Pakistan J. Zool., pp 1-12, 2024. **DOI**: https://dx.doi.org/10.17582/journal.pjz/20230820044600

An Annotated Checklist of Ichthyofaunal Diversity of the Godavari River, Andhra Pradesh, India

N. Veerabhadra Rao[1], P. Jawahar[2], N. Jayakumar[1], N.V. Sujathkumar[1], V. Rani[1], Ramesh Rathod[3] and Hari Prasad Mohale[1]*

[1]Fisheries College and Research Institute, Thoothukudi, Tamil Nadu Dr. J. Jayalalithaa Fisheries University, Tamil Nadu, India
[2]Tamil Nadu Dr. J. Jayalalithaa Fisheries University, Vettar River View Campus, Nagapattinam, Tamil Nadu, India
[3]Regional Centre for Central Institute of Freshwater Aquaculture, Vijayawada

Article Information
Received 20 August 2023
Revised 05 December 2023
Accepted 26 December 2023
Available online 23 May 2024
(early access)

Authors' Contribution
All authors contributed to the planning and structuring of the topic of the article. PJ suggested the topic and collection of review papers. NJ reviewed the initial script and suggested it. All authors must be read and suggested up to final manuscript and lots of helps.

Key words
Ichthyofauna, Species diversity, Species richness, Species evenness, Trophic level, IUCN status

ABSTRACT

A thorough examination of Ichthyofaunal diversity was carried out in the Godavari River in Andhra Pradesh from February 2022 to July 2023. The samples were identified up to the species level using standard taxonomic approaches such as morphometric, meristic, and descriptive features. A total of 88 fish species were reported in the six selected landing stations including 10 brackish water and 5 exotic fishes at Godavari River. An updated, comprehensive checklist of finfish with their current scientific names, trophic level, fishery status, and IUCN status was prepared after verification. Among the 16 orders, the order Cypriniformes was observed to have the highest contribution to the species diversity with 4 families, 19 genera, and 33 species, followed by Siluriformes with 19 species, and Cyprinodontiformes, Elopiformes, Gonorynchiformes, and Mulliformes with 1 family, 1 genera and 1 species. Among the six selected sampling stations, Rajamahendravaram was found to have rich species diversity, documented with 88 fish species followed by Dowleswaram 86 species, Kovvur 82 species, Tallapudi 72 species, Kunavaram 63 species, and Polavaram 41 species. Shannon - Wiener species diversity (H'), Species richness (d), and Species evenness (J) were represented during the study period.

INTRODUCTION

The Godavari River is India's second-longest river after the Ganga and drains into the country's third-biggest basin, which covers nearly 10% of the country's entire geographical area. The river is split into two streams, the Gautami to the left and the Vasistha to the right defines the boundary between the West and East Godavari districts. After flowing approximately fifty miles from the Dowleswaram Barrage, the Godavari River empties into the Bay of Bengal. The dam alignment cuts through two midstream islands. The barrage was raised to 10.6 m in 1970. At 40 feet (12 m) MSL, the reservoir has a gross storage capacity of 3.12 Tmcft and a dead storage capacity of 2.02 Tmcft. The Indian subcontinent has around 2500 fish species, 930 of which are freshwater and 1570 of which are marine. There are 801 freshwater fishes present (Froese and Pauly 2002). Ichthyofaunal diversity refers to the diversity of fish species that exist depending on context and magnitude; it can relate to alleles or genotypes within life forms within a fish community as well as species or life forms that exist throughout aquaculture environments (Burton *et al*., 1992). There are approximately 21,723 extant fish species in the world, including 8,411 freshwater species and 11,650 marine forms. India is one of the world's mega-biodiversity countries, ranking ninth in terms of freshwater mega-biodiversity (Mittermeier and Mitemeir, 1997). Biodiversity is the degree of variation of living forms within a particular ecosystem; biodiversity is necessary for ecological stabilization, conservation of overall environmental quality, and comprehending the inherent worth of all species on the planet, as expressed by Ehrlich and Wilson (1991). The dominance and variations in the ichthyofauna in the Godavari River species diversity is a measure of variety among different ecosystems. Traditional fishers in Dowleswaram and surrounding

* Corresponding author: haricof92@gmail.com
0030-9923/2024/0001-0001 $ 9.00/0

regions, 107 families from scheduled and backward castes, have fishing rights in these bodies of water, which have been recognized by the Gram Panchayats or Fisheries Department as Fishermen Cooperative Societies. The current study major focus on the assessment of Ichthyofauna, and species diversity of the Godavari River and provides the most recent database of fish species and is the first description of fish fauna in Dowleswaram, Rajamahendravaram, Kovvur, Kunavaram, Thallapudi, and Polavaram.

MATERIALS AND METHODS

The Ichthyofaunal sampling was carried out fortnightly from February 2022 to July 2023. The fishes were collected from three landing stations and its surroundings Kunavaram 17.573948 S, 81.251645 E (S1), Rajamahendravaram 16.997316 S, 81.769521 E (S2), Dowleswaram 16.964258 S, 81.783943 E (S3), Kovvur 17.023706 S, 81.730387 E (S4), Tallapudi 17.125425 S, 81.669358 E (S5), and Polavaram 17.249289 S, 81.647236 E (S6). Representative species are collected carefully with the help of local fishermen by using different types of gears and basket traps (Rama, 2014). In the laboratory, the samples were washed thoroughly and images were captured. These fish were fixed in glass jars before being preserved in a 10% formalin solution. Following that, the samples were recognized up to the species level using classical taxonomic methods such as morphometric features, meristic counts, and descriptive characters. Fish species identification was validated using guidelines produced by Day (1958), Talwar and Jhingran (1991), Jayaram (1999), Menon (1999) and Munro (2000).

Biodiversity assessment

Spatiotemporal (monthly, seasonal) variations in the diversity indices are Shannon - Wiener species diversity (H‘), Pielous‘s evenness (J‘), Margalef‘s species richness (d), Taxonomic diversity (Δ) were calculated by using PRIMER v7 software. The Shannon-Wiener index was used to calculate fish diversity for each station, and the following formula was used: $H'=3.3219(N\log_{10}N-\sum ni–\log_{10}ni)/N$. The species richness for each station was calculated following Margalef’s index (d) using the formula, $d=(S-1)/\log_e N$.Species evenness is a measure of equability and how equally individuals are distributed among species. Pielou’s evenness (j’) was used to calculate evenness using the formula, J’=H’/log2SorH’/ln2S. This is an index of the average taxonomic difference between any two individuals selected at random from distinct species. It was calculated using the following formula: $\Delta=[\sum\sum i<j wij\ xixj]/[N(N-1)/2]$. It($\Delta^*$) was calculated using the following formula, $\Delta^*=[\sum\sum i<j wij]/[S(S-1)/2]$. The average taxonomic distinctness of all pairings of species is the average taxonomic distance between them. The formula was used to determine the average taxonomic distinctness index $\Delta+ = [\Sigma\Sigma i<j(wij-\Delta+)2]]/[S(S-1)/2]$. Biodiversity-rich places are more and have less variance than low-diversity ones. The taxonomic distinctness index ($\Lambda+$) variation was determined using the following formula: $/\backslash+=[\Sigma\Sigma i<j(wij-\Delta+)2]]/[S(S-1)/2]$. Total phylogenetic diversity (sPhi+), which ensures the taxonomic breadth of the fishes present at different sampling stations, was calculated by determining the cumulative branch length of the whole taxonomic tree built using the Linnaean classification.

Fig. 1. Sampling site.

RESULTS

The current study assessed the diversity and population characteristics of fish species in the Godavari River in Andhra Pradesh from February 2022 to July 2023. A total of 88 fish species were documented in the six selected landing stations including 10 brackish water and 5 exotic fishes at Godavari River. An updated, comprehensive checklist of finfish with their current scientific names, trophic level, fishery status, and IUCN status was prepared after verification with published literature and web-based information such as Fish Base (Froese and Pauly 2002), Catalog of Fishes (Eschmeyer, 2023) (Table I).

In the present study, a total of 88 finfish species (Supplementary Fig. 1). Belonging to 16 orders, 33 families, and 62 genera were recorded from the Godavari River. Among the 16 orders, the order Cypriniformes was observed to have the highest contribution to the species diversity (4 families, 19 genera and 33 species), followed by Siluriformes (7 families, 12 genera and 19 species), Anabantiformes (3 families, 3 genera and 6 species),

Table I. Checklist of Ichthyofaunal diversity of Godavari River.

S. No.	Taxa/ Scientific name	Habitat	Trophic level	Population status	IUCN status
Osteoglossiformes/ Notopteridae					
1	*Notopterus notopterus* (Pallas, 1769)	FW	3.5	C	LC
2	*Chitala chitala* (Hamilton, 1822)	FW	3.7	R	NT
Clupeiformes/ Dorosomatidae					
3	*Tenualosa ilisha* (Hamilton, 1822)	FW, BW, M	2.9	R	LC
Pristigasteridae					
4	*Opisthopterus tardoore* (Cuvier, 1829)	FW, BW, M	3.4	R	LC
Cypriniformes/ Cyprinidae					
5	*Catla catla* (Hamilton, 1822)	FW	2.8	A	LC
6	*Cirrhinus mrigala* (Hamilton, 1822)	FW	2.4	C	LC
7	*Cirrhinus reba* (Day, 1878)	FW	2.5	C	LC
8	*Cirrihinus cirrhosus*(Bloch, 1795*)*	FW	2.4	M	VU
9	*Cyprinus carpio communis* (Linnaeus, 1758)	FW	3.1	R	LC
10	*Garra gotyla* (Gray, 1830)	FW	2.0	M	LC
11	*Garra annandalei* (Hora, 1921)	FW	-	M	LC
12	*Gymnostomus ariza* (Hamilton, 1807)	FW	2.7	C	LC
13	*Labeo bata* (Day, 1878)	FW	-	C	LC
14	*Labeo boggut* (Sykes, 1839)	FW	-	M	LC
15	*Labeo calbasu* (Hamilton-Buchanan, 1822)	FW	2	C	LC
16	*Labeo fimbriatus* (Bloch, 1795)	FW	2	C	LC
17	*Labeo rohita* (Hamilton, 1822)	FW	2.2	A	LC
18	*Osteobrama cotio* (Hamilton, 1822)	FW	2.9	A	LC
19	*Osteobrama belangeri* (Valencienues, 1844)	FW	2.8	C	NT
20	*Osteobrama vigorsii* (Sykes, 1839)	FW	2.8	C	LC
21	*Puntius chola* (Hamilton, 1822)	FW	2.5	M	LC
22	*Puntius ticto* (Hamilton, 1822)	FW	2.2	M	LC
23	*Puntius sophore* (Hamilton, 1822)	FW	2.6	C	LC
24	*Puntius terio* (Hamilton, 1822)	FW	2.6	R	LC
25	*Systomus sarana* (Hamilton, 1822)	FW	2.9	C	LC
26	*Rohtee ogilbii* (Sykes, 1839)	FW	2.8	R	LC
Cypriniformes/ Danionidae					
27	*Barilius barila* (Hamilton, 1822)	FW	3.2	R	LC
28	*Danio devario* (Hamilton, 1822)	FW	3	C	LC
29	*Amblypharyngodon microlepis* (Bleeker, 1853)	FW	3.3	C	LC
30	*Amblypharyngodon mola* (Hamilton, 1822)	FW	3.3	C	LC
31	*Esomus danrica* (Hamilton, 1822)	FW	2.4	M	LC
32	*Rasbora daniconius* (Hamilton, 1822)	FW	3.1	M	LC
33	*Salmostoma bacaila* (Hamilton, 1822)	FW	3.2	C	LC
34	*Salmostoma phulo* (Hamilton, 1822)	FW	3.2	C	LC

Table continued on next page.....

S. No.	Taxa/ Scientific name	Habitat	Trophic level	Population status	IUCN status
Cypriniformes/ Nemacheilidae					
35	*Nemacheilus corica* (Hamilton, 1822)	FW	2.8	R	LC
Cypriniformes/ Xenocyprididae					
36	*Ctenopharyngodon idella* (Valencienues, 1844)	FW	2	M	LC
37	*Hypophthalmichthys molitrix* (Valencienues,1844)	FW, BW	2	M	NT
Cyprinodontiformes/ Aplocheiidae					
38	*Aplocheilus panchax* (Hamilton, 1822)	FW	3.8	C	LC
Elopiformes/ Megalopidae					
39	*Megalops cyprinoides* (Broussonet, 1782)	FW, BW, M	3.5	R	DD
Gonorynchiformes/ Chanidae					
40	*Chanos chanos* (Forsskal, 1775)	FW, BW, M	2.4	C	LC
Siluriformes/ Bagridae					
41	Mystus bleekeri (Day, 1877)	FW	3.3	A	LC
42	*Mystus cavasius* (Hamilton, 1822)	FW	3.4	A	LC
43	*Mystus tengara* (Hamilton, 1822)	FW	3.2	A	LC
44	*Mystus vittatus* (Bloch, 1794)	FW	3.1	A	LC
45	*Sperata aor* (Hamilton, 1822)	FW	3.6	C	LC
46	*Sperata seenghala* (Sykes, 1839)	FW	3.8	C	LC
47	*Rita kuturnee* (Sykes, 1839)	FW, BW	3.5	A	LC
48	*Rita rita* (Hamilton, 1822)	FW, BW	3.7	R	LC
Siluriformes/ Claridae					
49	*Clarias batrachus* (Linnaeus, 1758)	FW, BW	3.4	M	LC
50	*Clarias gariepinus* (Burchell, 1822)	FW	3.8	R	LC
Siluriformes/ Heteropneustidae					
51	*Heteropneustes fossilis* (Bloch, 1794)	FW, BW	3.6	M	LC
Siluriformes/ Pangasiidae					
52	*Pangasius pangasius* (Hamilton, 1822)	FW, BW	3.4	R	LC
Siluriformes/ Schilbeidae					
53	*Eutropiichthys vacha* (Hamilton, 1822)	FW, BW	3.9	A	LC
54	*Proeutropiichthys taakree* (Sykes, 1839)	FW	3.2	C	LC
55	*Silonia silondia* (Hamilton, 1822)	FW, BW	3.5	R	LC
Siluriformes/Siluridae					
56	*Ompok bimaculatus* (Bloch, 1794)	FW, BW	3.9	C	NT
57	*Ompok pabda* (Hamilton, 1822)	FW	3.8	C	NT
58	*Wallago attu* (Bloch and Schneider, 1801)	FW, BW	3.7	R	VU
Siluriformes/ Sisoridae					
59	*Bagarius bagarius* (Hamilton, 1822)	FW, BW	3.7	R	VU
Anguilliformes/ Anguillidae					
60	*Anguilla bengalensis* (Gray, 1830)	FW, BW	3.8	M	NT
61	*Anguilla bicolour* (McClelland, 1844)	FW, BW	3.6	R	NT

Table continued on next page.....

S. No.	Taxa/ Scientific name	Habitat	Trophic level	Population status	IUCN status
Beloiniformes/ Belonidae					
62	*Xenentodon cancila* (Hamilton, 1822)	FW, BW	3.9	R	DD
Beloiniformes/ Hemiramphidae					
63	*Hyporhamphus limbatus* (Valencienues, 1847)	FW, BW	3.1	R	LC
Anabantiformes/ Channidae					
64	*Channa marulius* (Hamilton, 1822)	FW	4.5	C	LC
65	*Channa orientalis* (Bloch and Schneider, 1801)	FW, BW	3.8	C	VU
66	*Channa panctata* (Bloch, 1793)	FW, BW	3.8	A	LC
67	*Channa striata* (Bloch, 1793)	FW, BW	3.6	C	LC
Anabantiformes/ Osphronemidae					
68	*Trichogaster fasciata* (Bloch and Schneider, 1801)	FW	2.8	R	LC
Anabantiformes/ Anabantidae					
69	*Anabas testudineus* (Bloch, 1792)	FW, BW	3	M	LC
Synbranchiformes/ Mastacembelidae					
70	*Mastacembelus armatus* (Lacepède, 1800))	FW, BW	2.8	C	LC
Synbranchiformes/ Mastacembelidae					
71	*Macrognathus pancalus* (Hamilton, 1822)	FW, BW	3.5	A	LC
Gobiiformes/ Gobiidae					
72	*Psammogobius biocellatus* (Valencienues, 1847)	FW, BW, M	3.4	M	LC
73	*Glossogobius giuris* (Hamilton, 1822)	FW, BW, M	3.7	A	LC
74	*Awaous grammepomus* (Bleeker, 1849)	FW, BW	3.3	C	LC
Gobiiformes/ Eleotridae					
75	*Eleotris fusca* (Forster, 1801)	FW, BW, M	3.8	R	LC
Cichliformes/ Cichlidae					
76	*Oreochromis mossambicus* (Peters, 1852)	FW, BW	2.2	C	VU
77	*Pseudetroplus maculates* (Bloch, 1795)	FW, BW	2.7	C	LC
78	*Etroplus suratensis* (Bloch, 1790)	FW, BW	2.9	C	LC
Cichliformes/ Nandidae					
79	*Nandus nandus* (Hamilton, 1822)	FW, BW	3.9	M	LC
Cichliformes/ Ambassidae					
80	*Chanda nama* (Hamilton, 1822)	FW, BW	3.6	C	LC
Cichliformes/ Ambassidae					
81	*Parambassis ranga* (Hamilton, 1822)	FW, BW	3.5	C	LC
Perciformes/ Sciaenidae					
82	*Johnius coitor* (Hamilton, 1822)	FW, BW, M	3.4	R	LC
Perciformes/ Latidae					
83	*Lates calcarifer* (Bloch, 1790)	FW, BW, M	3.8	M	LC
Mulliformes/ Mullidae					
84	*Upeneus vittatus* (Forsskål, 1775)	BW, M	3.6	R	LC
85	*Mugil cephalus* (Linnaeus, 1758)	FW, BW, M	2.5	C	LC
86	*Planiliza macrolepis* (Smith, 1846)	FW, BW, M	2.6	R	LC
87	*Planiliza parsia* (Hamilton, 1822)	FW, BW, M	2	C	NE
88	*Rhinomugil corsula* (Hamilton, 1822)	FW, BW	2.4	C	LC

DD, data dificient; LC, least concern; NE, not evaluated; VU, vulnerable; R, rare; C, common; A, abundant; M, moderate; FW, freshwater fish; BW, brackish waterfish; M, migratory field.

Perciformes (4 families, 5 genera and 5 species), Gobiiformes (2 families, 4 genera and 4 species), Cichliformes (1 family, 3 genera and 3 species), Mugiliformes (1 family, 3 genera and 4 species), Clupeiformesand Beloiniformes (2 family, 2 genera and 2 species), Osteoglossiformes and Synbranchiformes (1 family, 2 genera and 2 species), Anguilliformes (1 family, 1 genera and 2 species), Cyprinodontiformes, Elopiformes, Gonorynchiformes, and Mulliformes (1 family, 1 genera and 1 species) (Fig. 2).

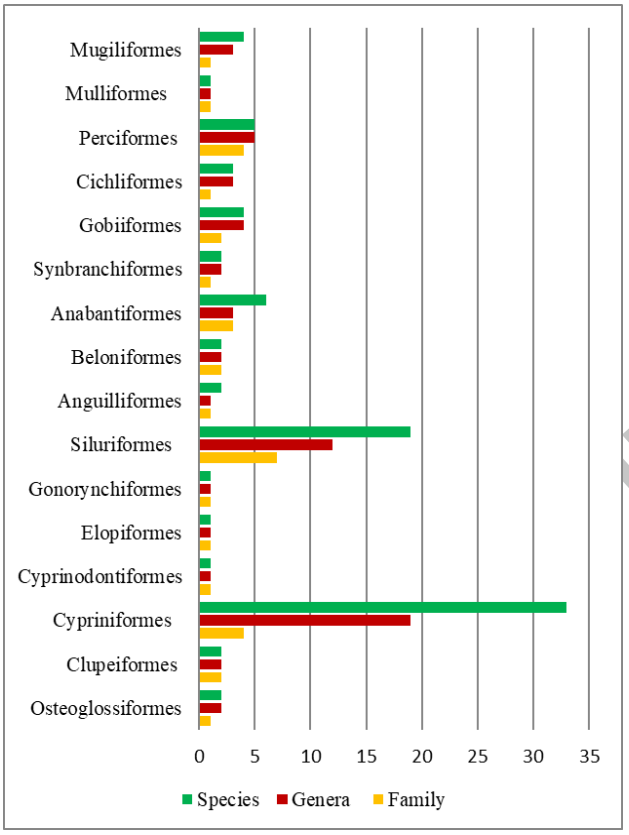


Fig. 2. Order-wise representation of Ichthyofaunal diversity.

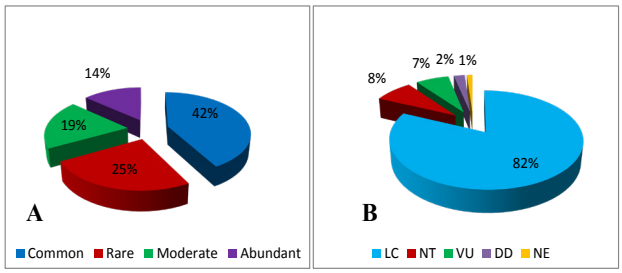


Fig. 3. Ichthyofaunal diversity (A), population status; B, IUCN status. For abbreviations, see Table I.

The trophic-level community structure of recorded fish species revealed the dominance of omnivores (69.31%) followed by carnivores (25%) and herbivores or planktivores (5.69%). The population status reported species were common (42.05%), rare (25.00%), moderate (19.31%), and abundant (13.63%) (Fig. 3). The IUCN status of recorded species was classified mostly as least concern (81.81%), followed by near threatened (8.64%), vulnerable (6.81%), data deficient (2.27%), and not evaluated (1.13%) (Fig. 3). Near-threatened and vulnerable species contributed to the tune of 15.45%. Among the 88 species identified in the river, 53.40% were determined to be food fishes to fulfill human nutritional requirements, 28.40% were ornamental, 12.5% were food and ornamental, and 5.68% served as food and game fish. In this region, 21 species were considered to be highly commercial, 37 species to be commercial, and 29 species to be of modest value. Further species diversity was found to be the highest during the Monsoon season compared to other seasons. *Labeo rohita* and *Catla catla* are found to be dominant species in total landing stations.

Among the six selected sampling stations, Rajamahendravaram was found to have rich species diversity, documented with 88 fish species followed by Dowleswaram 86 species, Kovvur 82 species, Tallapudi 72 species, Kunavaram 63 species, and Polavaram 41 species. Variations in the Spatial Shannon-Wiener species diversity [H ($\log^2$)] are represented in (Fig. 3). The highest H‘value was observed at Rajamahendravaram (5.616) followed by Dowleswaram (5.553), Kovvur (5.473), Tallapudi (5.455), Kunavaram (5.368), and lowest at Polavaram (5.031). Variations in the monthly H’values were observed to be within the range of 4.676 to5.652 (Fig. 4B). Variations in the seasonal H‘values for the Godavari River were estimated to be within the range of 4.994 to 5.630 (Fig. 4C). The Shannon - Wiener species diversity (H‘) values for seasonal were in the following order: North East monsoon>South West monsoon >Winter period>Hot weather period.

Variations in the spatial for species richness (d) are given in (Fig. 4A). The Margalef species richness highest was observed at Rajamahendravaram (8.162), followed by Dowleswaram (8.043), Kovvur (7.807), Tallapudi (7.031), Kunavaram (6.095) and lowest at Polavaram (3.816). The monthly values of species richness (d) for the Godavari River were found to be within the range of 3.458 to 8.747 (Fig. 4B). Species richness values for seasonal at Godavari River were estimated to be within the range of 4.190 to 9.087 (Fig. 4C). The Margalef richness for seasonal variations was in the following order: North East monsoon>South West monsoon >Winter period>Hot weather period. Species evenness expresses how evenly

the individuals in a community are distributed among the different species and it could be calculated by Pielous's evenness (J'). The evenness values range from zero to one, with zero, signifying no evenness and one, complete evenness. Spatial variation in species evenness highest was observed at Polavaram (0.952) followed by Kunavaram (0.898), Tallapudi (0.884), Rajamahendravaram (0.869), Dowleswaram (0.864), and Kovvur (0.860) (Fig. 3B). Species evenness (J') values for seasonal at Godavari River were observed to be within the range of 0.873 to 0.946 (Fig. 4B). The species evenness values month-wise estimated at Godavari River was observed to be within the range of 0.858 to 0.944 (Fig. 4C).

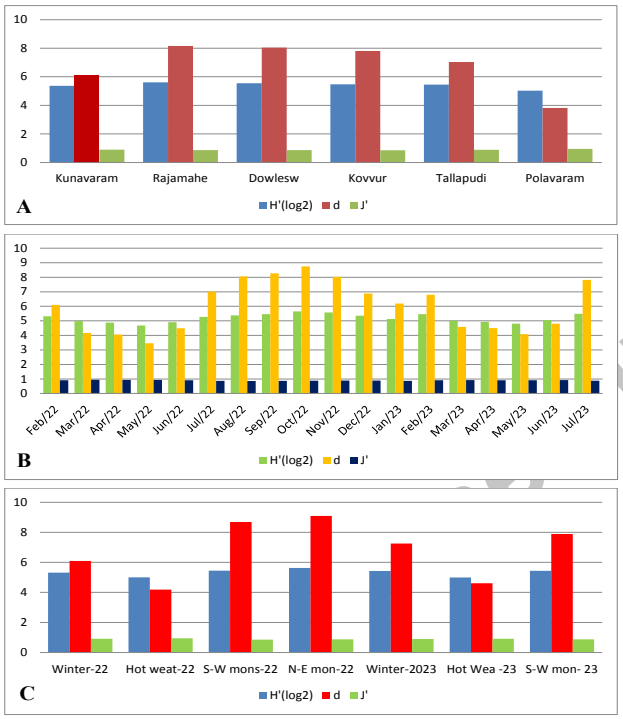


Fig. 4. Ichthyofaunal diversity indices: A, spatial variation; B, monthly variation; C, seasonal variation.

DISCUSSION

During the present research, an extensive survey was conducted on the ichthyofaunal diversity of the Godavari River, Andhra Pradesh from February 2022 to July 2023. Dominance and variations in the ichthyofauna in the Godavari River Species diversity is a measure of variety among different ecosystems. An updated checklist was prepared that included current scientific names, common names, habitat preference, trophic level, abundance, human utility, and IUCN Conservation Status. The current study is to evaluate the finfish varieties available at six selected landing stations in the Godavari River in Andhra Pradesh. In total, 88 fish species belonging to 16 orders, 33 families, and 62 genera were recorded in the Godavari River, including 10 brackish water and 6 exotic fishes. The number of fin fish observed appears to be significantly different from earlier observations. Pavinkumar (2014) previously recorded 100 ichthyofaunal species from 31 families and 60 genera in the pure freshwater zone, including migrating fishes in the Godavari River. Krishna-Prasad *et al*. (2012) documented the fish fauna of East Godavari inland water bodies, which includes 9 orders, 59 genera, and 146 species, some of which have lentic systems. Khedkar *et al*. (2014) found 114 fresh species in the Godavari River basin. When compared to the current study, these three authors found a wider range of organisms in river Godavari systems that included canals, tiny reservoirs, and huge tanks. Furthermore, 16 orders were recorded, which was more than the previous study by Krishna-Prasad *et al*. (2012), which found just 9 orders. Chinnababu *et al*. (2021) reported a total of 50 fish species from the selected locations of the Godavari River at Rajamahendravaram, which were significantly fewer than the current documented species. CIFE (2011) reported a total of 64 fish species belonging to 15 different families and 38 genera from Gangapur Dam to Raher in the Godavari River, Maharashtra. Earlier research found that the ichthyofaunal diversity of the Krishna River in Sangli District was 73 (Vishwakarma *et al*., 2014) and 106 (Laxmappa *et al*., 2015). The present species documented in the Godavari River are equivalent to the Krishna River's fish species richness. Furthermore, the species richness was found to be greater than in previous findings from Shillewar and Nanware (2008), Rankhamb (2011), and Balkhande *et al*. (2015) in the river Godavari.

Several researchers along the Narmada River have observed similar findings (Pathak *et al*., 2014; Vishwakarma *et al*., 2014; Siddiqui *et al*., 2014) are a few of the researchers have contributed to this work. The current study compares the number of orders and families with similarities to existing work. Tamboli and Jha (2010) identified 58 fish species from the Mahanadi River in the Janjgir Champa district of Chhattisgarh. Choubey and Qureshi (2013) identified 45 fish species from Rajnandgaon, Chhattisgarh, belonging to 15 families and 32 genera. In the Hirakud dam to Banki length of the Mahanadi River in Odisha, Singh (2014) found 56 species from 35 genera and 19 families. The research was done from 2017 to 2019 at 11 stations along the river from Bhagamandala in Karnataka to Poompuhar in Tamil Nadu and documented 146 fish species from 52 families CIFRI (2019). Six exotic species were documented throughout the research period:

Cyprinus carpio var. communis, Ctenopharyngodon idella, Hypopthalmichthys molitrix, Clarius gariepinus, and *Oreochromis mossambicus.* Common carp incidence was found to be high among these alien species, but African catfish occurrence was lower. Surprisingly, the presence of *Pterygoplichthys disjunctivus*, sucker-mouth catfish, and *Oreochromis niloticus* in the rivers Tamirabarani, Krishna, and Godavari (Laxmappa *et al*., 2015; Dinesh *et al*., 2020) has not been documented in the Godavari. Krishna Prasad *et al*. (2012) and Chinnababu *et al*. (2021) investigations found no evidence of these two species in the Godavari.

The order Cypriniformes was found to have the greatest contribution to species diversity among the 16 orders studied. Similar findings were made in other Indian rivers. Shillewar and Nanware (2008) reported similar results, observing that the order Cypriniformes was prevalent in the Godavari River near Nanded, with 13 fish species, followed by the order Silluriformes. The order Cypriniformes dominated the Godavari River, followed by the Siluriformes, according to Rankhamb (2011). Nilesh (2009) found 47 fish species in the north-eastern Godavari basin, with 15 species belonging to the dominating Cypriniformes group. CIFRI (2015) noticed 148 ichthyofaunal species divided into 49 groups, with Cyprinid species dominating with 43, followed by Bagrids (8) and Schilbids (6). Similar Cypriniformes dominance was recorded by (Krishna-Prasad *et al*., 2012; Kumar *et al*., 2013; Laxmappa *et al*., 2015; Chinnababu *et al*., 2021). This study also confirms that the order Cypriniformes is a diverse freshwater fish group in the Caribbean fauna of tropical Asia Kahar *et al*. (2023).

The Asian region has a limited grasp of fish faunal richness and conservation issues. The IUCN rated the observed species as Least Concern (81.81%) in the current study, followed by Near threatened (8.64%), vulnerable (6.81%), data deficient (2.27%), and not evaluated (1.13%). *Channa orientalis, Oreochromis mossambicus, Cirrhinus cirrhosa, Wallogo attu,* and *Bagarius bagarius* numbers were rapidly falling. These populations are vulnerable to extinction shortly, although they are not actively threatened. The near threatened genus *Anguilla, Ompak, Chitala,* and *Osteobrama* must be given due conservation initiative to sustain the stock. Freshwater fish diversity is currently declining at an alarming rate Sarkar *et al*. (2008), with 17 species critically endangered, 69 species endangered, and 81 species vulnerable in the Eastern Himalayas and Western Ghats (Allen *et al*., 2010; Molur *et al*., 2011). Swapnil *et al*. (2013) stated that Vulnerable (VU) 10.96%, near threatened (NT) 2.74%, and Endangered (EN) 17.81% of the freshwater fish fauna of Godavari, Maharashtra State. Around 54 fish species were of least concern, 4 near threatened, three vulnerable, five endangered, and two data deficient in the Krishna River. Recently Ray *et al*. (2022) reported that one species was endangered, three as near threatened, and 11 as data deficient in Gowthami-Godavari estuarine ecosystems. Further, he noted five exotic species were the most dominating.

In the present study, the fish species documented in Rajamahendravaram have the highest species diversity among the six sample stations, with 88 fish species, followed by Dowleswaram with 86, Kovvur with 82, Tallapudi with 72, Kunavaram with 63, and Polavaram with 41 species. Similar findings were reported by Basavaraja *et al*. (2014) at Anjanapura reservoir, Karnataka, where the abundance and diversity of fish were found to be exceptionally high in the area of the water body. The lesser species recorded at Polavaram might be due to damming effect as speculated by (Morita and Yamamoto, 2002; Michio *et al*., 2007). Only one species falls below the trophic level of 4.1. The analysis of trophic niches of the available fish species in the six sampling sites of river Godavari indicated the dominance of the carnivores group with 48 species. Nearly 32 species fall in the trophic level of 2.1 to 3.0. This indicates the healthy nature of the Godavari River. The fish fauna of river Godavari exhibits a strong heterogeneity in species composition and trophic diversity. This conforms with earlier studies of (Jacobsen *et al*., 1997: Balkhande and Kulkarni, 2015), which indicate the healthiness of Godavari River fish diversity is good.

A riverine ecosystem can be described by the fish diversity. Shannon-Wiener species diversity (H‘) is widely used to compare diversity across habitats. In general, higher H’ values indicate a well-preserved ecosystem with increased fish diversity. The diversity increases with both the number of species and evenness. In the majority of the ecological studies, the values of H’ commonly range between 1.5 and 3.5 and it also exceeds 4.0. In the present investigation, the variations in monthly H’ values were observed to be within the range of 4.676 to5.652. Variations in the seasonal H‘ values for the Godavari River were estimated to be within the range of 4.994 to5.630. The Shannon-Weiner diversity index values are nearly similar to other riverine fisheries in various parts of India. According to Bhutekar and Aher (2019), the Shannon diversity index ranged from 2.35 to 3.03 across several sampling sites, the index of 3.03 is an undamaged environment. He observed that the increasing level of pollution and habitat disturbance rendered the water unsure for fish community growth, as evidenced by the decreased diversity index value at the polluted site (2.35) in the Godavari River at Ambad Stretch. The Shannon-Weiner diversity index varied greatly, ranging from 1.89 to 3.51.

It is not feasible to estimate the rate of reduction in fish variety due to a lack of past information from this river, but the current study would be valuable as baseline data for any future assessment following interlinking. The lowest Shannon Weiner index was calculated at Polavaram with 5.031 which itself indicates a better diversity. Most notably, our findings show that damming at Polavaram and habitat loss has a reduction in the fish biodiversity in the region. The diversity indices at all sampling sites were relatively high due to the occurrence of reasonable numbers of species in the area. Generally, H` is the value that combines species diversity and evenness, where >3.99 is considered as non-impacted; 3.00–3.99 slightly impacted; 2.00–2.99 moderately impacted and > 2.00, severely impacted Namin and Spurny (2004). The H' index above 4 indicated a rich diversity in the estuarine waters Pavinkumar *et al*. (2015). In the present investigation the higher number of fish species and their abundance, H' value was very high at Rajamahendravaram. Month wise S-W diversity was estimated from February 2022 to July 2023. The values ranged between 4.676 (in May 2022) and 5.652 (October 2022) which indicates the species diversity was high in river Godavari, Andhra Pradesh.

In the present study variations in the spatial for species richness (d), Margalef species richnesswas observed between stations. The highest species richness was observed at Rajamahendravaram (8.162), followed by Dowleswaram (8.043), Kovvur (7.807), Tallapudi (7.031), Kunavaram (6.095) and the lowest at Polavaram (3.816). The monthly values of species richness (d) for the Godavari River were found to be between 3.458 and 8.747 (October 2022). Species richness values for seasonal at Godavari River were estimated to be within the range of 4.190 (Hot weather period 2022) to 9.087 (Northeast monsoon, 2022). Negi and Mamgain (2013), recorded species richness variation is less than the present study values and ranged between 0.036 and 0.173. The low diversity of fish at site I may be due to its high elevation compared to site II in Uttarakhand's Tonnes River. The estimated fish species richness (FSR) by Singh (2014) was substantially different (P0.05) in all environments except channel confluence and scour pool. Trophic niche models might be beneficial for analyzing both changed and less altered fish habitats in tropical rivers. In this study, species diversity and richness were decreased in the lower area compared to the higher area Habit *et al*. (2006). In the current study, the estimated d' values for the variety of fishes in the Godavari River are more monthly (3.458 to 8.747) and seasonally (4.190 to 9.087).

Species richness has a significant impact on species evenness (J'). Species evenness becomes less as individual species' dominance grows Clarke and Warwick (2001), and values range from 0 to 1, with zero indicating no evenness and one indicating total evenness. The above concept holds well in the present study also. The monthly estimated Species evenness (J') values for the Godavari River were found to be between 0.858 (August 2022) and 0.944 (March 2022) in the present study, while the seasonal values were found to be between 0.873 (Northeast monsoon) and 0.946 (hot weather 2022). These results were found within the range of zero to one. The reported evenness values in the River Ghaghara ranged from 0.754 to 0.847, which were more equivalent to those recorded by Dinesh *et al*. (2020). Sudhan *et al*. (2017), reported a higher evenness (>0.9) for the fish species dwelling in the upper stream of Pechiparai. The maximum spatial variation in species evenness was recorded in Polavaram (0.952), while the lowest was observed at Kovvur (0.860). The evenness values computed for the Godavari River in this study are greater, indicating that the fish groups in the river are not under stress. The place where diversity and species richness usually have a lower evenness value. The higher diversity estimates at Kovvur had a lower evenness value of 0.860. The higher evenness at Polavaram represented lower species diversity. Similar observations were reported by Dinesh *et al*. (2020) and Clarke and Warwick (2001). Usually, the less variation in the communities between the species the evenness will be higher. When all the species are equally abundant the evenness index should be highest and decreases towards zero as the relative abundance of the species diverse away from evenness Kaur *et al*. (2017).

CONCLUSION

The conservation of Ichthyofaunal biodiversity is one of the most significant environmental challenges. All of the species are edible and abundant during the monsoon season when fish are in high demand. Conservation strategies such as banning illegal fishing, identifying illegal fishing, protecting crucial breeding locations, and raising public awareness were recognized as necessary during the present investigation to conserve vulnerable fish species. Fishing for threatened species should be prohibited. During the breeding season, fishing and the use of big-eyed gear should be strictly restricted. Anthropogenic stress and siltation hurt both fish production and the overall riverine ecology. Because exotic fish have a negative influence on aquatic biodiversity, strict regulations limiting the import of non-native species should be adopted. Authorities must take the necessary steps to decrease human activity in and around the river, as well as monitor physicochemical and biological characteristics regularly to prevent pollution of the river's environment.

DECLARATIONS

Acknowledgment

The author would like to thank Dr. J. Jayalalithaa Fisheries University for providing the essential facilities at Fisheries College and Research Institute in Thoothukudi, Tamil Nadu.

Funding

The study received no external funding.

Supplementary material

There is supplementary material associated with this article. Access the material online at: https://dx.doi.org/10.17582/journal.pjz/20230820044600

Statement of conflict of interest

The authors have declared no conflict of interest.

REFERENCES

Allen, D.J., Smith, K. and Darwall, W., 2010. Assessment methodology. In: *Compilers* (eds. D.J. Allen, S. Molur and B.A. Daniel). The status and distribution of freshwater biodiversity in the eastern Himalaya. Cambridge, UK and Gland, Switzerland: IUCN, and Coimbatore, India: Zoo Outreach Organisation.

Balkhande, V. and Kulkarni, A.N., 2015. Studies of ichthyofaunal diversity of Godavari River at Dhangar Takli Tq Purna Dist., Parbhani, Maharashtra, India. *Int. J. Anim. Biol*., **1**: 187-189.

Basavaraja, D., Narayana, J., Kiran, B.R. and Puttaiah, E.T., 2014. Fish diversity and abundance in relation to water quality of Anjanapura reservoir, Karnataka, India. *Int. J. Curr. Microbiol. appl. Sci*., **3**: 747–757.

Bhutekar, D.D. and Aher, S.B., 2019. Biological monitoring of riverine ecosystem and its correlation with water quality. *Biosci. Biotech. Res. Comm*., **12**: 194-202.

Burton, P.J., Balisky, A.E., Coward, L.P., Cumming, S.G. and Kneshwaw D.D., 1992. The value of managing biodiversity. *For. Chron*., **68**: 225-237. https://doi.org/10.5558/tfc68225-2

Chinnababu, S., Kantipriya, K., Viswanadham, A. and Paidi, S., 2021. Fish diversity of Godavari River at raja mahendravaram, Andhra Pradesh, India. *Ann. Roman. Soc. Cell Biol.,* **25**: 21017–21022.

Choubey, K. and Qureshi, Y., 2013. Study of ichthyofaunal biodiversity of Rajnandgaon town, CG, India. *Int. Res. J. biol. Sci*., **2**: 21-24.

CIFE, 2011. Assessment of riverine fisheries and linking with water quality restoration programme- river Godavari in Maharshatra. *Final Rep*., pp. 1-110.

CIFRI, 2000. River Godavari- Environment and fishery, ICAR-CIFRI Bulletin No.102, pp. 27.

CIFRI, 2015. Annual report 2014-2015. ICAR-Central Inland Fisheries Research Institute, Kolkata. pp. 163.

CIFRI, 2019. Annual report, April-December 2019. ICAR Central Inland Fisheries Research Institute, Kolkata. pp. 376.

Clarke, K.R. and Warwick, R.M., 2001. A further diversity index applicable to species lists; variation in taxonomic distinctness. *Mar. Ecol. Prog. Ser*., **216**: 265-278. https://doi.org/10.3354/meps216265

Day, F., 1958. The fishes of India, being a natural history of the fishes known to inhabit the seas and freshwater of India, Burma and Ceylon, text and atlas, London, William Dawson and Sons Ltd. pp. 195-198.

Dinesh, K., Maurya, A.K., Prasad, L., Singh, C.P., Radhakrishnan, K.V. and Somasekara, S.R., 2020. Fish biodiversity and its diversity indices in the Himalayan River Ghaghara at Northern India. *J. Entomol. Zool. Stud*., **8**: 1559-1564.

Ehrlich, P.R. and Wilson, E.O., 1991. Biodiversity studies science and policy. *Science*, **253**: 758-762. https://doi.org/10.1126/science.253.5021.758

Eschmeyer, 2023. https://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp

Froese, R. and Pauly, D., 2002. *FishBase: A global information system on fishes*. World Wide Web electronic publication http://www.fishbase.org.

Habit, E., Belk, M.C., Tuckfield, R.C. and Parra, O., 2006. Response of the fish community to human-induced changes in the Biobio River in Chile. *Freshw. Biol*., **51**: 1–11. https://doi.org/10.1111/j.1365-2427.2005.01461.x

Jacobsen, D., Schultz, R. and Encalada, A., 1997. Structure and diversity of stream invertebrate assemblages: The influence of temperature with altitude and latitude. *Freshw. Biol*., **38**: 247-261. https://doi.org/10.1046/j.1365-2427.1997.00210.x

Jayaram, K.C., 1981. The freshwater fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka- A Handbook. Zoological Survey of India, Culcutta. pp. 475.

Jayaram, K.C., 1999. *The freshwater fishes of the Indian region*. Narendra Publicat in New Delhi, India. pp 551.

Jayaram, K.C., 2011. *The freshwater fishes of Indian region.* Narendra Publication House, New Delhi,

2nd Edition.

Kahar, R., Ahmed, N. and Arai, T., 2023. Year-round spawning of three tropical Cyprini formes fishes in Southeast Asia. *Sci. Rep*., **13**: 8971. https://doi.org/10.1038/s41598-023-36065-9

Kaur, H., Datta, S.N. and Singh, A., 2017. Fish catch composition and biodiversity indices at harike wetland. A Ramsar site in India. *J. Anim. Res*., **7**: 935–941. https://doi.org/10.5958/2277-940X.2017.00142.5

Khedkar, G.D., Lutzky, S., Rathod, S., Kalyankar, A.D. and David, L., 2014. A dual role of dams in fragmentation and support of fish diversity across the Godavari River basin in India. *Ecohydrology*, **7**: 1470. https://doi.org/10.1002/eco.1470

Krishna-Prasad, K.S., Narasimha, R.K. and Benarjee, G., 2012. Icthyofauna diversity and its abundance in east Godavari District, Andhra Pradesh. *Nat. Environ. Pollut. Technol*., **11**: 675-679.

Kumar, D.B., Archisman, R., Canciyal, J., Verma, S.K., Absar, A., Baitha, R., Kumar, R.M., Shreya, R. and Sarkar, U.K., 2023. The present status of ichthyofaunal diversity of river Ganga India. *Acta Ecol. Sin*., **43**: 307-332. https://doi.org/10.1016/j.chnaes.2021.10.008

Kumar, N.A., Benakappa, S.S. and Somashekara, S.R., 2013. Studies on ichthyofaunal diversity of Karanja reservoir, Karnataka, India. *Int. Res. J. environ. Sci*., **2**: 38–43.

Lakra, W.S., Sarkar, U.K., Kumar, R.S., Pandey, A., Dubey, V.K. and Gusain, O.P., 2010. Fish diversity, habitat ecology and their conservation and management issues of a tropical River in Ganga basin, India. *Environmentalis,* pp. 1-13. https://doi.org/10.1007/s10669-010-9277-6

Laxmappa, B., Vamshi, S., Sunitha, P., Jithender, K. and Naik, S., 2015. Studies on invasion and impact of feral population of Nile tilapia (*Oreochromis niloticus*) in Krishna River of Mahabubnagar district in Telangana, India. *Int. J. Fish. Aquacult. Stud*., **2**: 273-276.

Menon, A.G.K., 1999. Check list freshwater fishes of India, records of the zoological survey of India. *Occasional*, **175**: 366.

Michio, F., Kameyama, S., Kaneko, M., Nakao, K. and Ashley, F.S., 2007. Modelling the effects of dams on freshwater fish distributions in Hokkaido, Japan. *FW Biol*., **52**: 1511–1524. https://doi.org/10.1111/j.1365-2427.2007.01783.x

Mittermeier, R.A. and Mittermeier, G.C., 1999. Megadiversity: Earth's biologically wealthiest nations. *Chelonian Conserv. Biol.,* **3**: 537-537..

Molur, S., Smith, K.G., Daniel, B.A. and Darwall, W.R.T., (Compilers). 2011. *The status and distribution of freshwater biodiversity in the western Ghats, India*. 1-116. Published by IUCN, Cambridge, UK and Gland, Switzerland: IUCN, and Coimbatore, India: Zoo Outreach Organisation.

Morita, K. and Yamamoto, S., 2002. Effects of habitat fragmentation by damming on the persistence of stream-dwelling charr populations. *Conserv. Biol*., **16**: 1318–1323. https://doi.org/10.1046/j.1523-1739.2002.01476.x

Munro, I.S.R., 2000. *The marine and freshwater fishes of ceylon*. Biotech Books, Delhi.

Naik, A.K., Kumar, J., Mahesh, V. and Benakappa, S., 2013. Assessment of fish diversity of Tunga river, Karnataka, India. *Nautr. Sci*., **11**: 82-87.

Namin, J.I. and Spurny, P., 2004. Fish community structure of the middle course of the Becva river. *Czech J. Anim. Sci*., **49**: 43-50. https://doi.org/10.17221/4270-CJAS

Negi, R.K. and Mamgain, S., 2013. Species diversity, abundance and distribution of fish community and conservation status of tons river of Uttarakhand State, India. *J. Fish. Aquacult. Sci*., **8**: 617-626. https://doi.org/10.3923/jfas.2013.617.626

Nilesh, K.H., 2009. Fish diversity studies of two rivers of the Northeastern Godavari basin, India. *J. Threat. Taxa*., **1**: 514-518. https://doi.org/10.11609/JoTT.o1764.514-8

Pathak, T., Borana, K. and Zafar, T., 2014. Ichthyofauna of western region of Narmada river, Madhya Pradesh. *Int. J. Res. appl. Natur. Soc. Sci*., **2**: 25-28.

Pavinkumar, P., 2014. *Fish diversity in selected estuaries of southern Tamil Nadu*. M.F.Sc thesis submitted to Tamil Nadu Dr. J. Jayalalithaa University, Nagapattinam.

Pavinkumar, P., Jawahar, P. and Mogalekar, H.S., 2015. Estuarine fish diversity of Manakudy estuary Kanyakumari District, Tamil Nadu, India. *J. environ. biol. Sci*., **29**: 523-528.

Rama, R.K., 2014. A study on fish in gcraftandgear in Lower Manair Dam, Karimnagar Dt. Andhra Pradesh, India. *Int. J. M. Dis. Educ. Res*., **5**: 56-68.

Rankhamb, S.V., 2011. Ichthyofaunal diversity of Godavari River at Mudgal Tq. Pathri, Dist. Parbhani. *Rec. Res. Sci. Technol*., **3**: 11-13.

Yodha, R.K. and Kumar, C.R., 2014. Studies on the fish species diversity of river Narmada in Khedighat, Barwaha, MP, India. *Int. J. Dev. Res. Eng*., **1**.

Ray, P., Giridhar, M., Johnson, J.A. and Sivakuma, K., 2022. An overview of the fish diversity and their threats in the Gowthami-Godavari Estuary

in Andhra Pradesh, India. *J. Threat Taxa*., **14**: 21588–21604. https://doi.org/10.11609/jott.7842.14.8.21588-21604

Sarkar, U.K., Pathak, A.K. and Lakra, W.S., 2008. Conservation of freshwater fish resources of India: new approaches, assessment and challenges. *Biodivers. Conserv*., **17**: 2495-2511. https://doi.org/10.1007/s10531-008-9396-2

Shillewar, K.S. and Nanware, S.S., 2008. Biodiversity of fishes of Godavari River at Nanded, India. *Biosci. Biotechnol. Res. Asia*, **5**: 867-870.

Siddiqui, A., Chouhan, M. and Sharma, S., 2014. Biodiversity of ichthyofauna of Narmada River of Mandleshwar Region, Madhya Pradesh, India. *Sci. Secur. J. environ. Biol*., **1**: 21-25.

Singh, T.K., 2014. Fish diversity in selected stretch of the River Mahanadi in Odisha and the livelihood of inhabiting fisher community. *Int. Res. J. biol. Sci*., **3**: 98-104.

Sudhan, C., Kingston, D.S., Jawhar, P. and Anand, S., 2017. An account on ichthyofaunal diversity aquaculture fish production in reservoirs of India. *J. Aquacult. Trop*., **32**: 261-292.

Swapnil, S., Ghatge, Shamkant, T., Shelke, S.S., Jadhav, N.A, Pawar, A. and Chaudhari, K., 2013. Inventory of endemic freshwater fish fauna of Maharashtra State: India. *Rec. Zool. Surv. India*. **113**: 79-92.

Talwar, P.K. and Jhingran, A.G., 1991. *Inland fishes of India and adjacent countries, Balkemra, Rotterdam*, Vol. A. 1991.

Tamboli, R.K. and Jha, Y.N., 2010. Status of piscine diversity of river Mahanadi in Janjgir Champa District. *Int. Res. J. Lab. Land*., **2**: 139-143.

Vishwakarma, K.S., Mir, A.A., Bhawsar, A. and Vyas, V., 2014. Assessment of Fish assemblage and distribution in Barna Stream Network in Narmada basin (Central India). *Int. J. Adv. Res*., **2**: 888- 897.

Pakistan J. Zool., pp 1-12, 2024. **DOI**: https://dx.doi.org/10.17582/journal.pjz/20230820044600

Supplementary Material

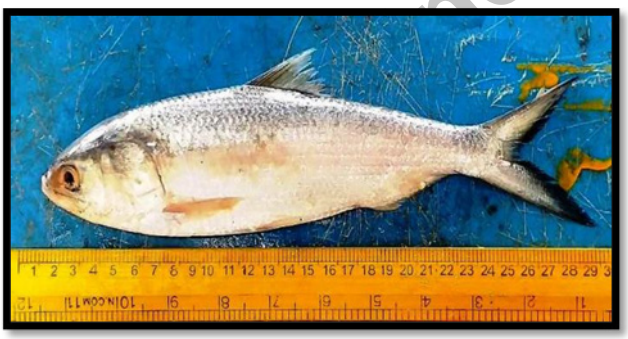
An Annotated Checklist of Ichthyofaunal Diversity of the Godavari River, Andhra Pradesh, India

N. Veerabhadra Rao[1], P. Jawahar[2], N. Jayakumar[1], N.V. Sujathkumar[1], V. Rani[1], Ramesh Rathod[3] and Hari Prasad Mohale[1]*

[1]Fisheries College and Research Institute, Thoothukudi, Tamil Nadu Dr. J. Jayalalithaa Fisheries University, Tamil Nadu, India
[2]Tamil Nadu Dr. J. Jayalalithaa Fisheries University, Vettar River View Campus, Nagapattinam, Tamil Nadu, India
[3]Regional Centre for Central Institute of Freshwater Aquaculture, Vijayawada

Notopterus notopterus **(Pallas, 1769)**

Chitala chitala **(Hamilton, 1822)**



Tenualosa ilisha **(Hamilton, 1822)**

Opisthopterus tardoore **(Cuvier, 1829)**

* Corresponding author: haricof92@gmail.com
0030-9923/2024/0001-0001 $ 9.00/0

Labeo catla **(Hamilton, 1822)**

Cirrhinus mrigala **(Hamilton, 1822)**

Cirrhinus reba **(Day, 1878)**

Cirrhinus cirrhosus (Bloch, 1795)

Cyprinus carpio communis (**Linnaeus, 1758*****)**

Garra gotyla **(Gray. 1830)**

Garra annandalei **(Hora, 1921)**

Gymnostomus ariza **(Hamilton, 1807)**

Labeo bata **(Day, 1878)**

Labeo boggut **(Sykes, 1839)**

Labeo calbasu **(Hamilton-Buchanan, 1822)**

Labeo fimbriatus **(Bloach, 1795)**

Labeo rohita **(Hamilton, 1822)**

Osteobrama cotio **(Hamilton, 1822)**

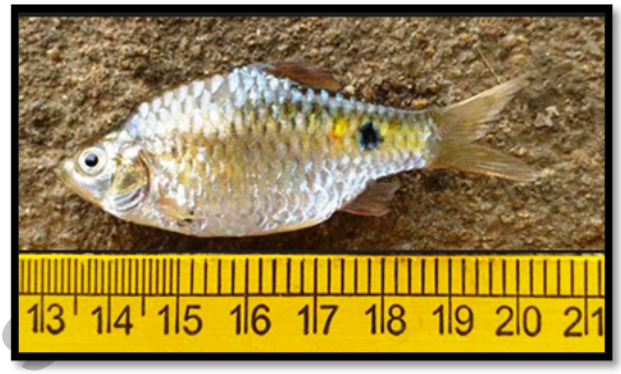
Osteobrama belangeri **(Valenciennes, 1844)**

Osteobrama vigorsii **(Sykes, 1839)**

Puntius chola **(Hamilton, 1822)**

Puntius ticto **(Hamilton, 1822)**

Puntius sophore **(Hamilton, 1822)**



Puntius terio **(Hamilton, 1822)**

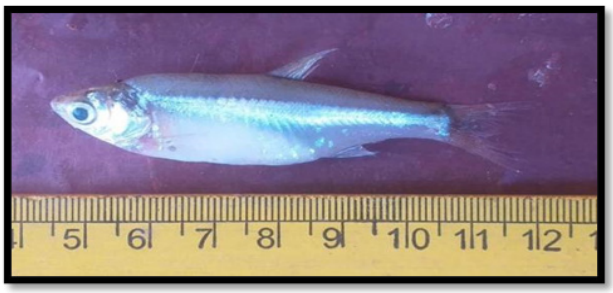
Systomus sarana **(Hamilton, 1822)**

Rohtee ogilbii **(Sykes, 1841)**

Barilius barila (Hamilton, 1822)

Danio devario **(Hamilton, 1822)**

Amblypharyngodon microlepis **(Bleeker, 1853)**



Amblypharyngodon mola **(Hamilton, 1822)**

*Esomus danricus(***Hamilton, 1822***)*

Rasbora daniconius **(Hamilton, 1822)**

Salmostoma bacaila **(Hamilton, 1822)**

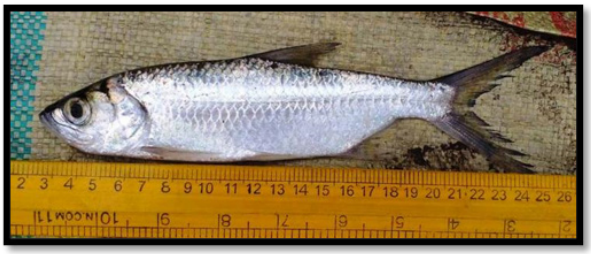
Salmostoma phu1lo **(Hamilton, 1822)**

Nemacheilus corica **(Hamilton, 1822)**

*Ctenopharyngodon idellus (***Valencienues, 1844***)*

Hypophthalmichthys molitrix **(Valencienns, 1844)**

Aplocheilus panchax **(Hamilton, 1822)**



Megalops cyprinoides **(Broussonet, 1782)**

Chanos chanos **(Forsskal, 1775)**

Mystus bleekeri **(Day, 1877)**

Mystus cavasius **(Hamilton, 1822)**

Mystus tengara **(Hamilton, 1822)**

Mystus vittatus **(Bloch, 1794)**

Spherata aor **(Hamilton, 1822)**

Spherata seenghala **(Sykes, 1839)**

Rita kuturnee **(Sykes, 1839)**

Rita rita **(Hamilton, 1822)**

Clarias batrachus **(Linneaeus, 1758)**

Clarias gariepinus **(Burchell, 1822)**

Heteropneustes fossilis **(Bloch, 1794)**

Pangasius pangasius **(Hamilton, 1822)**

Eutropiichthys vacha **(Hamilton, 1822)**

Proeutropiichthys taakree **(Sykes, 1839)**

Silonia silondia (**Hamilton, 1822)**

Ompok bimaculatus **(Bloch, 1794)**

Ompok pabda **(Hamilton, 1822)**

Wallago attu **(Bloach and Sckneider, 1801)**

Bagarius bagarius **(Hamilton, 1822)**

Anguilla bengalensis **(Gray, 1831)**

Anguilla bicolor **(Gray, 1831)**

Xenentodon cancila **(Hamilton, 1822)**

Hyporhamphus limbatus **(Valenciennes, 1847)**

Channa marulius **(Bloch and Schneider, 1801)**

Channa orientalis **(Bloch and Schneider, 1801)**

Channa punctata **(Bloch, 1793)**

Channa striata **(Bloch, 1794)**

Trichogaster fasciatus **(Bloch and Schneider, 1801)**

***Anabas testudineus (*Bloch, 1795)**

Mastacembelus armatus (*Lacepede, 1800*)

***Mastacembelus pancalus* (Hamilton, 1822)**

***Psammogobius biocellatus* (Valenciennes, 1837)**

***Glossogobius giuris* (Hamilton, 1822)**

***Awaous grammepomus* (Bleeker, 1849)**

***Eleotris fusca* (Forster, 1801)**

***Oreochromis mossambicus* (Peters, 1852)**

***Pseudetroplus maculates (*Bloch, 1795)**

***Etroplus suratensis* (Bloch, 1790)**

***Nandus nandas* (Hamilton, 1822)**

***Chanda nama* (Hamilton, 1822)**

***Parambassis ranga* (Hamilton, 1822)**

***Johnius coitor* (Hamilton, 1822)**

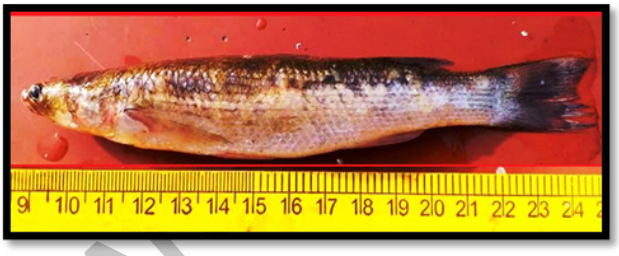
***Lates calcarifer* (Bloch, 1790)**

***Upeneus vittatus* (Forsskl, 1775)**

***Mugil cephalus* (Linnaeus, 1758)**

***Planiliza macrolepis* (Smith, 1846)**

***Planiliza parsia* (Hamliton, 1822)**



***Rhinomugil corsula* (Hamilton, 1822)**

Supplementary Fig. 1. Sample of Ichthyofaunal diversity of Godavari River.