fish from freshwater habitats including wetlands. Biodiversity is essential for stabilization of ecosystem protection of overall environmental quality for understanding intrinsic worth of all species on the earth [22]. Fish diversity of a wetland essentially represents the fish faunal diversity and their abundance. Wetlands conserve a rich variety of fish species which support to the commercial fisheries including ornamental fish. In our present study order Cypriniformes was found to be the most dominant group among all other orders which is in accordance with the other studies [23] [24] [25] [26]. Out of 26 families, cyprinidae was the most dominant group. Many researchers reported the strong dominance of this family in their investigations. Sarwade and Khillare [27] reported 60 species from Ujani wetland where cyprinidae was dominant with 36 species, Devi Prasad *et al.*, [28] reported 45 species from wetlands of Mysore where cyprinidae was dominant with 22 species, Das and Sabitry [29] reported 62 ornamental fish species from the river island, Masuli, Assam where cyprinidae was more dominant with 20 species, Anish Dua and Chander Parkash [30] reported 61 species from Harike wetland where cyprinidae was dominant with 27 species.

*Anguilla bengalensis*, *Ompok bimaculatus*, *Ompok pabda* and *Pseudotropius atherinoides* 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. *Cirrhinus reba*, *Puntius chola*, *Puntius sarana*, *Rasbora daniconius*, *Mystus vittatus*, *Clarias batrachus*, *Heteropneustes fossilis*, *Anabas testudineus*, *Channa gachua* and *Mastecembelus armatus* 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 *Badis badis*, *Aplocheilichthys panchax* and *Tetradon cutcutia*. It has been observed that in the winter and retreating monsoon season highest number of fish was recorded compared to the other seasons which may be due to receding water level of the lake, which enhance the fish-catching intensity. *Oreochromis mossambica* and *Cyprinus carpio* are the exotic ornamental species reported in our study which are quite frequent. *Heteropneustes fossilis* is also quite common, and it is abundant in sewage polluted areas because of its air breathing habit it can withstand low oxygen levels. Among the catfish group, *Mystus bleekeri*, *Mystus cavasius* and *Mystus vittatus* belonging to bagridae are of high economic importance while *Ompok bimaculatus*, *Ompok pabda* and *Ompok pabo* belonging to siluridae have moderate economic value. *Clarias batrachus* and *Heteropneustes fossilis* carry high economic value.

## CONCLUSION

In conclusion, Lake Kolleru 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 [31] [32]. 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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