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ICHTHYOFAUNAL DIVERSITY OF NARAYANAPURAM ANICUT AT NAGAVALI RIVER, SRIKAKULAM DISTRICT OF ANDHRA PRADESH, INDIA

K. RAMA RAO[1*] AND R. RAMACHANDRA RAO[2]

[1]Department of Zoology, Govt. Degree College, Tekkali, Srikulam Dt -532202, Andhra Pradesh, India.
[2]Department of Zoology, Govt. Degree College for Men, Srikulam Dt -532201, Andhra Pradesh, India.

AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Ichthyofaunal diversity in Nagavali River at Narayanapuram anicut was observed from July 2019 to June 2021. The occurrence of Fifty six fish species belong to nine orders, 19 families and 34 genera. In the present investigation Cypriniformes was contributed to 42.86% of the total species followed by Siluriformes 23.21%, Perciformes 16.07%, Channiformes 7.14%, Osteoglossiformes, Cyprinodontiformes, Ostariophysi, Anguilliformes and Beloiniformes each with1.64.00%. The number and Percentage composition of Population Status is highest of common which contributed to 42.85% followed by abundant which contributed to 25.00%, moderate which contributed to 19.64% and moderate with 12.50%. Shannon-Weiner diversity Index (H) ranged from 0.91 to 1.57. The highest maximum diversity ln(S) was recorded in September and the lowest in April and May 2019 to 2021.

Keywords: Ichthyofauna; population status; Shannon-wiener index; IUCN; CAMP status.

1. INTRODUCTION

Nagavali is a major freshwater fishery resource in Srikakulam district of Andhra Pradesh. Thotapalli and Madduvalasa Reservoirs were constructed across the Nagavali River. Narayanapuram is a minor irrigation Anicut was constructed in the year 1959-1963 at Narayanapuram village of Burja Mandal, Srikakulam District. India is one of the ninth mega freshwater biodiversity areas in the world. There are 2,500 species of fishes were identified, of which 930 species are freshwater and 1,570 species are marine [1]. The freshwater fish diversity is drastic depleted by influence of over exploitation, habitat destruction and invaded exotic fish species. The streams, canals and rivers are affecting number of environmental

**Corresponding author: Email: drkarriramarao@gmail.com;*

problems throughout the globe and largely associated with anthropogenic activities. Inland fishing based on canals and tanks are major source of income for the fishing communities. The traditional fishers, nearly 200 families belonging to Scheduled and Backward Castes hold the fishing rights in these water bodies.

2. MATERIALS AND METHODS

2.1 Study Area

Narayanapuram Anicut was lies between East longitude 83° 48' 0" E, North latitude 18° 23' 0" N, The average monsoon rainfall 1024 mm. Narayanapuram Anicut is mainly used for irrigation and fishing along with Nagavali River. It is originates from a hill near Lakhbahai village in Thuamul Rampur block of Kalahandi District. It touches Nakrundi, Kerpai areas of Kalahandi, Kalyansinghpur and Rayagada of Rayagada district of Odisha and merged in Bay of Bengal Mofasbandar near Kallepalli village near Srikakulam of Andhra Pradesh State. The total length of the river is about 256 kilometers (Figs. 1, 2).

The study was done from July 2019 to June 2021. The fishes were collected from different sites with the help of local fishermen by using different types of gears (Drag nets, Push nets, Cast nets, Stationary gill nets) and Bamboo baskets (Traps) [2]. Collected fishes were washed thoroughly and photographed in fresh condition. These fishes were brought to the laboratory for fixing them in glass jars and preserved in 9-10% formalin solution [3]. The fish were identified to the species level including Exotic fishes with the help of the keys for fishes of the Indian subcontinent Identification of the species was done mainly on the morphometric and meristematic characters [4,5,3,6,7,8]. Exotic fishes The conservation status of the fish species have been listed based on IUCN (2021.1) [9] and CAMP [10].

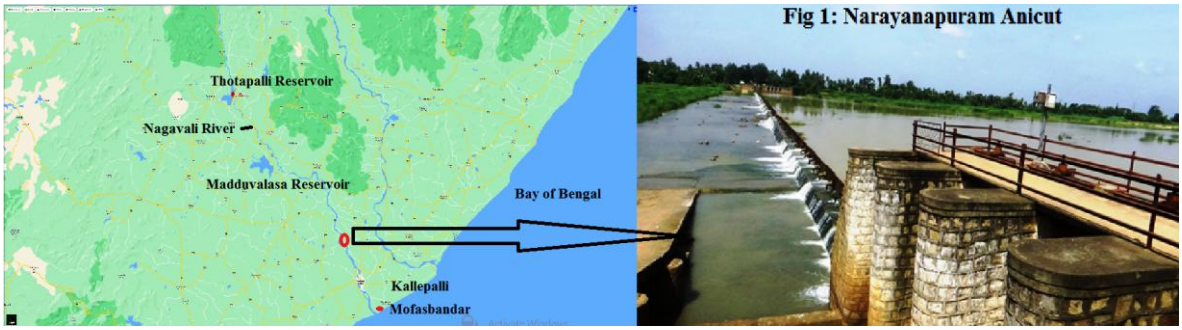


Fig. 1. Narayanapuram anicut

Fig. 2. Nagavali River

3. RESULTS

The results of the Ichthyofauna in Narayanapuram anicut along with Nagavali river from July 2019 to June 2021. The study revealed that the occurrence of fifty six species belong to nine orders, 19 families and 34 genera including eight exotic species (Plate 1). The list of Narayanapuram anicut fishes including their order, family, genus, species, common name, IUCN and CAMP status were recorded in the present investigation was given in Table 1. In the present study the number and percentage composition of families, genera and species under different orders are shown in Table 2 and Fig. 3. Order Cypriniformes was contributed to 42.86% of the total species followed by Siluriformes 23.21%, Perciformes 16.07%), Channiformes 7.14%, Osteoglossiformes, Cyprinodontiformes, Ostariophysi, Anguilliformes and Beloiniformes each with1.64%. Recorded out of 19families, Siluriformes contributed highest with 31.57% followed by Perciformes 26.31%, Cypiniformies 10.53%, Osteoglossiformes, Cyprinodontiformes, Anguilliformes, Beloiniformes and Channiformes each with 05.26%. Recorded genera out of 34, Cypiniformies contributed 38.24% of species followed by Siluriformes 23.21%, Perciformes 16.07%, Osteoglossiformes, Cyprinodontiformes, Ostariophysi, Anguilliformes, Beloiniformes and Channiformes each with 2.94%.

Present investigation is revealed that the number and percent composition of genera and species under various families were recorded in Table 3, Fig. 4. The generic composition of fishes belonging to different families shows that Cyprinidae contributed to 35.29%, Siluridae, Schilbeidae, Mastacembelidae and Ambassidae contributed to 5.88%, one genera each under Notopteridae, Cobitidae, Aplocheilidae, Bagridae, Clariidae, Pangasiidae, Heteropneustidae, Loricariidae, Anguillidae, Exocoetidae, Channidae, Gobiidae, Anabantidae and Cichlidae contributed to 2.94%. The species composition of fishes belonging to different families has revealed that the family Cyprinidae highest made up to 39.29%, followed by Bagridae that contributed to 8.93%, Channidae contributed to 7.14%, Cobitidae, Siluridae, Schilbeidae, Clariidae, Anguillidae, Cichilidae and Ambassidae each contributed to 3.57%. Notopteridae, Aplocheilidae, Pangasiidae, Loricariidae, Heteropneustidae, Exocoetidae, Gobiidae and Anabantidae constituted 1.79% each of total fish species.

The number and Percentage composition of Population Status is highest of common which contributed to 42.85% followed by abundant which contributed to 25.00%, moderate which contributed to 19.64% and moderate with 12.50% (Fig. 5). According to IUCN, 80.35% of species contributed to least concern (LC), 8.93% are not evaluated (NT), 5.36% are not evaluated (NE), 3.57% are data deficient (DD), 01.79% are endangered vulnerable (VU) (Table 4, Fig. 6). As per CAMP status of Not evaluated (NE) contributed to 41.07%, Low risk near threatened (LR nt) contributed to 30.36%, 16.07% of species of fish are vulnerable (VU), 11.47% is data deficient (DD) and endangered (EN) and 1.79% is low risk least concern (LRlc) (Table 4, Fig. 7).

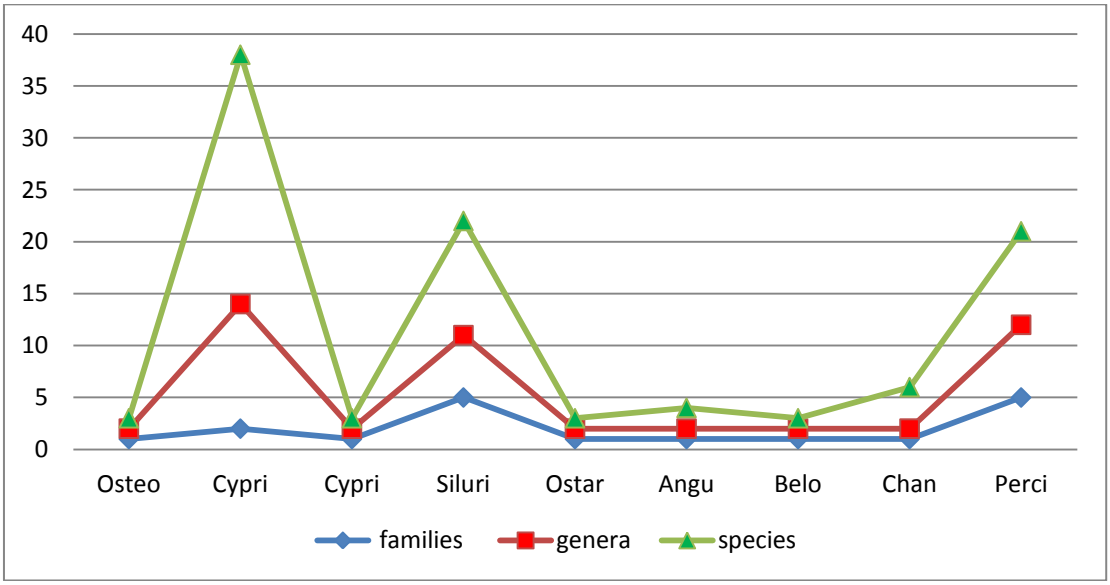


Fig. 3. Percent composition of families, genera and species

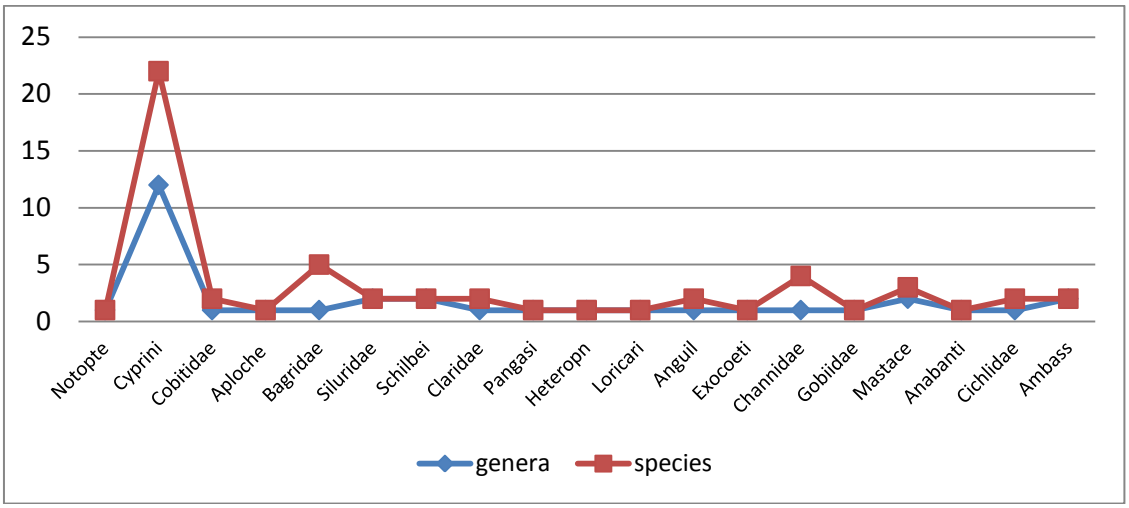


Fig. 4. Percentage composition of genera and species under various families

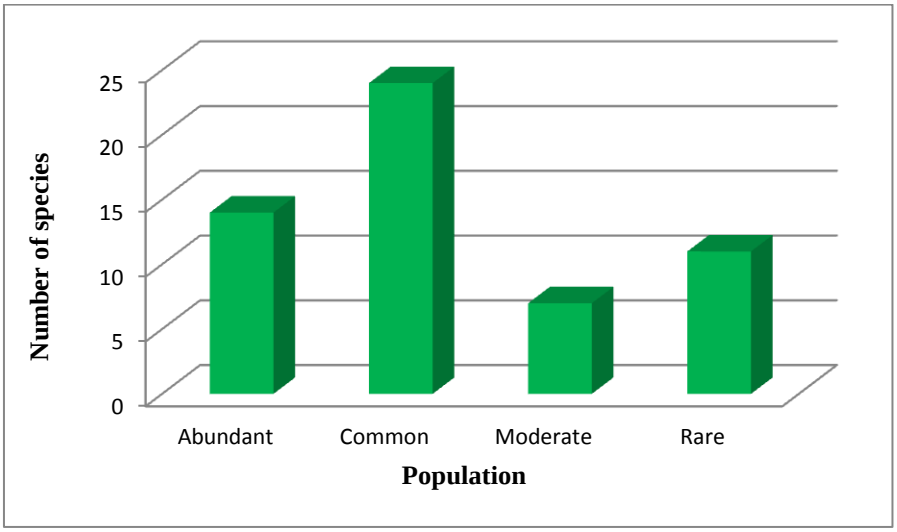


Fig. 5. Population status

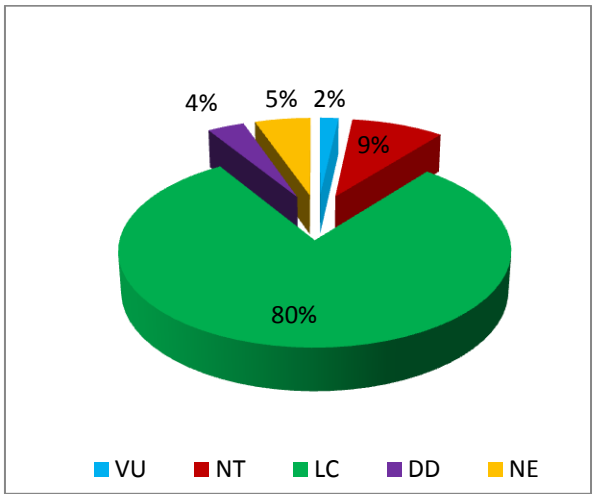


Fig. 6. IUCN (2021.1) [9]

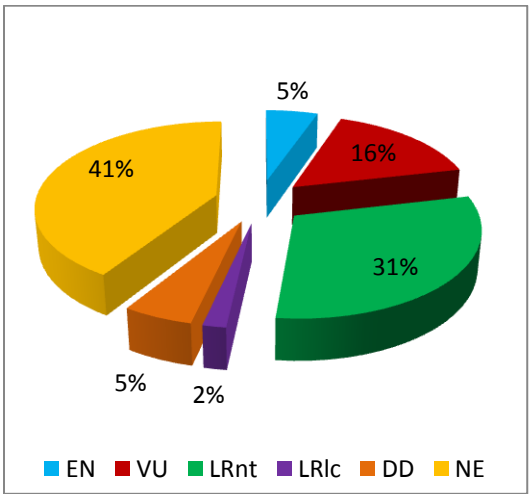


Fig. 7. CAMP status [10]

Table 1. List of fishes and their order, family, genus, species, population status, IUCN and CAMP status at Nagavali River – Plate 1

Order / Family	No.	Scientific Name	Population Status	IUCN Status (2021.1) [9]	CAMP Status 1998 [10]
Osteoglossiformes/	**I**				
1. Notopteridae (1)	1	*Notopterus notopterus*	C	LC	LRnt
Cypriniformes/	**II**				
2. Cyprinidae (21)	2	*Catla catla*	A	LC	LRnt
	3	*Labeo ariza*	C	LC	NE
	4	*Labeo calbasu*	C	LC	LRnt
	5	*Labeo dyocheilus*	R	LC	LRnt
	6	*Labeo rohita*	A	LC	LRnt
	7	*Cirrhinus mrigala*	A	LC	LRnt
	8	*Cirrhinus reba*	C	LC	VU
	9*	*Ctenopharyngodon idella*	C	LC	NE
	10*	*Cyprinus carpio*	M	VU	NE
	11*	*Hypopthalmicthys molitrix*	R	NT	NE
	12	*Osteobrama cotio cotio*	C	LC	LRnt
	13	*Puntius amphibius*	R	DD	NE
	14	*Puntius chola*	A	LC	VU
	15	*Puntius ticto*	A	LC	LRnt
	16	*Puntius sarana*	C	LC	VU
	17	*Puntius sophore*	A	LC	LRnt
	18	*Rasbora daniconius*	C	LC	LRnt
	19	*Salmostoma bacaila*	A	LC	DD
	20	*Salmostoma phulo*	C	LC	NE
	21	*Amblypharyngodon microlepis*	A	LC	NE
	22	*Amblypharyngodon mola*	A	LC	LRlc
	23	*Danio devario*	C	LC	NE
3. Cobitidae (2)	24	*Lepidocephalichthys berdmorei*	M	LC	NE
	25	*Lepidocephalichthys guntea*	M	LC	NE
Cyprinodontiformes/	**III**				
4. Aplocheiidae (1)	26	*Aplocheilus panchax*	C	LC	DD
Siluriformes/	**IV**				
5.Bagridae (5)	27	*Mystus bleekeri*	C	LC	VU
	28	*Mystus cavasius*	C	LC	LRnt
	29	*Mystus gulio*	R	LC	NE
	30	*Mystus tengara*	A	LC	NE
	31	*Mystus vittatus*	A	LC	VU
6. Siluridae (2)	32	*Ompok bimaculatus*	C	NT	EN
	33	*Wallago attu*	C	NT	LRnt
7. Schibeidae (2)	34	*Eutropiichthys vacha*	C	LC	VU
	35	*Pseudeutropius atherinoides*	C	LC	NE
8. Claridae (2)	36	*Clarias batrachus*	C	LC	NE
	37*	*Clarias gariepinus*	R	LC	NE
9. Heteropneustidae (1)	38	*Heteropneustes fossilis*	A	LC	VU
10. Pangasiidae	39*	*Pangasius pangasius*	R	LC	NE
Ostariophysi	**V**				

Order / Family	No.	Scientific Name	Population Status	IUCN Status (2021.1) [9]	CAMP Status 1998 [10]
11. Loricariidae	40*	*Pterygoplichthys pardalis*	R	NE	NE
Anguilliformes/	**VI**				
12. Anguillidae (1)	41	*Anguilla bengalensis bengalensis*	C	LC	EN
	42	*Anguilla bicolor bicolor*	M	LC	EN
Beloiniformes/	**VI**				
13. Exocoetidae (1)	43	*Hyporhamphus limbatus*	R	LC	NE
Channiformes/	**VII**				
14. Channidae (4)	44	*Channa marulius*	R	LC	LRnt
	45	*Channa orienalis*	C	NE	VU
	46	*Channa panctata*	A	LC	LRnt
	47	*Channa striatus*	C	LC	LRnt
Perciformes/	**VIII**				
15. Gobiidae (1)	48	*Glossogobius giuris*	C	LC	LRnt
16. Mastacembelidae (3)	49	*Mastacembelus armatus*	A	LC	VU
	50	*Mastacembelus pancalus*	M	LC	LRnt
	51	*Macrognathus aculates*	R	NE	NE
17. Anabantidae (1)	52	*Anabas testudineus*	M	DD	DD
18. Cichlidae (2)	53*	*Oreochromis mossambicus*	M	NT	NE
	54*	*Oreochromis niloticus*	R	NT	NE
19. Ambassidae (2)	55	*Chanda nama*	C	LC	NE
	56	*Ambassis ranga*	C	LC	NE

A= Abundant (76-100%); C = Common (51-75%); M = Moderate (26-50%); R = Rare (1-25%) of the total catch.
EN- Endangered; VU- Vulnerable: LRnt- Lower risk near threatened; LRlc- Lower risk least concern; LC- Least concern; DD- Data deficient; NE- Not evaluated, NT: Near threaten.
**Exotic fishes No.s: , 10, 11, 37, 39, 40, 53 and 54*

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

S. No	Orders	% of families in an order	% of genera in an order	% of species in an order
1	Osteoglossiformes	5.26	2.94	1.79
2	Cypriniformies	10.53	38.24	42.86
3	Cyprinodontiformes	5.26	2.94	1.79
4	Siluriformes	31.57	23.53	23.21
5	Ostariophysi	5.26	2.94	1.79
6	Anguilliformes	5.26	2.94	3.57
7	Beloiniformes	5.26	2.94	1.79
8	Channiformes	5.26	2.94	7.14
9	Perciformes	26.31	20.59	16.07

Shannon-Wiener Index diversity indices of fish species in Nagavali river at Narayana Puram anicut represented in richness of fish species was highest in September month and lowest in April and May. Shannon-Weiner diversity (H) ranged from 0.91 to 1.57. The highest diversity was recorded in October and the lowest in January. Maximum diversity possible ln(S) is highest in September and lowest in May. The highest Evenness reported in October and January and lowest in May. These results indicated that good diversity index having at Nagavali river at Narayanapuram anicut (Table 5, Figs. 8, 9, 10, 11). The results exhibit good fish diversity occurring in this stretch of the river.

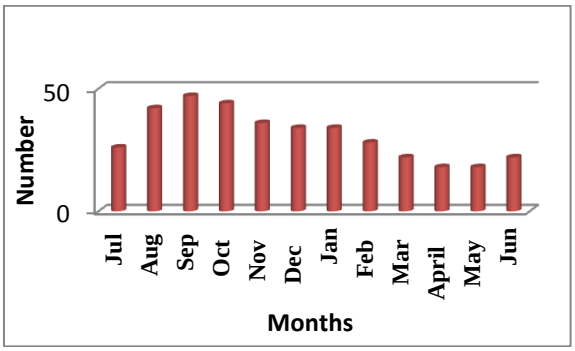


Fig. 8. Species richness

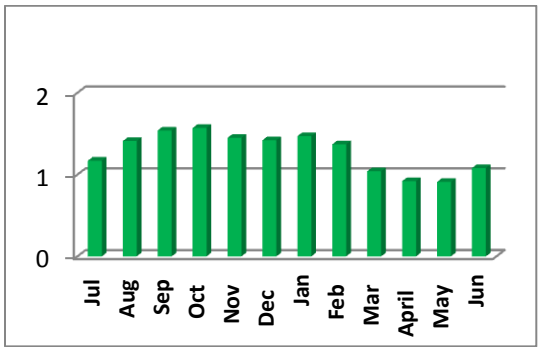


Fig. 9. Shannon-Weiner diversity (H)

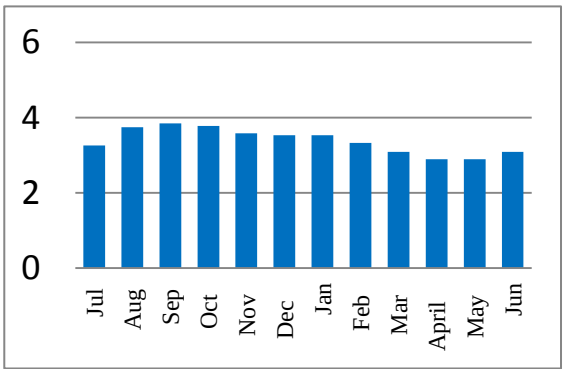


Fig. 10. Maximum diversity possible

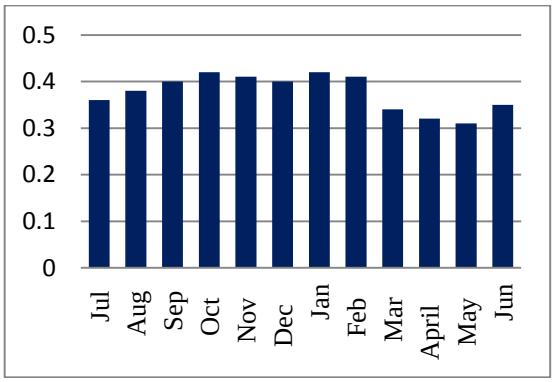


Fig. 11. Evenness E

Table 3. Number and percentage composition of genera and species under various families

S. No	Families	% of genera in a family	% of species in a family
1	Notopteridae	2.94	1.79
2	Cyprinidae	35.29	39.29
3	Cobitidae	2.94	3.57
4	Aplocheilidae	2.94	1.79
5	Bagridae	2.94	8.93
6	Siluridae	5.88	3.57
7	Schilbeidae	5.88	3.57
8	Claridae	2.94	3.57
9	Pangasiidae	2.94	1.79
10	Heteropneustidae	2.94	1.79
11	Loricariidae	2.94	1.79
12	Anguillidae	2.94	3.57
13	Exocoetidae	2.94	1.79
14	Channidae	2.94	7.14
15	Gobiidae	2.94	1.79
16	Mastacembelidae	5.88	5.36
17	Anabantidae	2.94	1.79
18	Cichlidae	2.94	3.57
19	Ambassidae	5.88	3.57
		34	56


Notopterus notopterus


Catla catla


Labeo ariza


Labeo calbasu


Labeo dyocheilus


Labeo rohita


Cirrhinus mrigala


Cirrhinus reba


Ctenopharyngodon idella


Cyprinus carpio

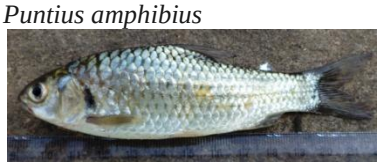

Hypophthalmichthys molitrix


Osteobrama cotio cotio


Puntius chola

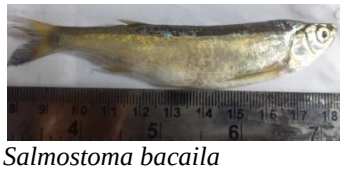

Puntius ticto


Puntius amphibius

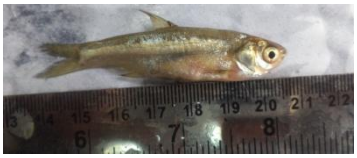

Puntius sarana sarana

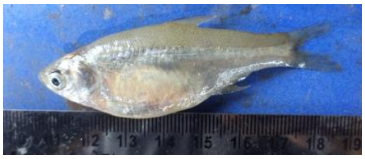

Puntius sophore


Rasbora daniconius


Salmostoma bacaila


Salmostoma phulo


Amblypharyngodon microlepis


Amblypharyngodon mola


Danio devario


Lepidocephalichthys berdmorei


Lepidocephalichthys guntea


Aplocheilus panchax


Mystus bleekeri


Mystus cavasius

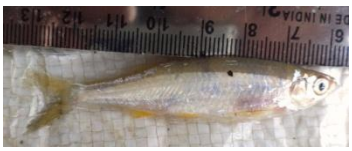

Mystus gulio

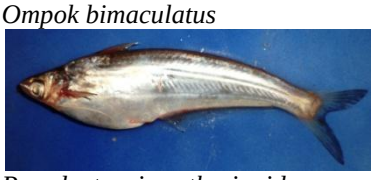

Mystus tengara


Mystus vittatus


Ompok bimaculatus


Wallago attu


Eutropiichthys vacha


Pseudeutropius atherinoides


Clarias batrachus

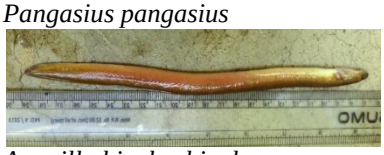

Clarias gariepinus


Heteropneustes fossilis


Pangasius pangasius


Pterygoplichthys pardalis


Anguilla bengalensis


Anguilla bicolor bicolor


Hyporhamphus limbatus


Channa marulius


Channa orienalis


Channa panctata


Channa striata


Glossogobius giuris


Mastacembelus armatus


Mastacembelus pancalus


Macrognathus aculates

Anabas testudineus

Oreochromis mossambicus

Oreochromis niloticus

Chanda nama

Ambassis ranga

Plate 1.

Table 4. Percentage occurrence of fish species in Nagavali River under the conservation status IUCN (2021.1) [9] and CAMP [10]

Category		EN	VU	NT	LRnt	LRlc	LC	DD	NE
IUCN (2021.1) [9]	No. of species	-	01	05	-	-	45	02	03
	% contribution	-	1.79	8.93	-	-	80.35	3.57	5.36
CAMP [10]	No. of species	03	09	-	17	01	-	03	23
	% contribution	5.36	16.07	-	30.36	1.79	-	5.36	41.07

Table 5. Shannon-Weiner diversity index in Nagavali River from July 2019 to June 2021

Fish Population / Monthly	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April	May	Jun
Species richness	26	42	47	44	36	34	34	28	22	18	18	22
Shannon-Weiner diversity(H)	1.17	1.41	1.54	1.57	1.45	1.42	1.47	1.37	1.04	0.92	0.91	1.08
Maximum diversity possible **ln(S)**	3.26	3.74	3.85	3.78	3.58	3.53	3.53	3.33	3.09	2.89	2.89	3.09
Evenness **E**	0.36	0.38	0.40	0.42	0.41	0.40	0.42	0.41	0.34	0.32	0.31	0.35

4. DISCUSSION

The results of the Ichthyofauna in Narayanapuram anicut along with Nagavali river the occurrence of fifty six species belong to nine orders, 19 families and 34 genera. The impact of exotic fishes on aquatic biodiversity in India and freshwater fish diversity reported by Biju Kumar [8]. Order Cypriniformes was contributed to 42.86% of the total species followed by Siluriformes 23.21%, Perciformes 16.07%), Channiformes 7.14%, Osteoglossiformes, Cyprinodontiformes, Ostariophysi, Anguilliformes and Beloiniformes each with1.64%. The similar results were earlier made by Vijayalaxmi et al. [11], Chandra Sekhara Rao et al. [12], Renuka and Heena Mubeen, [13]. Recorded 19families, Siluriformes contributed highest with 31.57% followed by other represented families. Mukunda Rao, and Ramachandra Rao, [14] identified to forty six fish species of 54 wetlands in Srikakulam District in Andrapradesh state. The number and Percentage composition of Population Status is highest of common which contributed to 42.85% followed by abundant which contributed to 25.00%, moderate which contributed to 19.64% and moderate with 12.50%. Rama Rao and Vinod Kumar [15] represented the population status is 14 species were common which contributed to 35.90%, 11 species

abundant which contributed to 28.20%, 08 species moderate in the total catch. According to IUCN 80.35% of species contributed to least concern (LC), 8.93% are not evaluated (NT), 5.36% are not evaluated (NE), 3.57% are data deficient (DD), 01.79% are endangered vulnerable (VU). Ramaneswari and Sridhar, [16] made observations of the study reveled the presence of 31species with the occurrence of 28 species in Thotapalli reservoir and 26 species in Gottabarrage reservoir. Fourteen belonged to order Cypriniformes, five of Siluriformes, Order Cypriniformes showed its dominance in both reservoirs. Sanjay Paunikar [17] represented to 16 species of Cypriniformes, 7 species of Siluriformes, 3 species of Synbranchiformes, 6 species of Perciformes and 1 species of Beloniformes have been recorded. Shannon-Wiener Index diversity indices of fish species in Nagavali river at Narayana Puram anicut represented to richness, Shannon-Weiner diversity (H), Maximum diversity possible ln(S) and Evenness is high at September and October months. Rama Rao [18], Rama Rao and Vinod Kumar [15] observed the diversity indices results were good having in the Sunamudi Gedda. Nunoo and Agbo [19] calculated the species diversity is 1.67, it indicates a highly complex community of species interactions.

5. CONCLUSIONS

The present work provide a latest database of the 56 fish species and is the first ever documentation of fish fauna of the Nagavali River at Narayanapuram anicut. The study reveals that, there is sufficient number of species contributing significantly towards the River fishery. All the species are having edible value and the abundance in monsoon period when fish species becomes high capturing. The study revealed that many species like *Channa orienalis, Wallago attu, Ompok bimaculatus, Clarias batrachus, Heteropneustes fossilis, Macrognathus aculates* catch was depleted to comparatively early periods. The study area along with Nagavali River is being threatened by various human activities for destructive fishing.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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