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Diversity of fish fauna in lower Manair reservoir of Karimnagar district (A.P.), India

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ABSTRACT

Diversity of fish fauna in the Lower Manair reservoir was studied from September-2010 to August-2011. Samples were collected monthly with help of local fishermen by using fishing nets. A total of 44 species of fishes belonging to 8 orders such as Cypriniformes (18 species) Siluriformes (11species), Perciformes (6 species), Channiformes (4 species) Beloniformes(2 species), Angulliformes (one species) Osteoglossiformes (one species) and Mogiliformes(one species). Of these, 24 species of fish are least concerned, 8 are data deficient (DD), 10 are not evaluate (NE), 1 species of fish is vulnerable and 1 species of fish is near threatened. Shannon-Weiner diversity (H'), Evenness (J) and species richness (S) for different months were calculated..

Key words: Lower Manair reservoir, Fish diversity, Shannon-Weiner diversity (H'), Evenness (J) and species richness (S).

INTRODUCTION

Fishes are one of the prime important elements in the aquatic habitat and play a key role in economy of many nations [1] as they have been a stable item in the diet of many people [2]. As animal proteins consumed by 1 billion people worldwide [3, 4]. The country is endowed with vast and varied resources possessing reservoir ecological heritage and rich biodiversity. Freshwater fishery sites are varied like 45,000 km. of rivers, 1, 26,334 km. of canals, ponds and tanks 2.36 million hectares and 2.05 million hectares of reservoirs [5, 6].

India is one of the mega biodiversity hot spots contributing 11.72% of the globe fish biodiversity. In India there are about 2500 species of fishes which 930 freshwater and 1,570 marine are estimated [7]. India harbor resources in the world [8]. Jayaram [9] listed 742 freshwater species of fishes under 233 genera, 64 families and 16 orders from India region. Talwar and Jhingran [10] estimated 2546 species of fish belonging to 969 genera, 254 families and 40 orders. Devi and Indra [11] reported the checklist of 667 fresh water fish species of India.

The fish fauna of Andhra Pradesh has been reported by several workers [12, 13, 14, 15, 16, 17, 18, 19 and 20]. Present investigations were under taken to study the fish biodiversity, the fish abundance and richness of fishes was evaluated and their IUCN status and measures of conservation of Lower Manair reservoir in Karimnagar district.

MATERIALS AND METHODS

1. Study area:

The Lower Manair Reservoir situated at Karimnagar District in Andhra Pradesh **(Fig-1)**. It lies between North latitude 18º.38' and East longitude 79º.12'. Full capacity of the reservoir 24.00 tmcft, the water spread at on area of about 31, 284 sq.km, has provided sufficient fishing ground for more than 1000 permanently residing fishermen over 25 years. The water of this Reservoir is used for drinking, agriculture and supports fish culture.

2. Collection of fish sample:
The collections were made once in a week from 10 points of the Lower Manair reservoir from September 2010 to August-2011 with the help of local fishermen using different types of nets. The collected fishes were photographed labeled and preserved in 10% Formalin solution and brought to the laboratory. Smaller fishes were directly placed in the 10% formalin solution while large fishes were given an incision on the abdomen before they were fixed. The fishes were identified with help of standard reference material [10, 21]. The conservation status of the fish species are based on [22, 23 and 24]. The qualitative and quantities' analysis of fish species was carried out. Species Shannon-Wiener index [H= $-\sum P_i$ long P_i], Evenness index [$J=H/H_{max}$] and Species richness [$S=\frac{S-1}{logN}$] were worked out.

Shannon-Weiner index: $H= -\sum P_i \log P_i$ Where, H = Shannon – Weiner index**,** Pi = ni /N**,** $\sum$ = Sum**,** ni = Number of individuals of each species in the sample**,** N = Total number of individuals of all species in the sample.

Evenness: $J=H/H_{max}$ Where, J = Evenness index, 'H' is the *Shannon – Weiner index*, $H_{max=}$log S, 'S' is the number of species.

Species richness: $S=\frac{S-1}{logN}$ S= is the index of species richness, S= total number of species, N= total number of individuals.

Fig-1. Satellite image of Lower Manair reservoir

RESULTS AND DISCUSSION

A total of 44 species from 8 orders, 16 families and 26 genera were recorded during the present study. They are *Amblypharyngodon mola, Amblypharyngodon microlepis, Puntis chola, Puntis sophore, Puntis sarana, Rasbora daniconius, Rasbora elanga, Salmostoma bacaila Salmostoma phulo, Catla catla, Cirrhinus reba, Cirrhinus mrigala, Cyprinus carpio, Labeo.rohita, Labeo ariza, Osteobrama cotio cotio, Labeo calbasu, Labeo fimbriatus* under Cypriniformes, *Mystus tengara Mystus aptengra, Mystus bleeker, Mystus cavasius, Mystus vitatus, Mystus seenghala, Ompok bimaculatus, Wallago attu, Eutropiichthys vacha, Clarias batrachus Heteropneustes fossilis* under Siluriformes, *Anguilla bicolor* under Angulliformes, *Notopterus notopterus* under Osteoglossiformes, *Xenentodon cancila, Hyporhampus gaimardi* under Beloiniformes, *Channa punctatus, Channa straiatus, Channa marulius, Channa orientalis* under Channiformes, *Glosogobius giuris, Mastacembelus armatus, Mastacembelus pancalus, Trichogaster fasciatus, Chanda nama, Ambassis ranga* under Perciformes, *Rhinomugil corsula* under Mogiliformes. A systematic list of fishes observed from the reservoir has been provided in (**table-1 and Fig-2-35)**.

Fig-2. ***Amblypharyngodon microlepis***

Fig-3. ***Catla-catla***

Fig-4. ***Cirrhinus reba***

Fig-5. ***Cirrhinus mrigala***

Fig-6. ***Cyprinus carpio carpio***

Fig-7. ***Labeo calbasu***

Fig-8. ***Labeo ariza***

Fig-9. ***Osteobrama cotio cotio***

Fig-10. ***Puntius sarana***

Fig-11. ***Puntius sophore***

Fig-12. ***Rasbora elanga***

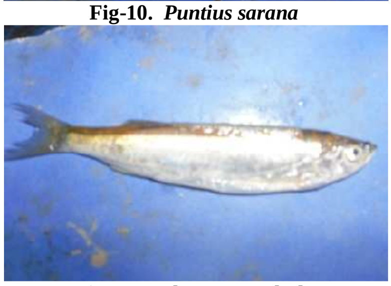

Fig-13. ***Salmostoma phulo***

Fig-14. ***Mystus tengara***

Fig-15. ***Mystus aptengra***

Fig-16. ***Mystus cavasius***

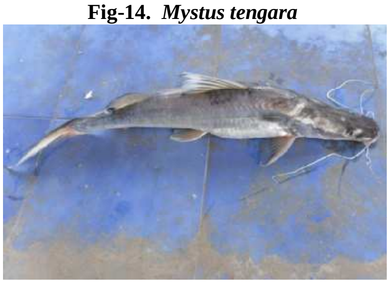

Fig-17. ***Mystus seenghala***

Fig-18. ***Ompok bimaculatus***

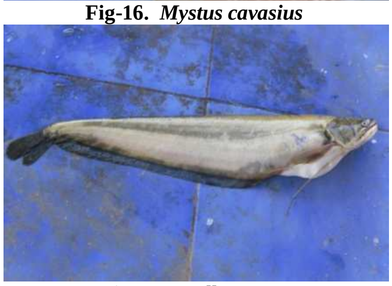

Fig-19. ***Wallago attu***

Fig-20. ***Eutropiichthys vacha***

Fig-21. ***Clarias batrachus***

Fig-22. ***Heteropneustes fossilis***

Fig-23. ***Anguilla bicolor***

Fig-24. ***Notopterus notopterus***

Fig-25. ***Xenentodon cancila***

Fig-26. ***Hyporhampus gainardi***

Fig-27. ***Channa marulius***

Fig-28. ***Channa punctata***

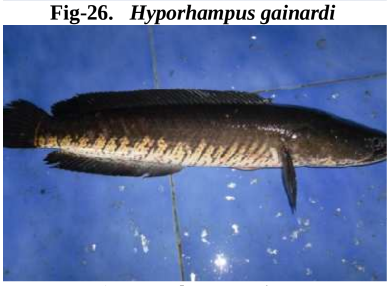

Fig-29. ***Channa striata***

Fig-30. ***Glosogobius giuris***

Fig-31. ***Mastacembelus armatus***

Fig-32. ***Mastacembelus pancalus***

Fig-33. ***Trichogaster fasciatus***

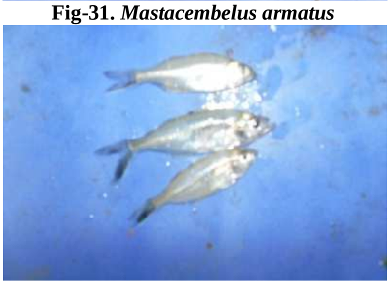

Fig-34. ***Chanda nama***

Fig-35. ***Rhinomugil corsula***

Table-1. List of fishes recorded in Lower Manair reservoir with their CAMP, 1998 status, CAFF (2006) status and IUCN status.

Order and Family	Species	CAMP (1998)	CAFF (2006)	www.iucnredlist.org
Cypriniformes				
Cyprinidae	1. *Amblypharyngodon microlepis*(Bleeker)			DD
	2. *Amblypharyngodon mola*(Hamilton)	LR-lc	LR-lc	LC
	3. *Catla Catla*(Hamilton)	VU	LR-nt	NE
	4. *Cirrhinus reba*(Hamilton)	VU	VU	LC
	5. *Cirrhinus mrigala*(Hamilton)	LR-nt	LR-nt	LC
	6. *Cyprinus carpio carpio*(Linnaus)			VU
	7. *Labeo calbasu*(Hamilton)	LR-nt	LR-nt	LC
	8. *Labeo fimbriatus*	LR-nt	LR-nt	LC
	9. *Labeo rohita*(Hamilton)	LR-nt	LR-lc	LC
	10. *Labeo ariza*			LC
	11. *Osteobrama cotio cotio*(Hamilton)	LR-nt	Lr-nt	LC
	12. *Puntius chola*(Hamilton)			LC
	13. *Puntius sarana*(Hamilton)	VU	VU	LC
	14. *Puntius sophore*(Hamilton)	LR-nt	LR-nt	LC
	15. *Rasbora daniconius*(Hamilton)	NE	LR-lc	LC
	16. *Rasbora elanga* (Hamilton)			NE
	17. *Salmostoma phulo*(Hamilton)			NE
	18. *Salmostoma bacaila*(Hamioton)	LR-lc	DD	LC
Siluriformes				
Bagridae	19. *Mystus bleeker*(Day)	VU	VU	DD
	20. *Mystus cavasius*(Hamilton)	LR-nt	LR-nt	LC
	21. *Mystus seenghala*(Sykes)	NE	LR-nt	NE
	22. *Mystus tengara*(Hamilton)			LC
	23. *Mystus vitatus*(Bloch)			DD
	24. *Mystus aptengra*			DD
Siluridae	25. *Ompok bimaculatus*(Bloch)	EN	EN	DD
	26. *Wallago attu*(Schneider)	LR-nt	LR-nt	NT
Schilbeidae	27. *Eutropiichthys vacha*(Hamilton)			LC
Clariidae	28. *Clarias batrachus*(Linnaeus)	VU	VU	LC
Heteropneustidae	29. *Heteropneustes fossilis*(Bloch)	VU	VU	LC
Anguilliformes				
Anguillidae	30. *Anguilla bicolor*			DD
Osteoglossiformes				
Notopteridae	31. *Notopterus notopterus*(Pallas)	LR-nt	EN	LC
Beloiniformes				
Belonidae	32. *Xenentodon cancila*(Hamilton)	LR-nt	Lr-nt	LC
Exocoetidae	33. *Hyporhampus gaimardi*			DD
Channiformes				
Channidae	34. *Channa marulius*(Hamilton)	LR-nt	VU	LC
	35. *Channa orientalis*(Humilton)			NE
	36. *Channa punctatus*(Bloch)	LR-nt	LR-nt	NE
	37. *Channa striatus*(Bloch)	LR-nt	LR-nt	NE
Perciformes				
Gobiidae	38. *Glosogobius giuris*(Hamilton)			DD
Mastacembelidae	39. *Mastacembelus armatus*(Lacepede)	NE	VU	LC
	40. *Mastacembelus pancalus*(Hamilton)	LR-nt	LR-nt	NE
Osphronemidae	41. *Trichogaster fasciatus* (Bloch&Schneider)			NE
Ambassidae	42. *Chanda nama*(Hamilton)			LC
	43. *Ambassis ranga(Hamilton-1822)*			NE
Mogiliformes				
Mugilidae	44. *Rhinomugil corsula*(Hamilton)			LC

EN (Endangered), Vu (Vulnerable), Lr-nt (Lower risk near threatened), LR-lc (Lower risk least concern), NE (Not evaluate), DD (Data defifient), LC (least concern) and NT (Near threatened).

The monthly percentages of different orders of fishes are presented during September 2010 to August 2011 in **(Fig-36)**. The maximum percentage of Cypriniformes (88.68%) was recorded in January and minimum (50.90%) represented in April. In Siluriformes was maximum percentage (35.48%) of recorded in February and minimum percentage (3.77%) in January. In case of Angulliformes maximum percentage (0.73%) recorded in July and minimum percentage (0.081%) in May, not recorded any Angulliformes species in September to November, February and July. The maximum percentage (1.25%) of Osteoglossiformes recorded in November and minimum percentage (0.26%) in month of January, not recorded any Osteoglossiformes species in September and May. Beloiniformes recorded maximum percentage (4.02%) in June and minimum (0.39%) in January, not recorded any Beloiniformes in October, November, July and August**.** Channiformes recorded maximum percentage (6.48%) in June and minimum percentage (1.39%) in January. Perciformes recorded the maximum percentage (12.27%) of in April and minimum (3.66%) in July. Mogiliformes recorded maximum percentage (1.5%) of in September and minimum percentage (0.11%) in October, not recorded any Mogiliformes species in November to February, April, May and July. Seasonal dynamics of the fish population showed that high value of fish diversity during rainy and winter months in the present study [25], which implied that reservoir receive large volume of less polluted and high oxygenated water which favoring the improvement of fish growth and most of the fishes migrate for breeding. During summer when water flows is greatly reduced in to reservoir appears to be devoid fish.

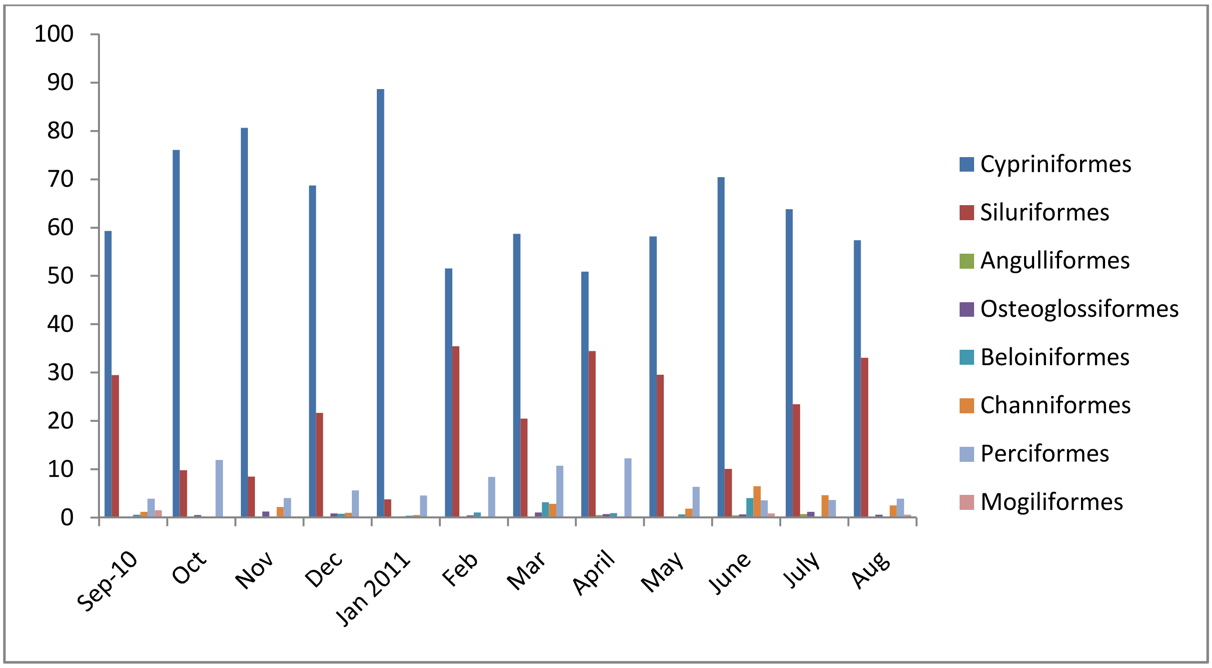

Fig- 36: Order-wise monthly percentage of different fishes (September 2010 to August 2011)

Number and percent composition of families, genera and species under various orders are presented in **(table-2 and Fig-37)**. As far as the genera and families to different orders are concerned order cypriniformes consists of nine genera (34.61%) under one family (6.25%), Siluriformes of six genera (23.07%) under five families (31.25%), Perciformes of five genera (19.23%) under four families (25%), Channiformes of one genera (3.84) under one family (6.25%), Beloniformes of two genera (7.69%) under two families (12.5%), Angulliformes, Osteoglossiformes and Mogiliformes of single genera (3.84%) under single family(6.25%) each **(Table-2 and Fig-38)**.

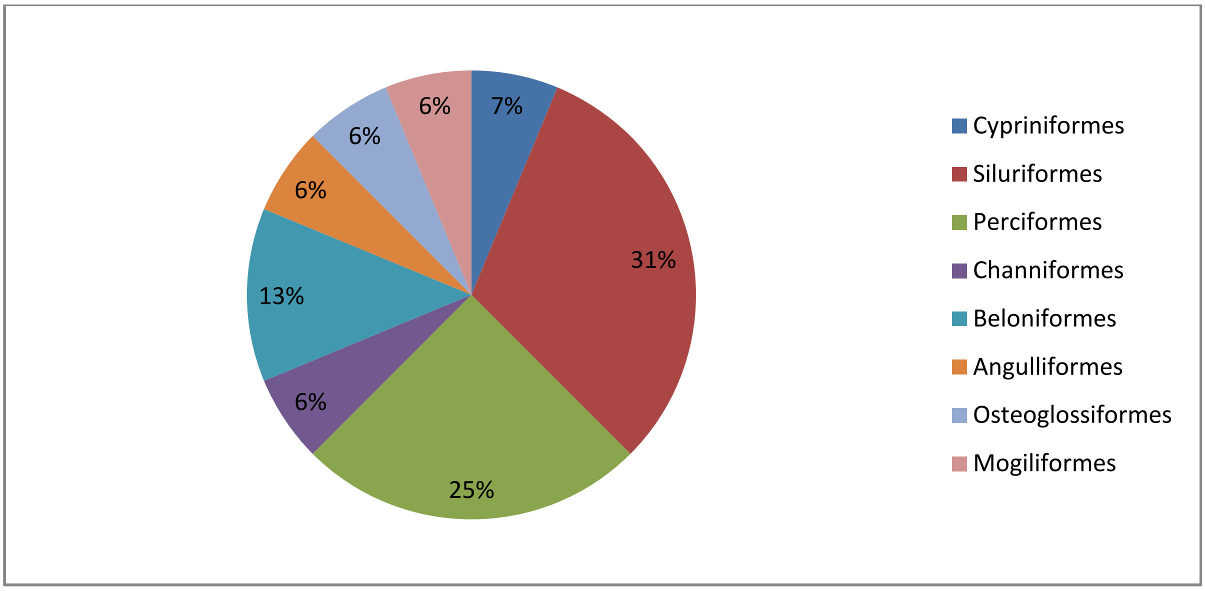

Fig. 37 showing percent contribution of families to the orders

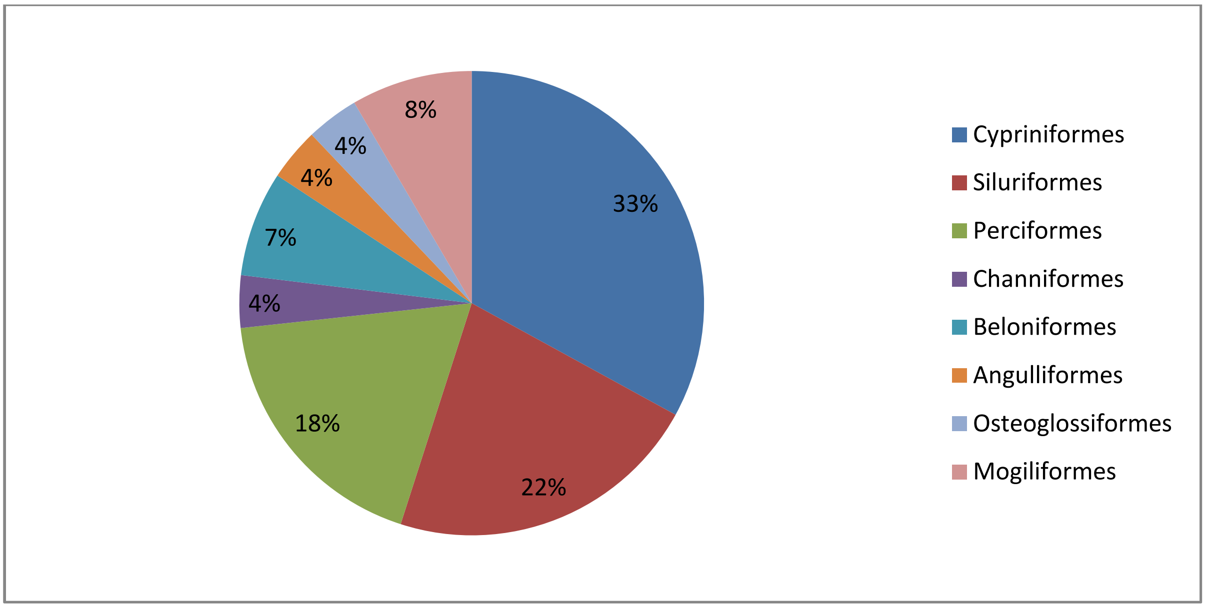

Fig. 38 showing percent contribution of genera to the orders

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 an order	% of species in an order
1	Cypriniformes	1	9	18	6.25	34.61	40.9
2	Siluriformes	5	6	11	31.25	23.07	25
3	Perciformes	4	5	6	25	19.23	13.63
4	Channiformes	1	1	4	6.25	3.84	9.09
5	Beloniformes	2	2	2	12.5	7.69	4.54
6	Angullifromes	1	1	1	6.25	3.84	2.27
7	Osteoglossiformes	1	1	1	6.25	3.84	2.27
8	Mogiliformes	1	1	1	6.25	8.84	2.27

Order Cypriniformes has been found to be a major order with 18 species and percent contribution of 40.90%. Siluriformes comes next with 11 species and percent contribution of 25%. Perciformes with five species and percent contribution of 13.63%. Chaniformes with four species and percent contribution of 9.09%. Beloniformes with two species and percent contribution of 4.54%. Angulliformes, Osteoglossiformes and Mogiliformes with one species each and percent contribution of 2.27% follow the order. Garg [26] have studied 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. Shahnawas [27] have studied order Cypriniformes was most dominant group with 62.30% fallowed by Siluriformes with 18.18%, Perciformes with 16.88%, Osteoglossiformes with 1.29% and Cyprinodontiformes with 1.29% percent contribution follow sequence.

Number and percent composition of genera and species under various families are presented in **(Table-3)**. The generic composition of fishes belonging to different families shows that nine genera under Cyprinidae contribute to 34.61%, two genera each under Siluridae and Ambassidae contribute to 7.69% each and one genus each under Bagridae, Schilbeidae, Claridae, Heteropneustidae, Gobiidae, Mastacembelidae, Osphronimidae and Migilidae contribute to 3.84% each. The species composition of fishes belonging to different families has revealed that 18 species are belonging to family cyprinidae that made up to 40.90%, six species to family Bagridae that contributed 13.63%, four species belonging to family Channidae constituting 9.09%, two species each to families Siluridae, Mastacembelidae and Ambassidae making to 4.54% and one species each to families Schilbeidae, Claridae Heteropneustidae, Anguillidae, Notopteridae, Belonidae, Exocoetidae, Gobiidae, Osphronimidae and Migilidae contributing 2.27% each of total fish species [28] **(Table-3)**.

Among all the 44 species recorded in reservoir one species (*Cyprinus carpio*) was exotic and others species were indigenous to Andhra Pradesh. According to the CAMP [22], 16 species of fish are Lower risk near threatened (LR-nt), six species of fish are Vulnerable (VU) and two species of fish is Endangered (EN). According to the IUCN [24], one species is Near threatened, one is Vulnerable, eight are data deficient (DD), ten are not evaluate (NE) and rest 24 are Least concerned were found [29] **(Table-1)**.

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	9	34.61	18	40.90
2	Bagridae	1	3.84	6	13.63
3	Siluridae	2	7.69	2	4.54
4	Schilbeidae	1	3.84	1	2.27
5	Claridae	1	3.84	1	2.24
6	Heteropneustidae	1	3.84	1	2.27
7	Anguillidae	1	3.84	1	2.27
8	Notopteridae	1	3.84	1	2.27
9	Belonidae	1	3.84	1	2.27
10	Exocoetidae	1	3.84	1	2.27
11	Channidae	1	3.84	4	9.09
12	Gobiidae	1	3.84	1	2.27
13	Mastacembelidae	1	3.84	2	4.54
14	Osphronimidae	1	3.84	1	2.27
15	Ambassidae	2	7.69	2	4.54
16	Migilidae	1	3.84	1	2.27

Diversity indices of fish species in Lower Manair reservoir presented **(Table-4)**. The fish species diversity (H^{-}) ranged from 2.569 to 3.102. The highest diversity was recorded in June 2011 the lowest in January 2011. These results indicate good diversity. Barthem [30] found variation in the Shannon-Weiner index of from 2.2 to 3.2. According to Wilhm and Dorris [31] Shannon index (H^{-}) values ranged from >3 indicates clean water. 1.00 to 3.00 indicates moderate water and <1.00 indicates heavily polluted water. The fish species diversity (J) ranged from 0.758 to 1.546. The highest diversity was recorded in July 2011 and lowest in February 2011. It is clearly indicate that there is evenly distribution of the fish fauna [22]. The richness of fish species ranged from 3.794 to 5.321. It was highest in July 2011 and lowest in May 2011.

Table-4: Diversity indices of fish species in Lower Manair reservoir.

Indices	Sep-10	Oct	Nov	Dec	Jan-11	Feb	Mar	April	May	June	July	Aug
H^{-}	2.706	2.677	2.632	2.684	2.569	2.898	3.034	3.036	2.888	3.102	2.967	3.054
J	1.134	0.813	0.916	0.795	0.809	0.758	0.928	1.044	0.772	1.391	1.546	1.444
S	4.651	4.258	4.257	4.324	4.213	3.843	4.675	4.274	3.794	6.063	5.321	5.126

H=Shannon-Weiner diversity index, J=Evenness diversity index, S= Species richness

CONSERVATION

Conservation steps have been found during present investigation that the stopping illegal fishing, identifying illegal protecting crucial breeding habitats, creating mass awareness are need to save the threatened fish fauna of this reservoir, also fishermen and protecting divers fish resources.

The biotic indices of Shannon-Weiner, Evenness and richness were fairly significant in during study period. The diversity of fish fauna is more in Lower Manair reservoir. It is recommended that further the reservoir can be consider being in good condition for fish production.

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