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Assessment of Fish Biodiversity in Upper Mullamari Reservoir, Basavakalyan, Karnataka (India)

***A.S. Kumar Naik, S.R. Somashekara., Jitendra Kumar., V. Mahesh., S. Benakappa., H.N. Anjaneyappa., and P. Nayana**

Karnataka Veterinary, Animal and Fisheries Sciences University, Department of Fisheries Resources and Management, College of Fisheries, Mangalore – 575002, India.
**Corresponding address: kumarasnaik@gmail.com*

ABSTRACT

The present investigation was carried out in Upper Mullamari Reservoir situated in Bidar district, Karnataka. Monthly sampling was done in three fish landing centers *viz*, Kherda, Sharannagar, and Mashala. During the study period, it was observed that the 32 species of finfishes belonging to 26 genera, 14 families and 6 orders were recorded. Among them Cypriniformes represented 17 species followed by Siluriformes (9), Perciformes (3) and order Symbracnhiformes, Osteoglossiformes and Clupiformes contributed one species each. The Simpson's index of diversity (1- Lambda') was highest in Kherda (0.894) followed by Mashala (0.893) and Sharannagar (0.860). This indicated that the greater fish biodiversity in Kherda fish landing centre when compared to other two centers. The abundance of fish species was more in Sharannagar (S= 23, N=423) followed by Kherda (S =28, N= 403), and Mashala (S =27, N= 322).

Keywords: Ichthyofauna, Biodiversity, Upper Mullamari Reservoir, Karnataka

Introduction

India is endowed with vast resource of reservoirs with more than 3.0 million hectors of water spread area. The fish species diversity, which is currently recognized worldwide, shows 25,000 species of which 10,000 species are found

in freshwater ecosystem and about 11.7% are found in Indian waters. Thus, freshwater fish discovery can serve as a platform of livelihood and biodiversity of conservation values [1]. Dams and reservoirs in India, which are constantly increasing in numbers, play an important role not only in electric and water supply but also in providing a source of fish to the local community, for food, research, sustainable aquaculture and maintenance of fish diversity [2]. Hence, reservoirs constitute important resources for all types of fisheries activities including fish culture, recreational and commercial fisheries [3].

Dams in India have converted flowing rivers into reservoirs, which have a profoundly different hydrological character than rivers to which indigenous species have adapted to. Fish species like *Labeo calbasu, Bagarius bagarius* and *Hilsa hilsa* have been severely affected by these changes. Most of the rivers and reservoirs are now dominated by exotic fish like grass carp, silver carp and other predatory fishes, which tolerate high pollution and static water levels. Over-exploitation and habitat degradation, as an example, have depleted the stocks and reduced the replacement rate in the population [4]. The levels of endemicity were found to be very high over all the vertebrate taxa in the Hyderabad-Karnataka region. Fishes in this region are also found to have high endemicity [5]. The documentation of the species found here as well as their distribution of the species found here is crucial. This together with the identification of the threats will help in formulating the needed conservation measures. In the present study an attempt has been made to highlight the fish biodiversity to formulate future strategies for development and fish conservation and also helps in species selection for aquaculture in this region.

Material and Methods

Study area and sampling sites

The Upper Mullamari Reservoir is an irrigation project which consists of a dam constructed across the River Mullamari which is a minor tributary of River Bheema in Bidar district of Karnataka. It is a perennial reservoir with total water spread area of about 277 hectare. The reservoir is situated in the northern part of Karnataka state between (77^0 00' 00" E longitude and 17^0 42' 00" N latitudes) presents typical climate of peninsular India with semi arid conditions. The location map of study area is shown in Fig. 1.

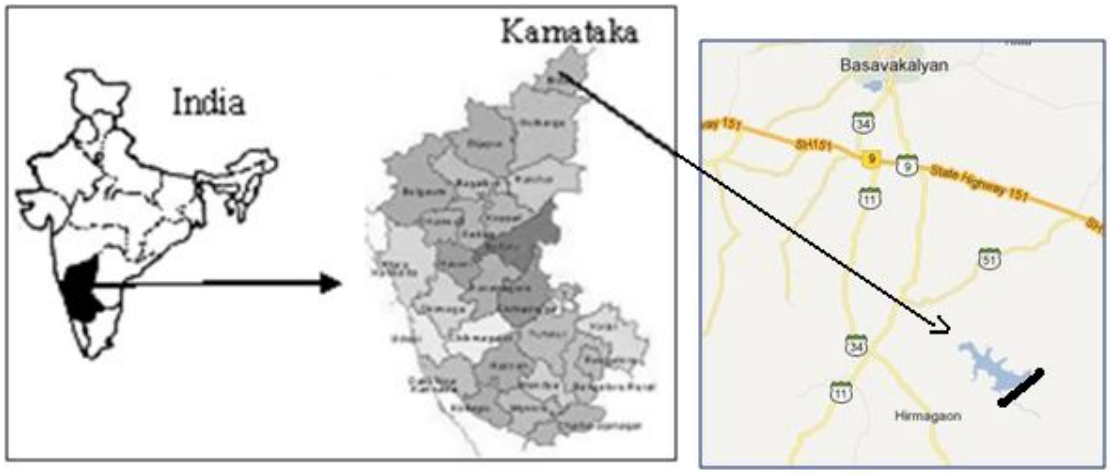

Fig: 1 Study Location Upper Mullamari Reservoir, Basavakalyan, Karnataka

Data collection

Monthly fish data were collected from three selected fish landing centers *viz*; Kherda, Sharannagar and Mashala during the study period from June 2008 to July 2009 with the help of local fishermen belong to Upper Mullamari Fishermen Co-operative Society (Regd.), Sarannagar, Basavakalyan by gill net fishing. The fresh and preserved fish specimens were identified by using standard taxonomic keys *viz.* [6] and [7], Classification was carried out on lines of [8, 9, 10]. FAO identification sheets, ITIS (Integrated Taxonomic Information System) standard report (http://www.itis.gov), Fish Base (http://fishbase.org) and other reference books. The collected fish were identified up to species level.

Diversity indices

The diversity of fishes was calculated by Shannon- Weiner and Pielou's evenness indices. Hill's abundance was used to examine the variation in the number of dominant species. Species richness was calculated by Margalef's index. The similarity in species composition was studied by calculating the Bray-Curtis Co-efficient. However, all the diversity indices were done by using the PRIMER V.6 analytical package developed by Plymouth Marine Laboratory, U.K. [11].

Results and discussion

The result of the present study revealed the occurrence of thirty two fresh water fish species belonging to six orders. The analysis of data indicated that the order Cypriniformes was dominant with 16 fish species followed by order Siluriformes 9, and Perciformes 3. The order Clupiformes, Symbranciformes, and Osteoglassiformes each with one species have been recorded from the three sampling centers in the Upper Mullamari Reservoir. The list of fish

species recorded in the fish landing centers are shown in Table 1. The diversity in terms of number (32 species) was observed in the present study in that Cyprinidae formed the major fish family constituting 50% followed by Bagridae 9.37%, Siluridae 6.25%, and Channidae 6.25%, (Fig. 2). The other families (Balitoridae, Claridae, Heteropneustidae, Schilbeidae, Pangasiidae, Ambassidae, Mastacembelidae, Engraulidae, and Notopteridae) contributing 3.12% each to the total fish species.

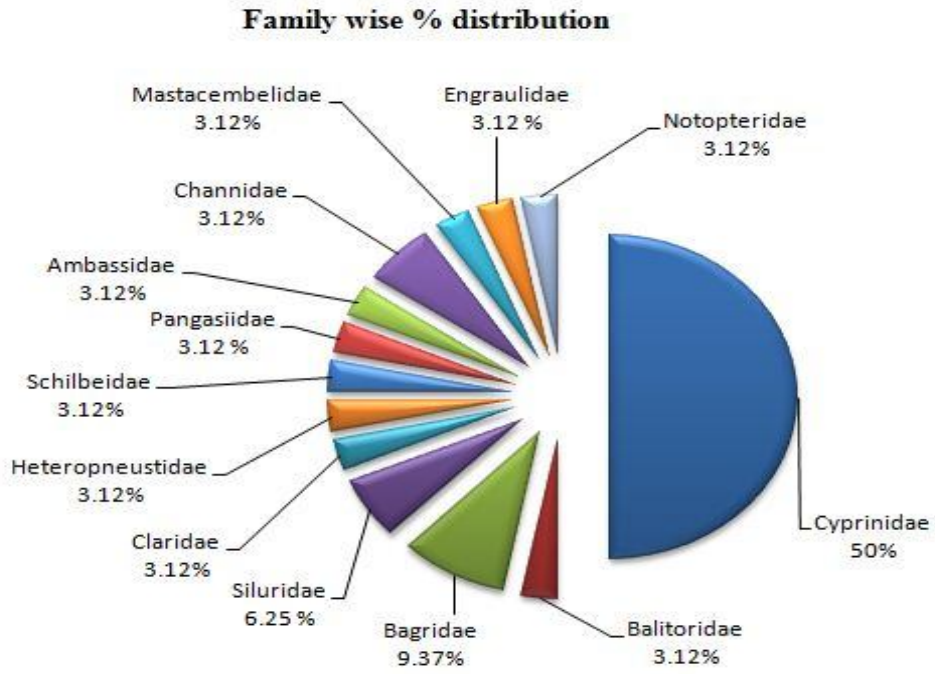

Fig: 2 Diagrammatic representation of the % Contribution in each family

Table: 1. Number of fish species recorded in the Upper Mullamari Reservoir

			Fish landing centers (Fish landings in Number)		
Sr No.	Family	Species	Kherda	Sharan nagar	Mashala
	Cypriniformes				
1	Cyprinidae	*Catla catla* (Hamilton,1822)	53	71	62
2	Cyprinidae	*Labeo rohita* (Hamilton,1822)	43	82	12
3	Cyprinidae	*Labeo boggut* (Hamilton,1822)	12	3	5
4	Cyprinidae	*Labeo fimbriatus* (Hamilton,1822)	16	8	2
5	Cyprinidae	*Cirrhinus mrigala* (Hamilton,1822)	36	23	41
6	Cyprinidae	*Cyprinus carpio* (Linnaeus, 1758)	98	107	65
7	Cyprinidae	*Ctenopgaryngodon idella*	13	2	17

		(Valenciennes,1844)			
8	Cyprinidae	*Hypophthalmichthys molitrix* (Valenciennes,1844)	4	13	11
9	Cyprinidae	*Garra gotyla* (Gray, 1830)	4	5	9
10	Cyprinidae	*Barilius barilius* (Hamilton 1822)	12	14	7
11	Cyprinidae	*Barilius bola* (Hamilton 1822)	3	0	4
12	Cyprinidae	*Osteobrama cotio* (Hamilton,1822)	3	2	0
13	Cyprinidae	*Salmostoma bacaila* (Hamilton 1822)	0	0	1
14	Cyprinidae	*Puntius chilinoides (*Hamilton,1822)	6	0	0
15	Cyprinidae	*Rasbora danioconius* (Hamilton,1822)	17	6	13
16	Cyprinidae	*Danio rerio* (Hamilton 1822)	0	0	2
17	Balitoridae	*Noemacheilus rupelli* (Sykes 1839)	3	0	4
	Siluriformes				
18	Bagridae	*Spearota seengala* (Sykes,1839)	14	17	11
19	Bagridae	*Mystus bleekeri* (Day 1877)	2		3
20	Bagridae	*Rita rita* (Valenciennes 1840)	0	5	1
21	Siluridae	*Ompok bimaculatus* (Bloach,1794)	17	12	4
22	Siluridae	*Ompok pabda* (Hamilton 1822)	4	23	11
23	Claridae	*Clarias batrachus* (Linnaeus,1758)	15	2	19
24	Heteropneustidae	*Heteropneustes fossilis* (Bloch 1794)	6	2	5
25	Schilbeidae	*Silonia silonda* (Hamilton, 1822)	3	0	0
26	Pangasiidae	*Pangasius pangasius* (Hamilton 1822)	0	7	3
	Perciformes				
27	Ambassidae	*Chanda nama* (Hamilton, 1822)	2	0	0
28	Channidae	*Channa striatus* (Bloch,1793)	3	7	1
29	Channidae	*Channa marulius* (Hamilton 1822)	2	4	0
	Symbranchiformes				
30	Mastacembelidae	*Mastacembalus armatus* (Lacepede,1800)	5	3	6
	Clupiformes				
31	Engraulidae	*Setipinna phasa* (Hamilton 1822)	3	0	1
	Osteoglassiformes				
32	Notopteridae	*Notopterus notopterus* (Pallas,1769)	4	5	2

Among Cyprinidae, *Catla catla, Labeo rohita, L. boggut, L. fimbriatus, Cirrhinus mrigala, Cyprinus carpio, Ctenopgaryngodon idella, Hypophthalmichthys molitrix, Garra gotyla, Barilius bola, Puntius chilinoides, Osteobrama cotio, Salmostoma bacaila, Barilius barilius, Rasbora danioconius, Danio rerio* were recorded. The Genus *Labeo* represented by 3 species followed by Genus *Cyprinus.*

The order Siluriformes contributed 9 fish species, among them the family Bagridae contributes 3 fish species (9.37%) followed by Siluridae (6.25%),

Claridae (3.12%), Heteropneustidae (3.12%), Schilbeidae (3.12%) and Pangasiidae (3.12%). The order perciformes contributed 3 fish species among them, the family Channidae two and Ambassidae with one. The order Symbranciformes, Clupiformes, and Osteoglassiformes contribute with one fish species. Among them the family Mastacembelidae (3.12%), Engraulidae (3.12%), and Notopteridae (3.12%) contribute with each species respectively.

The results are in accordance with various studies on the biodiversity of fishes in this region. The fish fauna of Himayasgar Lake in Hyderabad and recorded 32 species belonging to 11 families under 6 orders [12]. It has been observed that 11 fish species belonging to 5 orders from Sirur dam of Nanded District [13]. The 20 species recorded from 13 genera and 7 families included in 4 orders from Ghogaon reservoir of Satara district [14]. About 28 fish species observed including 9 species of carps, 5 of catfishes, 2 of feather backs, 5 of live fishes and 7 belonging to miscellaneous fishes in Palas-Nilegaon reservoir in Osmanabad district [15]. Until now in Karnataka, 201 fresh water fishes species belonging to 9 orders, 27 families and 84 genera have been recorded, of which 40 fish species are under threatened. Our study depicted the presence of 32 fish species contributing about 15.92 percent to the total fish diversity of Karnataka [10].

The fish species richness, abundance and biodiversity indices in all the three sites are shown in table 2. In line with the higher number of species and their abundance, Shannon diversity H' ($\log_e$) was more in Kherda (2.68) than Mashala (2.62) and Sharannagar (2.37). The Pielou's evenness (J') of the species was also more in Kherda (0.80). However, Margalef's species richness (d) showed clear differences between the centers. Further the number of dominant species (N_2) was more in Kherda. The similarity in species composition and abundance among centers was in the range from 63.89 -73.60 (Table: 3). Overall the number of fish landings was more in Sharannagar (N=423) followed by Kherda (N=403) and Mashala (N=322) (Table: 4). This indicated the greater fish biodiversity in Kherda when compared to other two fish landing centers.

Table: 2 - The centre wise diversity Indices of finfish in Upper Mullamari Reservoir

Fish Landing Centers	Species	Quantity	Species Richness	Pielou's evenness	Shannon	Simpson	Hills abundance	
	S	N	D	J'	H' (loge)	1-Lambda'	N_1	N2
Kherda	28	403	4.50	0.80	2.68	0.894	14.59	9.282
Sharannagar	23	423	3.63	0.75	2.37	0.860	10.76	7.046
Mashala	27	322	3.50	0.79	2.62	0.893	13.83	9.115

Table: 3 - Bray - Curtis similarities for Fish catch data of Upper Mullamari Reservoir

Centers	Kherda	Sharannagar	Mashala
Kherda	-	-	-
Sharannagar	73.608	-	-
Mashala	74.483	63.893	-

The present study largely focuses on fish species richness and diversity of Upper Mullamari Reservoir. There is a need to formulate sustainable strategies to save fish community of this reservoir system as a whole. Being important reservoir in northern part of Karnataka, this reservoir supports variety of fish fauna. About 600 fishermen families of Basavakalyan and Humnabad taluka of Bidar district are entirely or partially depended on the fisheries of this reservoir for their livelihood. Due to multiple uses of fisheries resources, fishing has become a major industry and a large number of these aquatic communities are under a big threat of extinction.

Conclusions

Conservation of fish diversity assumes top most priority under changing circumstances of gradual habitat degradation. Knowledge of available resources and the biological characters of species serve the baseline information for further studies on resource conservation and maintenance. The induction of NFDB fish stocking schemes and its consequences on the indigenous fish fauna of the reservoir should be studied for further management and development of fisheries in this reservoir. The findings of this study are expected to benefit the planning and management towards sustainable fishery and conservation programmes of Upper Mullamari Reservoir.

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