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Vinita R. Kashyap
Associate Profesor of Zoology, Govt. Science College, Rewa, Madhya Pradesh, India

Corresponding Author:
Vinita R. Kashyap
Associate Profesor of Zoology, Govt. Science College, Rewa, Madhya Pradesh, India

An analysis of fish diversity in a freshwater Bansagar pond of Rewa (M.P.) India

Vinita R Kashyap

Abstract
This paper describes the analysis of fish diversity in a freshwater Bansagar pond of Rewa (M.P.) India, where fish diversity were conducted during Jan. 2020 to Dec. 2020. Human activities have resulted in drastic degradation of aquatic resources resulting in the alteration of structure and function. As fish constitute almost half of the total number of vertebrates it is very important that their diversity is preserved. Hence the present study was conducted to analyse the fish diversity in Bansagar pond. A total of 172 fishes belonging to 10 different families were identified. Among the various families, Cyprinidae recorded the highest species richness (6 species), followed by Channidae (3 species) and Bagridae (2 species). All the other families were represented by only one fish species. In terms of percentage, Cyprinidae represented 61.63% of the total fish population followed by Channidae 9.88%, Siluridae 6.98%, Bagridae 5.82%, Anguillidae 4.07%, Gobiidae 3.49%, Anabaenidae 2.91%; Aplocheilidae 2.33%, Cichlidae 1.74% and Clariidae 1.16%. Species richness 18, Abundance 172, Shannon Wieners Index 1.02, Simpson's Dominance Index 0.092 and Simpson's Diversity Index 0.91.

Keywords: fish diversity, fresh water, species richness, Bansagar pond

Introductions
India is one of the 12-mega biodiversity countries having two biodiversity hotspots, namely the Western Ghats and the Eastern Himalayas that are included amongst the top eight most important hotspots in the world. It also has rich freshwater (rivers, irrigation canals, tanks, lakes, reservoirs) fish diversity. This diversity is being eroded each day mainly because of unending anthropogenic stress. This diversity is not only the wealth of India and the world but it also has serious implications on fishery. The country is endowed with vast and varied resources possessing river ecological heritage and rich biodiversity. Freshwater fishery sites are varied like 45,000 Km. of rivers, 1,26,334 Km. of canals, ponds and tanks 2.36 million hectares and 2.05 million hectares of reservoirs (Ayappan and Birdar, 2004) [1]. According to Jenkins (2003) [2] freshwater biodiversity has declined faster than marine or terrestical diversity over the past 30 years. Human activities have resulted in drastic degradation of aquatic resources resulting in the alteration of structure and function. As fish constitute almost half of the total number of vertebrates it is very important that their diversity is preserved. Hence the present study was conducted to analyse the fish diversity in fresh water pond, Rewa district, Madhya Pradesh.

Material and Methods
Bansagar pond is located in Rewa district 24°32' north latitude and 81°15' east longitude with an elevation 316 meter. Bansagar Colony Pond is constructed near Bansagar Colony, Saman, Tehsil- Huzur, Distt. Rewa (M.P.) area on the Rewa-Sidhi-Shahdol road nearly 0.9 km. away from New Bus Stand, Choona Bhattha, Rewa. The total area of the pond is about 2.5 hect. In which 1.6 hect. area is used for the fish culture. The width of pond is nearly 1298 feet upstream side and 2287 feet at downstream side and minimum and maximum depth is 10 feet and 20 feet in downstream and upstream side respectively.

Data Collection and Analysis: Fish sampling was performed in five sampling sites during the period from January 2020 to December 2020 with the help of local fishermen using different types on nets. Photographs were taken prior to preservation as formalin decolorizes the fish. Fishes brought to the laboratory were fixed in this solution in separate jars according to the size of species. Smaller fishes were directly placed in the formalin solution while larger fishes were given an incision on the abdomen before they were fixed.

The fishes were labeled giving serial numbers, exact collection site, date of the collection and the local name of fish used in this region. Identification of fishes was carried out by following Talwar and Jhingran (1991) [3].

Water samples were collected between 8 and 9 am and transported to the laboratory immediately for further analyses. Water temperature was measured at the time of sampling using mercury thermometer while pH was measured with standard pH meter. Other parameters were analyzed in the laboratory according to the methods suggested by American Public Health Association (APHA, 1992) [4].

Fish were subjected to diversity analysis using different indices like Shannon – Weiner Index (H) (1963), Simpson Dominance Index (D) and Simpson Index of Diversity (ID) (1949).

Shannon - Weiner index was calculated by using the formula:

$H = \Sigma$ pi log 2Pi

where
H = Shannon-Weiner index
Pi = ni /N
ni = Number of individuals of each species in the sample
N = Total number of individuals of all species in the sample.

Abundance of fish population was calculated by the sum of all available fishes in different sites. Species richness was simply estimated by the variety of fish species in five different sites.

Data regarding threats faced by the fish fauna were obtained from both primary (direct observations and interaction with local stakeholders and fishermen) and secondary sources.

Simpson's Diversity Indices: Simpson's diversity index is a measure of diversity. In ecology, it is often used to quantify the biodiversity of a habitat. It takes into account the number of species present, as well as the abundance of each species.

Simpson's index of dominance was calculated by using the formula:

$$D = \Sigma \frac{ni(ni-1)}{N(N-1)}$$

Where,
ni = the total number of individuals of a particular species.
N = the total number of individuals of all species.
Simpson's index of diversity 1 =D

Results and Discussion

Details of the various species of fish that were caught in the system are presented in Tables 1, 2 and Fig. 1. As evident from the Table, a total of 172 fishes belonging to 10 different families were identified. Among the various families, Cyprinidae recorded the highest species richness (6 species), followed by Channidae (3 species) and Bagridae (2 species). All the other families were represented by only one fish species. In terms of percentage, Cyprinidae represented 61.63% of the total fish population followed by Channidae 9.88%, Siluridae 6.98%, Bagridae 5.82%, Anguillidae 4.07%, Gobiidae 3.49%, Anabaenidae 2.91%; Aplocheilidae 2.33%, Cichlidae 1.74% and Clariidae 1.16%. A familywise comparison reveals that in Cyprinidae, the most dominant species in terms of number was *Catla catla* followed by *Cirrhinus mrigala* while among Channidae, the most dominant species was *Channa striatus* and in Bagridae it was *Mystus carasius*. Literature reveals that abiotic and biotic factors play an important role in fish diversity in freshwater ecosystems. Sivakami *et al.* (2014) [5] reported that pH and dissolved oxygen are key habitat features which can be correlated to fish diversity, while Sharma and Gupta (1994) [6] reported that the ideal temperature for growth of fishes was between 14.5 and 38.6 °C. In the present study, the water temperature was found to range between 22 and 30 °C which appears favourable for growth of fish.

Jhingran5 suggested that the ideal pH for fish growth was between 7 and 9 units. In the present study also, the pH averaged 7 to 8.8 °C units which is favourable for fish growth. Welch (1952) [7] reported that DO levels of less than 3 mg/l should be regarded as hazardous to lethal under average conditions and that 5 mg/l or more should be present in waters if conditions are to be favourable for fish culture. A perusal of the DO levels in the present study reveals that DO levels were always above 3 mg/l. Prasad *et al*. (2009) [8] and Dhurvey and Kashyap (2019) [9] suggested that increased BOD values can decrease DO levels and affect fish productivity.

A perusal of literature reveals that Shukla and Pandey (2019) [10] while studying a lake in Rewa district recorded a maximum diversity of Cyprinidae followed by Channidae, Anabantidae and Bagridae while Saket and Pandey (2019) [11] while analyzing the fish diversity in Bansagar pond reported maximum diversity to occur in Cyprinidae followed Clariidae. These results are in conformity with the present observations.

Table 1: Fish Diversity of Bansagar pond during Jan. 2020 to Dec. 2020.

S. No.	Family		Fishes		%age
1.	Cyprinidae	1.	*Catla catla*	32	18.60
		2.	*Cirrhinus mrigala*	24	13.95
		3.	*Cirrhinus reba*	12	6.98
		4.	*Ctenopharyngodon idella*	18	10.47
		5.	*Cyprinus carpio*	9	5.23
		6.	*Labeo rohita*	11	6.40
2.	Bagridae	7.	*Mystus carasius*	6	3.49
		8.	*Mystus vittatus*	4	2.33
3.	Channidae	9.	*Channa punctatus*	8	4.65
		10.	*Channa striatus*	2	1.16
		11.	*Notopterus notopterus*	7	4.07
4.	Siluridae	12.	*Ompok bimaculatus*	12	6.98
5.	Anabantidae	13.	*Anabas testudineus*	5	2.91
6.	Anguillidae	14.	*Anguilla bengalensis*	7	4.07
7.	Aplocheilidae	15.	*Aplocheilus lineatus*	4	2.33
8.	Clariidae	16.	*Clarias batrachus*	2	1.16
9.	Gobiidae	17.	*Glossogobius giuris*	6	3.49
10.	Cichlidae	18.	*Oreochromis mossambicus*	3	1.74
				172	100

Table 2: Fish Diversity Indices

Species richness	18
Abundance number	172
Shannon Wieners Index	1.02
Simpson's dominance index	0.092
Simpson's diversity index	0.91

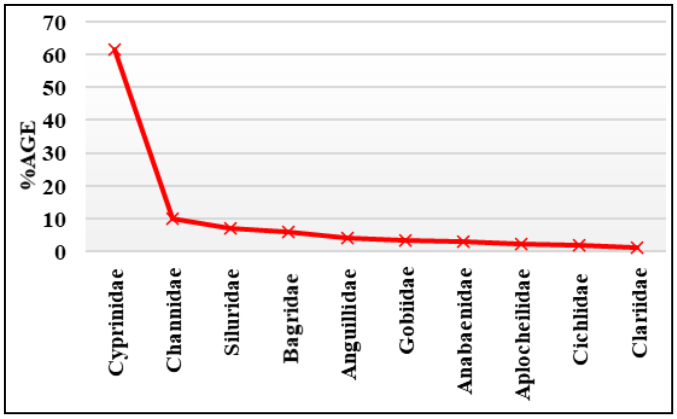

Fig 1: Graph analysis of fish population in family wise at Bansagar pond during Jan. 2020 to Dec. 2020.

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