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Studies on Ichthyofaunal Diversity of Karanja Reservoir, Karnataka, India

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Abstract

The present work is an attempt to assess the biodiversity of fish fauna in Karanja Reservoir located in the northern part of Karnataka between 17°22'30" N latitude and 76°59'0" E longitude. During the study period, it was observed that the 64 species of finfishes belonging to 37 genera, 16 families and 5 orders were recorded. Among them order Cypriniformes represented 31 fish species followed by Siluriformes 20, Perciformes 10, Osteoglossiformes 2 and order Synbranchiformes 1 fish species. The Simpson's index of diversity (1- Lambda') was highest in Athiwala (B) (0.9235) followed by Byalahalli (A) (0.8970) and Kheni Ranjola (C) (0.8842). This indicated that the greater fish biodiversity in Athiwala fish landing centre when compared to other two centres. Overall the number of fish landings was more in A (S= 60, N= 7342) followed by B (S= 59, N= 5507), A (S= 59, N= 3487) and the species richness (d) was more in B (7.1106). However, Margalef's species richness (d) showed clear differences between the centres. Further the number of dominant species (N_2) was more in B. The similarity in species composition and abundance among centres was in the range of 76.21-83.46. In this study an attempt has been made to evaluate the ichthyofaunal diversity in the region and suggests mitigating measures.

Keyword: Karanja Reservoir, Fish diversity, species richness Karnataka.

Introduction

Karnataka, the eighth largest State in India, is situated on the western edge of the Deccan plateau. The climate and physiography of the region make the state one of the most important in the country with regard to water resources. Total 74 reservoirs in Karnataka state cover an area of 2, 28,657 ha among them, 46 belong to the category of small reservoirs, (< 1000 ha) with a water spread area of 15, 253 ha, 16 medium reservoirs have water spread area of 29, 078 ha and the large reservoirs (> 5000 ha) over 1, 79, 556 ha. Among the small reservoirs, those less than 500 ha outnumber the rest. Thus, Karnataka has 4, 37,292 ha of water spread area under different categories of man-made impoundments. Large reservoirs constitute 80% of the total area, followed by the medium (13%) and small (7%) ones. A large number of studies covering a wide variety of ecosystems and organisms suggest that species richness tends to vary strongly with ecosystem production and habitat heterogeneity[1]. Biodiversity is manifested at all levels of bio-organization from cell to ecosystem and refers to enumerable kinds of living organisms inhabiting terrestrial, marine and freshwater ecosystems[2]. Ichthyofaunal diversity refers to variety of fish species depending on context and scale; it could refer to alleles or genotypes within of life forms within a fish community and to species or life forms across aqua regimes[3]. Studies of spatial and temporal patterns of diversity, distribution and species composition of freshwater fishes are useful to examine factors influencing the structure of the fish community[4]. Fish species are also an important indicator of ecological health and the abundance and health of fish will show the health of water bodies[5]. Human activities such as modification of the environment, culture, harvesting and effects of modernization have contributed to the pollution of water bodies which serve as habitat for fishes[6]. Karnataka's total water area under man-made impoundments covering an area of 4, 37,292 ha is undoubtedly one of the largest in the country, holding tremendous potential for fisheries development. Yet, very little scientific studies have been made on the reservoirs of the State. Karanja Reservoir is one of the important reservoirs in Northern Karnataka that need serious attention in its management and conservation of fishery resources. Detailed studies on fish fauna of this reservoir are still lacking. It is partly for this reason that we were inspired to conduct the current study on the fish diversity of Karanja Reservoir so as to determine the current conditions of the fish fauna of the river.

Material and Methods

The Karanja reservoir a major perennial reservoir of the district and located at Bhalki taluka of the Bidar district at 17°22′30″ N latitude and 76°59′0″ E longitude (Figure.1). It is created due to the construction of dam across the river Karanja, a tributary of Manjra River of Godavari system. It is a medium reservoir having water spread area of 5,673 ha with gross irrigation potential of 1, 62,818 hectares. Sampling for fish was conducted from the month of July 2008 to June 2009 at three very important pre-selected fish landing center viz., Byalahalli (A), Athiwala (B) and Kheni Ranjola (C). Fishes were sampled

monthly at all the three fish landing centres set up in the study areas of the reservoir using gill nets (mesh size measuring 30, 45, 50 and 60 mm).

Identification of fish species: All fish caught were identified to species level using standard taxonomic viz. Fishes of India, FAO identification sheets, ITIS (Integrated Taxonomic Information System) standard report (http://www.itis.gov), Fish Base (http://fishbase.org) and other reference books.

Diversity indices: The diversity of fishes was calculated by Shannon- Weiner and Pielou's evenness indices. Since individual size of fish species differed greatly, the indices are expressed in terms of biomass and not in terms of number of individuals. 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 Coefficient. However, all the diversity indices were done by using the PRIMER V.5 analytical package developed by Plymouth Marine Laboratory, U.K.

Results and Discussions

The result of the present study revealed the occurrence of 64 fresh water fish species belonging to 37 genera, 16 families and 5 orders were recorded. The order Cypriniformes was dominant with 31 fish species (48.43%) followed by order Siluriformes 20 (31.25%), Perciformes 10 (15.62%), Osteoglossiformes 2 (3.12%), and Synbranchiformes with one fish species (1.56%) (figure.2). Although, 64 species were recorded, the Cyprinidae was observed as the dominant family with 27 fish species (42.18%) followed by Bagridae, 9 fish species (14.06 %) (figure.3).The distribution of fish species is quite variable because of geographical and hydrological conditions. The fish species density, abundance and distribution recorded from three fish landing centres are shown in table-1.

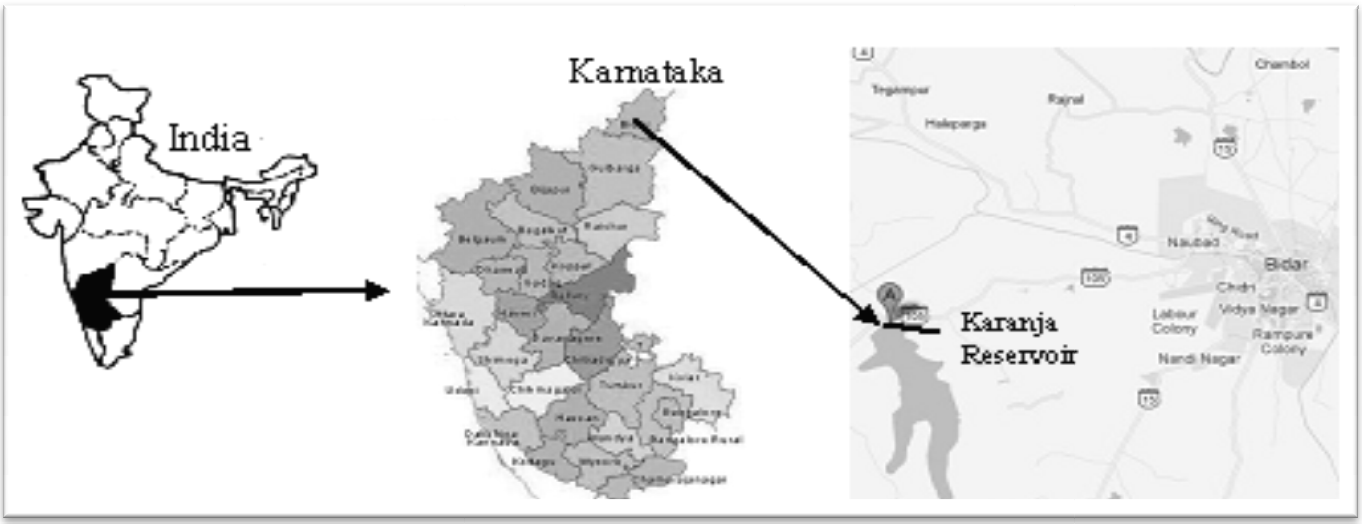

Figure-1
Location of Karanja Reservoir

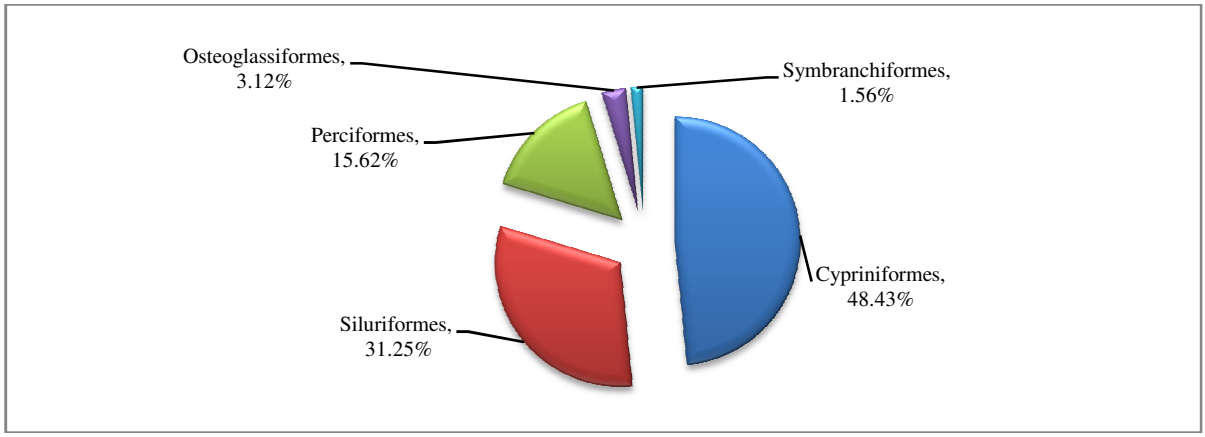

Figure-2
Diagrammatic representations of the % number contribution of each order

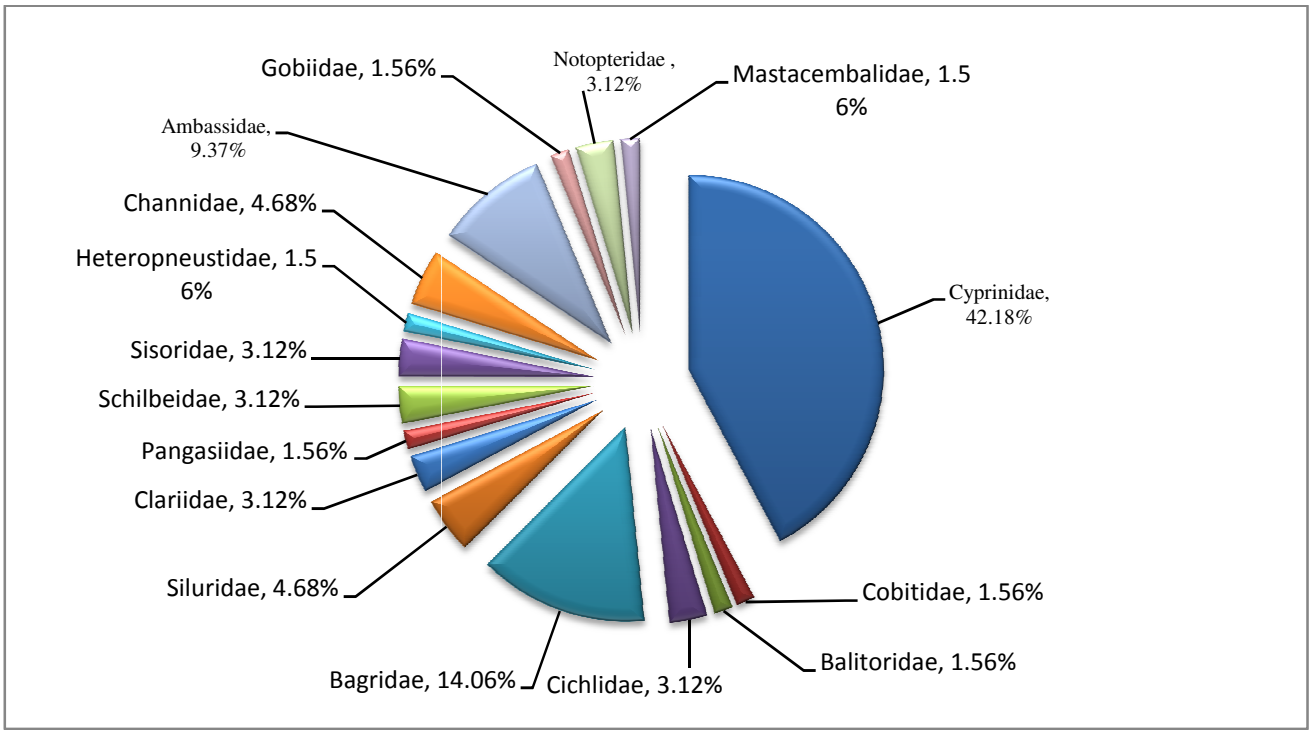

Figure-3
Diagrammatic representations of the % number contribution of each family

Table-1
Fish catch data of Karanja Reservoir, Bidar (in numbers)

Sl. No.	Fish Species	Order/Family	Sampling Centres		
			A	B	B
	CYPRINIFORMES				
1	*Catla catla* (Hamilton,1822)	Cyprinidae	1652	721	1352
2	*Labeo rohita* (Hamilton,1822)	Cyprinidae	781	231	1028
3	*Labeo calbasu* (Hamilton,1822)	Cyprinidae	21	32	56
4	*Labeo fimbriatus* (Hamilton,1822)	Cyprinidae	98	16	43
5	*Labeo bata* (Hamilton,1822)	Cyprinidae	0	5	7
6	*Labeo gonius* (Hamilton,1822)	Cyprinidae	3	2	5
7	*Labeo kontius* (Hamilton,1822)	Cyprinidae	1	1	0
8	*Cirrhinus mrigal* (Hamilton,1822)	Cyprinidae	614	241	450
9	*Cirrhinus cirrhosa* (Hamilton,1822)	Cyprinidae	56	38	76
10	*Cirrhinus reba* (Hamilton,1822)	Cyprinidae	1	1	1
11	*Cyprinus carpio nudus* (Linnaeus, 1758)	Cyprinidae	671	98	173
12	*Cyprinus carpio specularis* (Linnaeus, 1758)	Cyprinidae	342	67	156
13	*Cyprinus carpio communis* (Linnaeus, 1758)	Cyprinidae	739	78	134
14	*Ctenopharyngodon idella* (Valenciennes,1844)	Cyprinidae	562	254	285
15	*Hypophthalmichthys molitrix*(Valenciennes,1844)	Cyprinidae	35	113	148
16	*Barilius bola* (Hamilton, 1822)	Cyprinidae	9	3	11
17	*Garra gotyla* (Gray, 1830)	Cyprinidae	1	2	1
18	*Puntius sarana* (Hamilton,1822)	Cyprinidae	1	11	0
19	*Puntius filamentosus* (Hamilton,1822)	Cyprinidae	15	4	7
20	*Puntius dobsoni* (Hamilton,1822)	Cyprinidae	2	13	15
21	*Puntius ticto* (Hamilton,1822)	Cyprinidae	3	5	8
22	*Puntius chola* (Hamilton,1822)	Cyprinidae	2	6	1

23	*Amblypharyngodon mola* (Hamilton, 1822)	Cyprinidae	12	4	2
24	*Barilius barilius* (Hamilton, 1822)	Cyprinidae	0	13	2
25	*Osteobrama cotio* (Hamilton, 1822)	Cyprinidae	1	0	1
26	*Salmostoma bacaila* (Hamilton, 1822)	Cyprinidae	1	1	0
29	*Rasbora daniconius* (Hamilton,1822)	Cyprinidae	1	4	1
27	*Botia almorhae* (Gray, 1831)	Cobitidae	3	2	1
28	*Noemacheilus rupelli* (Sykes 1839)	Balitoridae	0	3	2
30	*Oreochromis mossambicus* (Peters 1852)	Cichlidae	514	324	367
31	*Oreochromis niloticus* (Linnaeus, 1758)	Cichlidae	213	125	82
	SILURIFORMES				
32	*Sperata aor* (Hamilton-Buchanan,1822)	Bagridae	48	63	112
33	*Sperata seenghala* (Sykes,1839)	Bagridae	192	128	213
34	*Mystus bleekeri* (Day, 1877)	Bagridae	15	26	42
35	*Mystus cavasius* (Hamilton, 1822)	Bagridae	22	12	4
36	*Mystus grassius* (Hamilton, 1822)	Bagridae	12	0	2
37	*Mystus tengra* (Hamilton, 1822)	Bagridae	7	13	18
38	*Mystus vittatus* (Bloch, 1794)	Bagridae	12	14	2
39	*Rita rita* (Valenciennes, 1840)	Bagridae	8	4	0
40	*Rita gogra* (Sykes, 1839)	Bagridae	3	7	2
41	*Ompok bimaculatus* (Bloach,1794)	Siluridae	115	54	64
42	*Ompok pabda* (Hamilton, 1822)	Siluridae	14	87	37
43	*Wallago attu* (Bloach & Schneider,1801)	Siluridae	113	89	61
44	*Clarias batrachus* (Linnaeus,1758)	Clariidae	76	123	63
45	*Clarias gariepinus* (Burchell, 1822)	Clariidae	19	42	49
46	*Pangasius pangasius* (Hamilton, 1822)	Pangasiidae	37	57	92
47	*Ailia coilia* (Hamilton, 1822)	Schilbeidae	2	1	7
48	*Silonia silonda* (Hamilton, 1822)	Schilbeidae	2	1	1
49	*Bagarius bagarius* (Hamilton, 1822)	Sisoridae	9	1	6
50	*Gagata cenio* (Hamilton, 1822)	Sisoridae	2	0	0
51	*Heteropneustes fossilis* (Bloch, 1794)	Heteropneustidae	18	14	3
	PERCIFORMES				
52	*Channa marulius* (Hamilton, 1822)	Channidae	75	44	53
53	*Channa punctatus* (Bloch,1793)	Channidae	53	35	56
54	*Channa striatus* (Bloch,1793)	Channidae	23	97	35
55	*Ambassis nama* (Hamilton, 1822)	Ambassidae	2	4	2
56	*Parambassis ranga* (Hamilton, 1822)	Ambassidae	2	0	2
57	*Chanda baculis* (Hamilton, 1822)	Ambassidae	7	4	4
58	*Chanda nama* (Hamilton, 1822)	Ambassidae	5	2	6
59	*Chanda ranga* (Hamilton, 1822)	Ambassidae	3	4	2
60	*Anabas testudineus* (Bloch, 1792)	Anabantidae	6	1	1
61	*Glossogobius giuris* (Hamilton, 1822)	Gobiidae	0	0	2
	OSTEOGLOSSIFORMES				
62	*Notopterus notopterus* (Pallas,1769)	Notopteridae	39	53	76
63	*Chitala chitala* (Hamilton-Buchanan, 1822)	Notopteridae	34	65	46
	SYNBRANCHIFORMES				
64	*Mastacembelus armatus* (Lacepede,1800)	Mastacembelidae	13	24	29

Among the recorded fish species, the high abundance of fish species with maximum availability in number was *Catla catla (Hamilton,1822)* followed by, *Labeo rohita (Hamilton,1822), Cirrhinus mrigal (Hamilton,1822), Oreochromis mossambicus (Peters 1852), Ctenopharyngodon idella (Valenciennes,1844), Cyprinus carpio communis (Linnaeus, 1758), Cyprinus carpio nudus (Linnaeus, 1758), Cyprinus carpio specularis (Linnaeus, 1758), Sperata seenghala (Sykes,1839), Oreochromis niloticus (Linnaeus, 1758), Hypophthalmichthys molitrix (Valenciennes,1844), Wallago attu (Bloach&Schneider,1801), Clarias batrachus (Linnaeus,1758), Ompok bimaculatus (Bloach,1794), Sperata aor (Hamilton-Buchanan,1822)* were recorded in all the sites. Fish species such as *Labeo kontius (Hamilton,1822), Osteobrama cotio Hamilton, 1822, Salmostoma*

bacaila (Hamilton 1822), *Gagata cenio (Hamilton 1822), Glossogobius giuris (Hamilton, 1822), Cirrhinus reba (Hamilton,1822), Garra gotyla (Gray, 1830), Silonia silonda (Hamilton, 1822), Parambassis ranga (Hamilton, 1822), Noemacheilus rupelli (Sykes 1839), Botia almorhae* (Gray, 1831), *Rasbora daniconius (Hamilton,1822), Ambassis nama (Hamilton 1822), Anabas testudineus (Bloch, 1792), Puntius chola (Hamilton,1822), Chanda ranga (Hamilton, 1822), Labeo gonius (Hamilton,1822)* were recorded in lesser number. Fish species *Gagata cenio, Glossogobius giuris, and Osteobrama cotio* reported at only one landing center.

Among Cypriniformes, the Cyprinidae contribute (42.18%) represented with *Catla catla*, *Labeo rohita, L. calbasu, L. fimbriatus, L. bata, L. gonius, Cirrhinus mrigal, Cyprinus carpio nudus, C. carpio specularis, C. carpio communis, Ctenopharyngodon idella, Hypophthalmichthys molitrix, Puntius sarana, P. filamentosus, P. dobsoni, P. vittatus*, *P.ticto, Tor sp., Garra gotyla*. The Genus *Labeo* represented by 6 species and *Puntius* with 5 species. The other families like Cobitidae (1.56%), Balitoridae (1.56%), Cichlidae (3.12%), Bagridae (14.06%), Siluridae (3.12%), Clariidae (4.68%), Pangasiidae (1.56%), Schilbeidae (3.12%), Sisoridae (3.12%), Heteropneustidae (1.56%), Channidae (4.68%), Ambassidae (9.37%), Gobiidae (1.56%), Notopteridae (3.12%), and Mastacembelidae (1.56%) (figure. 2).

The 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 fish landing centre B (3.0896) than in A (2.6969), and C (2.7485). The Pielou's evenness (J') of the species was also more in B (0.7577). However, Margalef's species richness (d) showed clear differences between the centres. Further the number of dominant species (N_2) was more in B. The similarity in species composition and abundance among centres was in the range of 76.21-83.46 (table 3). Overall the number of fish landings was more in A (S= 60, N= 7342) followed by B (S= 59, N= 5507), A (S= 59, N= 3487) and the species richness (d) was more in B (7.1106) (table-1). This indicated the greater fish biodiversity in B when compared to other two fish landing centres. The fish species richness, abundance and biodiversity indices in all the three sites are shown in table-2 and 3.

The overall diversity of fish (64 fish species) found in the present study was considerably higher or very nearer to the number of species reported from many rivers of Karnataka and adjoining states like Andra Pradesh and Maharashtra. Sreekantha and Ramachandra[7] reported 43 fish species from the Sharavathi River and Thirumala and others[8] recorded 33 fish species from Bhadra. Bapurao Jadhav[9] recorded 58 species belonging to 16 families and 35 genera from the very important Koyana River. Hiware and Pawar[10] recorded 43 fish species from Nath Sagar dam, Pathan, in Aurangabad district and Pawar and Pawar[11] reported 50 species with 6 exotic and 42 indigenous fish species from Kanher Dam from Satara district. Valsangkar[12] recorded 17 indigenous and 5 introduced fish species from Shivajisagar reservoir. Babu Rao[13] has studied fish fauna of Himayatsagar Lake in Hyderabad and recorded 32 species belonging to 11 families under 6 orders and Sakhare and Joshi[14] observed 28 fish species 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. Pawar and others[15] observed 11fish species belonging to 5 orders from Sirur dam of Nanded District. In a study Murlikrishna and Piska[16] recorded 31 fish species from secret Lake Durgamcheruvu, Ranga Reddy district near Hyderabad of Andhra Pradesh.

The present study of fish fauna in Karanja Reservoir showed that most of the fish species recorded were widely distributed in the streams, rivers and reservoirs of North Karnataka and the present investigation reveals that Cyprinid fishes are found to be the more dominant group than others. The considerable quantity of Indian Major Carp such as *Catla catla, Labeo rohita* and *Cirrhinus mrigal* were recorded in all the three landing centres.

Table-2
The centre wise diversity indices of finfish in Karanja Reservoir

Fish Landing Centres	Species	Quantity (Kg)	Species Richness	Pielou's evenness	Shannon	Simpson	Hills abundance	
	S	N	D	J'	H' (loge)	1- Lambda'	N_1	N2
A	60	7342	6.628	0.658	2.6969	0.8970	14.83	9.702
B	59	3487	7.110	0.757	3.0896	0.9235	21.97	13.02
C	59	5507	6.733	0.674	2.7485	0.8842	15.61	8.626

Table-3
Bray - Curtis similarities for Fish catch data of Karanja Reservoir

Centres	A	B	C
A	0	0	0
B	76.21971	0	0
C	82.21382	83.46322	0

Due to the illegal supply of African catfish (*Clarias gariepinus)* fish seeds, the *Clarias gariepinus* which is regarded as most destructive fish in the wild[17] is recorded in very good numbers and continue to start dominating in the reservoir therefore; immediate measures should be taken to prevent it from further entering into this system. Considerable landing of *Oreochromis mossambicus and O. niloticus* were recorded in all the fish landing centres. Ecologically, these fishes have adverse effect on the indigenous fish diversity of the reservoir. Fishing rights, including exploitation, stocking and disposal by licensing of Karanja Reservoir, as a rule, is vested with the Department of Fisheries, Govt. of Karnataka. In some areas, variety of fishing gear is employed for fishing. Gill nets, both surface and bottom set, are the most common. A variety of traps are employed for catching prawn, air breathing catfishes and murrels, while rod and line are sometimes employed to catch *Wallago attu*, *Ompok spp*. and *Mastacembelus* spp. Except the issuing of licenses from the Department of Fisheries and stocking of fish seeds, there is no monitoring and regulation of fishing in the Karanja Reservoir due to the inadequate staff and other required facilities (particularly logistics).

Conclusion

Being important reservoir of north Karnataka, it supports variety of fish fauna and each species often consists of several indigenous groups with a distinct genetic makeup. There could be uncertainties with all scientific endeavors to monitor abundance and productivity of stocks and the underlying causes. Further, there are uncertainties with regard to climate change, aquatic ecosystem productivity, predation and fishing pressure. The Karnataka Veterinary, Animal and Fisheries Sciences University which is located nearer to this reservoir may take up further studies on the fish fauna of the reservoir and formulate suitable management strategies for the sustainable development of the fisheries resources of Karanja Reservoir.

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