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Ichthyofaunal diversity of Gotta Barrage at Hiramandalam, Vamsadhara River, Srikakulam Dt. Andhra Pradesh, India

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Abstract
The ichthyofaunal survey confirmed the presence of 49 fish species from 12 orders, 19 families, and 33 genera from February 2021 to January 2023 at Gotta Barage's four landing points. Five of the 49 species are alien. The order Cypriniformes dominated with 23 species, accounting for 46.93% of all species, followed by Siluriformes 11 (22.44%), Channiformes 3 (6.12%), Synbranchiformes and Cichliformes each 2 (4.08), Osteoglossiforme, Cyprinodontiformes, Anguilliformes, Beloiniformes, Gobiiformes, Anabantiformes and Ovalentaria each with 01 (2.04%). In the present study fish species divided into three groups based on trophic level to represent highest to zooplanktivorous 51.02%, followed by piscivorous 26.53% and herbivorous represents to 18.36%. According to IUCN status 41 species contributed to 83.67% are least concern (LC), five species contributed to 10.20% are near threaten (NT), one species contributed to 02.04% are vulnerable (VU) not evaluated (NE) and data deficient (DD).

Keywords: ichthyofauna, trophic level, zooplanktivorous, piscivorous, herbivorous, IUCN

Introduction
Gotta Barrage is around 45 km from Srikakulam District, which is located in Andhra Pradesh's extreme northeastern region. The Vamsadhara River rises in the Eastern Ghats of Orissa and flows through Srikakulam District in Bhamini Mandal before entering the Gulf of Bengal at Kalingapatnam. The primary river in North Eastern Andhra is the Vamsadhara. The North Eastern Andhra area is made up of three districts on the northwestern coast of the Indian state of Andhra Pradesh. The Heeramandalam reservoir, with a storage capacity of 19 TMC, is complete, but the water supply from the Vamsadhara River must still be given by constructing a side weir on the river. There is presently just 2.5 TMC of dead storage and 5 TMC of natural runoff from catchment regions. Even after the tribunal's verdict, the state of Odisha refuses to build the side weir, while the state of Andhra Pradesh prepares to pump water into the dam from the nearby Gotta barrage pond. Hiramandalam reservoir might be used as the bottom reservoir of a 10,000 MW capacity pumped storage hydroelectric plant in the future to meet the region's continual renewable and green power demands. Hiramandalam Reservoir's dead storage is being used to provide potable water to 800 communities in Uddanam. Artisanal fishing encompasses a wide range of small-scale, low-tech, and low-capital fishing methods. The current study aims to give up-to-date information on the fish species found in this reservoir.

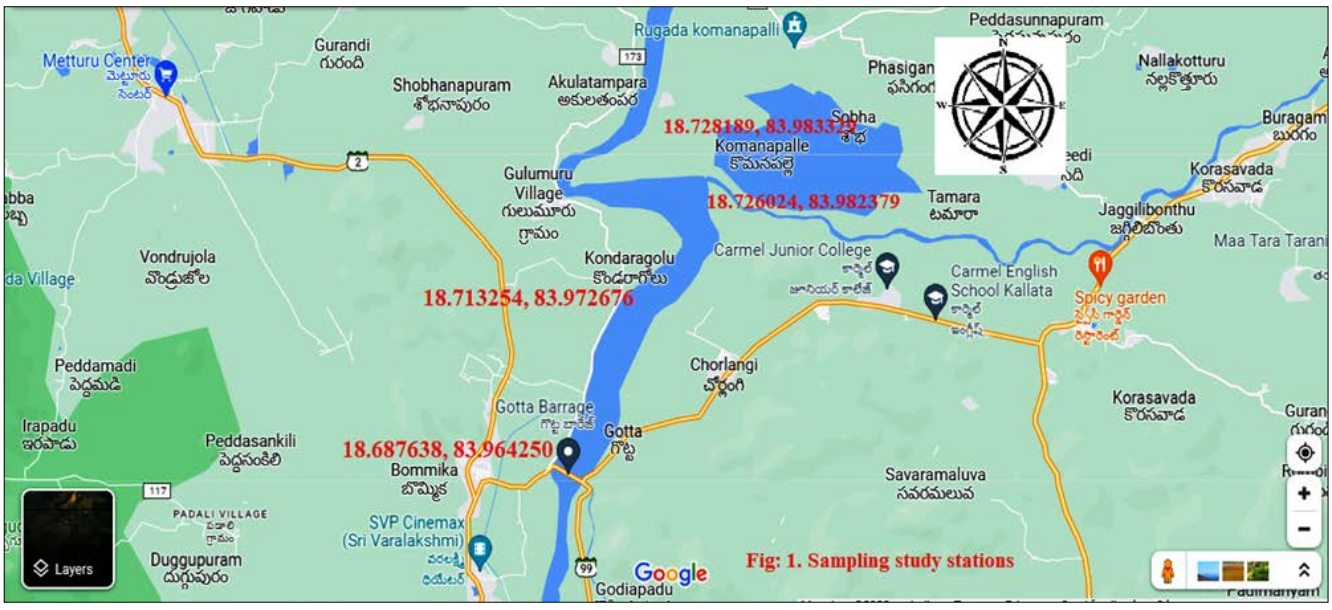


Fig 1

Materials and methods

Study area

Gotta Barrage is located between the longitudes 83° 48' 0" E and 18° 23' 0" N, with an average monsoon rainfall of 1024 mm. It is a separate river with its own basin. From February 2021 to January 2023, the research was carried out at four landing sites: abe Gotta Barrage Junction (18.687638, 83.964250), Kondaragolu (18.713254, 83.972676), Vamsadhara and Mahendra Ttanaya Rivers Junction (18.726024, 83.982379), and Komanapalli (18.728189, 83.983329) (Fig 1). The fish were collected from several stations with the assistance of local fishermen using various types of gear (Drag nets, Push nets, Cast nets, Stationary gill nets) and bamboo baskets (Traps). Rama Rao (2014a) [9]. Freshly collected fish were carefully cleansed and photographed. These fish were taken to the lab and fixed in glass jars before being preserved in a 9-10% formalin solution (Jayaram, 1999) [4]. The fishes were recognised to the species level using keys for Indian subcontinent fishes. The species were identified primarily based on morphometric and meristematic characteristics (Day, 1958, Jayaram, 1981, 1999, Talwar and Jhingran, 1991, Nath and Dey, 2000) [1, 4, 15, 8]. The IUCN conservation status of the fish species has been listed (2023).

Result and discussion

The results of the present study revealed that the occurrence of 49 fish species belonging to 12 orders, 19 families, and 33 genera observed Feb 2021 to Jan 2023 at four landing stations. Out of 49 species five are exotic species (*indicates). In the current study, a list of fishes were compiled, including their order, family, genus, species, population status, trophic level and IUCN status. The listed species were given in Table 1. In the present investigation the number and percentage composition of families, genera and species under different orders are shown in Table 2 and Fig 1. Sridhar (2015) [14] reported 26 species in Gottabarrage reservoir, belonged to the orders Cypriniformes, newline Siluriformes, Perciformes, Synbranchiformes, Osteoglossiformes and Anguilliformes. Priyanka et al., (2021) [11] studied of ichthyofaunal diversity shows occurrence of rich ichthyofaunal diversity, witha total of 40 fish species belonging to 29 genera, 15 families, and 9 orders in Siddheshwar reservoir. The similar results were found at various reservoirs in this region. Rama Rao (2018) recorded 57 fish species belong to seven orders, 18 families and 34 genera were reported including four are exotic species at Kalingadal reservoir.

Order cypriniformes was dominant with 23 species which contributed to 46.93% of the total species followed by Siluriformes 11 (22.44%), Channiformes 3 (6.12%), Synbranchiformes and Cichliformes each 2 (4.08), Osteoglossiforme, Cyprinodontiformes, Anguilliformes. Beloiniformes, Gobiiformes, Anabantiformes and Ovalentaria each with 01 (2.04%). Recorded genera out of 33, Cypiniformies highest with 14 (42.42%), followed by Siluriformes contributed 7 (21.21%), Synbranchiformes and Ovalentaria each 2 (6.06%), Osteoglossiformes, Cyprinodontiformes, Anguilliformes, Beloiniformes, Channiformes, Gobiiformes, Cichliformes and Anabantiformes each 01 (3.03%). Recorded families out of 19, Siluriformes 06 (31.57%), Cypriniformes 03 (15.78%), Osteoglossiformes, Cyprinodontiformes, Anguilliformes, Beloiniformes, Channiformes, Gobiiformies, Synbranchiformes, Cichliformes, Anabantiformes and Ovalentaria each 01 (5.26%). Priyanka et al., (2021) [11] reported to Cypriniformes dominated with 18 species, followed by the orders Siluriformes with 8, Channiformes with 4, Preciformeswith 3, Clupeiformes and Mastcembeliformes with 2, and the rest of the orders Angulliformes, Beloniformes, andMugiliformes with a single species. The homogeneous percentage of Order Cypriniformes was contributed to 42.86% of the total species observed in Narayana puram anicut at Nagavali River (Rama Rao and Ramachandra Rao, 2021) [12], Rama Rao (2014b) [10].

In the present study fish species divided into three groups based on trophic level, namely, 2.0–2.5, 2.5–3.5, and 3.5–4.5, to represent highest to omnivours 51.02%, followed by carnivorous 26.53% and herbivorous represents to 18.36% (Fig 2). The trophic level community structure of recorded fish species demonstrated the dominance of top-level carnivores (39%), followed by mid-level carnivores (28%), predators (17%), omnivores (14%), and herbivores or planktivores (2%), according to Haojie Su (2021) [2]. The majority of the finfish species identified during this investigation were found to meet human protein requirements.

The number and Percentage composition of Population Status is 25 species were common which contributed to 51.02%, 12 species were abundant which contributed to 24.48%, 7 species are moderate which contributed to 14.28% and 5 species were moderate which contributed to 10.20% in the total catch (Fig. 3). According to IUCN status 41 species contributed to 83.67% are least concern (LC), five species contributed to 10.20% are near threaten (NT), one species contributed to 02.04% are vulnerable (VU) not evaluated (NE) and data deficient (DD) Fig 4. According to Priyanka et al., (2021) [11] represents the IUCN red list categories, 52.5% of the species are least concern, 20% are not evaluated, 10% are near threatened, 5 % are data deficient, 5% are lower risk near threatened and vulnerable, and2.5% are lower risk least concern (Rama Rao and Vinod Kumar, 2017) [13].

Table: 1 List of fishes and their order, family, genus, species, population status and IUCN status at Gottabarrage

No.	Order / Family	Scientific name	Trophic level	Population status	IUCN status
1	Osteoglossiformes/ Notopteridae	*Notopterus notopterus*	3.5	C	LC
2	Cypriniformes/ Cyprinidae	*Labeo catla*	2.8	A	LC
3	Cypriniformes/ Cyprinidae	*Labeo calbasu*	2.0	C	LC
4	Cypriniformes/ Cyprinidae	*Labeo dyocheilus*	-	R	LC
5	Cypriniformes/ Cyprinidae	*Labeo rohita*	2.2	A	LC
6	Cypriniformes/ Cyprinidae	*Cirrhinus mrigala*	2.4	A	LC
7	Cypriniformes/ Cyprinidae	*Cirrhinus reba*	2.5	C	LC
8*	Cypriniformes/ Cyprinidae	*Ctenopharyngodon idella*	2.0	C	LC
9*	Cypriniformes/ Cyprinidae	*Cyprinus carpio*	3.1	M	VU

10	Cypriniformes/ Cyprinidae	*Gymnostomus ariza*	2.7	C	LC
11*	Cypriniformes/ Cyprinidae	*Hypopthalmicthys molitrix*	2.0	R	NT
12	Cypriniformes/ Cyprinidae	*Osteobrama cotio*	2.9	C	LC
13	Cypriniformes/ Cyprinidae	*Puntius chola*	2.5	A	LC
14	Cypriniformes/ Cyprinidae	*Puntius ticto*	2.2	A	LC
15	Cypriniformes/ Cyprinidae	*Systomus sarana*	2.9	C	LC
16	Cypriniformes/ Cyprinidae	*Puntius sophore*	2.6	A	LC
17	Cypriniformes/ Danionidae	*Rasbora daniconius*	3.1	C	LC
18	Cypriniformes/ Danionidae	*Salmostoma bacaila*	3.2	C	LC
19	Cypriniformes/ Danionidae	*Salmostoma phulo*	3.2	C	LC
20	Cypriniformes/ Danionidae	*Amblypharyngodon microlepis*	3.3	A	LC
21	Cypriniformes/ Danionidae	*Amblypharyngodon mola*	3.3	A	LC
22	Cypriniformes/ Danionidae	*Danio devario*	3.0	C	LC
23	Cyprinidae/ Cobitidae	*Lepidocephalichthys berdmorei*	2.8	M	LC
24	Cyprinidae/ Cobitidae	*Lepidocephalichthys guntea*	2.7	M	LC
25	Cyprinodontiformes/ Aplocheiidae	*Aplocheilus panchax*	3.8	C	LC
26	Siluriformes/ Bagridae	*Mystus bleekeri*	3.3	C	LC
27	Siluriformes/ Bagridae	*Mystus cavasius*	3.4	C	LC
28	Siluriformes/ Bagridae	*Mystus gulio*	4.0	R	LC
29	Siluriformes/ Bagridae	*Mystus tengara*	3.2	A	LC
30	Siluriformes/ Bagridae	*Mystus vittatus*	3.1	A	LC
31	Siluriformes/ Siluridae	*Ompok bimaculatus*	3.9	C	NT
32	Siluriformes/ Siluridae	*Wallago attu*	3.7	C	NT
33	Siluriformes/ Schibeidae	*Eutropiichthys vacha*	3.9	C	LC
34	Siluriformes/ Claridae	*Clarias batrachus*	3.4	C	LC
35	Siluriformes/ Heteropneustidae	*Heteropneustes fossilis*	3.6	A	LC
36	Siluriformes/ Pangasiidae	*Pangasius pangasius*	3.4	R	LC
37	Anguilliformes/ Anguillidae	*Anguilla bengalensis*	3.8	R	LC
38	Beloiniformes/ Exocoetidae	*Hyporhamphus limbatus*	3.1	R	LC
39	Channiformes/ Channidae	*Channa orienalis*	3.8	C	NE
40	Channiformes/ Channidae	*Channa panctata*	3.8	A	LC
41	Channiformes/ Channidae	*Channa striatus*	3.6	C	LC
42	Gobiiformies/ Gobiidae	*Glossogobius giuris*	3.7	C	LC
43	Synbranchiformes/ Mastacembelidae	*Mastacembelus armatus*	2.8	C	LC
44	Synbranchiformes/ Mastacembelidae	*Macrognathus pancalus*	3.5	C	LC
45	Anabantiformes/ Anabantidae	*Anabas testudineus*	3.0	M	DD
*46**	Cichliformes/ Cichlidae	*Oreochromis mossambicus*	2.2	M	NT
*47**	Cichliformes/ Cichlidae	*Oreochromis niloticus*	-	R	NT
48	Ovalentaria/ Ambassidae	*Chanda nama*	3.9	C	LC
49	Ovalentaria/ Ambassidae	*Parambassis ranga*	3.6	C	LC

A= Abundant (76-100%); C = Common (51-75%); M = Moderate (26-50%); R = Rare (1-25%) of the total catch.
EN- Endangered; VU- Vulnerable: LC- Least concern; DD- Data deficient; NE- Not evaluated, NT: Near threaten.
*Exotic fishes No.s: 8, 9, 11, 46 and 47

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	3.03	2.04
2	Cypriniformies	15.78	42.42	46.93
3	Cyprinodontiformes	5.26	3.03	2.04
4	Siluriformes	31.57	21.21	22.44
5	Anguilliformes	5.26	3.03	2.04
6	Beloiniformes	5.26	3.03	2.04
7	Channiformes	5.26	3.03	6.12
8	Gobiiformies	5.26	3.03	2.04
9	Synbranchiformes	5.26	6.06	4.08
10	Cichliformes	5.26	3.03	4.08
11	Anabantiformes	5.26	3.03	2.04
12	Ovalentaria	5.26	6.06	2.04

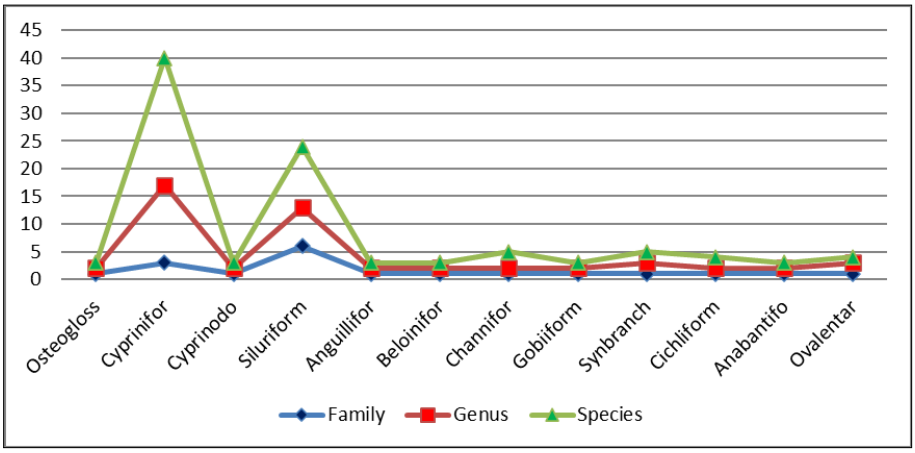


Fig 1: Composition of families, genera and species

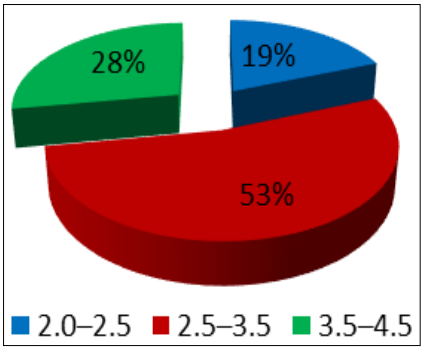


Fig 2: Trophic position

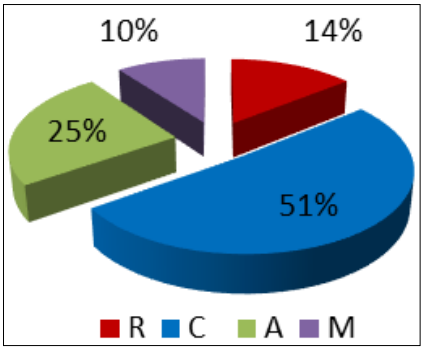


Fig 3: Population status

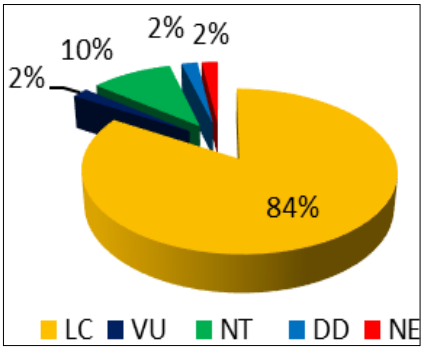


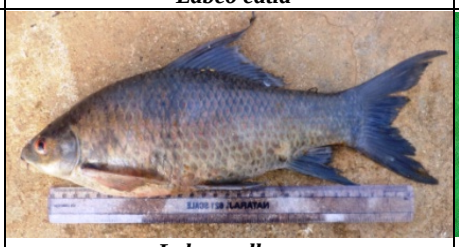
Fig 4: IUCN status

Notopterus notopterus

Labeo catla

Labeo rohita

Cirrhinus mrigala



Labeo calbasu

Labeo dyocheilus

Cyprinus carpio

Ctenopharyngodon idella

Systomus sarana

Channa panctata

Channa striatus

Fig 5

Conclusion

The water level lowers substantially throughout the summer. Anthropogenic stress has a negative influence on both fish productivity and the general ecology of reservoirs. Reservoir officials should maintain water levels, particularly in the summer, and take the appropriate precautions to prevent human activity in and around the reservoir. Generally, efforts to combat ghost fishing focus on prevention and elimination. Preventing the loss or abandonment of fishing gear is the goal of prevention techniques.

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