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Comparative analysis of fish diversity from three rural cooperative managed ponds of Bhopal district, MP, India

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Abstract
Fsh fauna diversity of three rural cooperative managed ponds of Berasia Block of Bhopal District was observed for one year. 19 fish species under 4 order and 7 families from Birah shyam khedi pond. The sequence of the species abundance in Birah Shyam Khedi pond was Cypriniformes>Siluriformes> Perciformes >Osteoglossiformes. 16 fish species were recorded under 4 order and 7 families from Joonapani pond. The sequence of the species abundance in Joonapani pond was Cypriniformes>Siluriformes>Perciformes> Osteoglossiformes. 11 fish species were recorded under 4 order and 5 families from Bhojapura pond. The sequence of the species abundance in Bhojapura pond was Cypriniformes> Siluriformes= Perciformes> Osteoglossiformes. Among the three rural ponds Order Cypriniformes formed the major portion of the Ichthyofaunal diversity. The aim of investigation was to document the fish species of the three rural ponds so that some necessary steps should be taken by concern management/authority to conserve fish diversity.

Keywords: berasia block, birah shyam khedi pond, bhojapura pond, fish diversity, ichthyofaunal

1. Introduction
In the world, fish constitutes almost half of the total vertebrates (Nelson *et al*., 2016) [1]. In all aquatic habitats they live (Arthington *et al*., 2016) [2]. In the socio-economic development of the country fisheries play an instrumental role. It is also provides a valuable source of livelihood for economically backward people (Devi *et al*., 2012) [3]. Fishes have nutritional and medicinal importance as well chief food source (Ullah *et al*., 2014) [4]. It is also provides employment, alternate source of income and promotes growth of new subsidiary industries (Kumar *et al.,* 2018) [5]. Fishes are the sources of protein supply (Mohanty *et al*., 2019) [6].

In the world 21,723 living species of fish have been recorded out of 39,900 species of vertebrates (Jayaram, 1999) [7] of which 8411 are freshwater species and 11,650 are marine. In India, there are 2500 species of fishes; of which 930 live in fresh waterand 1570 are marine (Kar, 2003) [8]. India is one of the most biodiversity countries in the world. It has 9th position in fresh water Mega biodiversity (Mittermeier *et al*., 1997) [9]

Madhya Pradesh has very large area of aquatic ecosystem. It covers 3.0 lakh hectare water areas in the form of reservoir, lakes and ponds (Directorate of Fisheries, Madhya Pradesh) [10]. Madhya Pradesh is rich in freshwater reservoirs and its fish diversity. Therefore, Madhya Pradesh has great scope for fish production. Ponds help to conserve rich variety of fish species which support commercial fisheries. Related to diversity of fish fauna many studies have been conducted in different district of Madhya Pradesh. Uchchariya *et al.,* (2012) [11] studied fish biodiversity of Tighra reservoir of Gwalior District. Paunikar *et al,* (2012) [12] studied the diversity of fish fauna of the Gour River in Jabalpur District. Solanki *et al.,* (2015) [13] have conducted a study on diversity of satpura dam of Sarni of Betul District. Saini *et al.,* (2017) [14] studied Fish diversity of River Narmada, Jabalpur Region. Ghulam *et al.,* (2017) [15] studied Ichthyofaunal diversity of Halali reservoir of Vidisha district. Kakodiya S.K. *et at.,* (2018) [16] studied fish diversity of Narmada river at Hoshsngsbsd district. All these studied have shown that most of the districts of Madhya Pradesh are rich in fish diversity. Therefore, the present investigation also helpful to explore fish diversity of Bhopal district.

In Bhopal district many investigations have been done at different water bodies to find diversity of fish fauna. Chourey *at al.,* (2006) [17] conducted a study on problems of pond fish culture in Bhopal district but they did not study the fish diversity of rural ponds in Beresia Block. Sharma *et al.,* (2014) [18] conducted a study on biodiversity and catch composition of ornamental fish fauna inhabiting upper Lake of Bhopal. Bhargava *et al.,* (2014) [19] studied abundance of fish fauna of Shahpura lake with refrence to Physico-Chemical Parameters. Rana *et al.,* (2015) [20] conducted a comparative study of diversity indices of lower and upper Lake of Bhopal. Meena *et al.,* (2016) [21] have studied Fish Biodiversity of District Bhopal at Phanda and Baresia block of Bhopal district. They studied seven rural ponds of Berasia block for fish diversity but not included ponds of Birah Shyam khedi, Joona pani and Bhojapura. Many studies have been done for finding fish fauna of Bhopal district but selected ponds of present investigation have not been studied. Keeping this aim in view rural ponds in Berasia block, Bhopal Distict in Madhya Pradesh have been selected to find the diversity of fish Fauna.

The present investigation has been conducted on three Ponds of Berasia block in Bhopal district in Madhya Pradesh. These are Birah Shyam Khedi pond, Joonapani pond and Bhojapura pond. These are important and extensive reservoirs. The Birah Shyam khedi pond is managed by Nagar Palik Berasia with the help of cooperative society. The Joonapani pond is managed by

Janpad Panchyat Berasia and Bhojapura pond is managed by Gram panchayat Ramgarha.

The present investigation was conducted to find out the fish diversity and idea about dominant, common, moderate, rare and absent of particular species in these ponds. The result of present investigation will be very useful for designing management plans for the conservation of fish diversity and their habitats. The proper documentation of fish diversity also helpful to develop

Information about fish diversity and to explore the fish fauna in rural ponds of Berasia block of Bhopal district (M.P).

2. Material and methods

Berasia is a block of Bhopal district of Madhya Pradesh. It is 43 km away from Bhopal at latitude 23.6279 N and longitude of 77.4314 E. Three rural and managed ponds were selected in Berasia block. These are Birah Shyam Khedi pond (296 Hectare), Joonapani pond (10 Hectare) and Bhojapura pond (5 Hectare). The Birah shyam khedi pond 7 km away,Joonapani km away and Bhojapura pond is km away From Berasia Town. These are constructed ponds for irrigation and fish culture. The Birah Shyam khedi pond and Joonapani pond are perennial but Bhojapura pond does not have sufficient water up to month of April-May. There is no restriction on cattle entry and sewage water mixing in these ponds. The bottom of ponds contains clay and receives direct sunlight.

Fishes were collected in 3 seasons (pre monsoon from February to May, monsoon from June to September and post monsoon from October to January) for time period of 1-year April 2018- March 2019. Fishes were collected with the assistance of native fishermen by differing types of nets together with gill nets; cast net, hand nets etc. Fishes specimens were conjointly collected from different fish landing sites. Those fish species were not identified were preserved in 4% formaldehyde solution at the field. Unidentified Fish specimens dropped at laboratory were preserved in 10% formalin solution in separate specimen's jar consistent with the scale of specimen.

The fish species was known by customary keys of Jayaram (1981) [22] Qureshi & Qureshi (1983) [23], Jhingran (1991) [24] and Shrivastava (1998) [25]. Visual observations were conjointly administered if the water was clear, to grasp the distribution of fish species.

The relative abundance of fishes were classified into four classes specifically dominant (76-100% of total catch), common (51-75% of the total catch), moderate (26-50% of total catch) and rare (1-25% of the total catch), assumptive the fishing efforts constant for every catch.

The Ethical Committee for Animal Experimentation and Research, Saifia College of Science, Bhopal, India affirmed the utilization of creatures (approval number SSC/06-06-22/, dated October 26, 2006). The exploration work of the institution is done in exacting consistence with the Guidelines for Use of Laboratory Animals in Medical Colleges (2001) of the Indian Council of Medical Research, just as with the Breeding of and Experiments on Animals Amendment Rules (2001) and the Prevention of Cruelty to Animals Act (1966).

3. Result and Discussion

3.1 Birah shyam khedi pond

In this pond total 19 fish species was recorded. These were *Catla catla, Cyprinus carpio, Cirrhinus mrigala, Labeo calbasu, Labeo rohita, Labeo bata, Puntius saphore, Ctenopharyngodon idella, Hypophthalmichthys molitrix, Mystus seenghala, Wallago attu, Claris batrachus, Mystus bleekeri, Heteropneustes fossilis (Bloch), Channa punctata, Channa marulius, Oreochromi mossambicus, Notopterus notopterus, Mastacembelus armatus*. (Table 3)

Among these Catla catla, *Cirrhinus mrigala Cirrhinus, Hypophthalmichthys molitrix Channa marulius and Notopterus notopterus* were dominant species. *Cyprinus carpio, Labeo calbasu, Labeo rohita, Labeo bata, Ctenopharyngodon idella, Channa punctata, Oreochromi mossambicus, Mystus seenghala* and *Heteropneustes fossils (Bloch)* were common species. *Puntius saphore, Wallago attu, Claris batrachus, Mystus bleekeri and Mastacembelus armatus* were rare species. (Table 3)

Out of 19 species, 9 species *Catla catla, Cyprinus carpio, Cirrhinus mrigala, Labeo calbasu, Labeo rohita, Labeo bata, Puntius saphore, Ctenopharyngodon idella* and *Hypophthalmichthys molitrix*, belonging to order Cypriniformes constitutes about 47.36% of total fish fauna, 5 species *Mystus seenghala, Wallago attu, Claris batrachus,M. bleekeri* and *Heteropneustes fossils* belonging to order Siluriformes constitute about 26.31%, 3 species *Channa punctata, Channa marulius a*nd *Oreochromis mossambicus* from order Perciformes 15.78% and 2 species *Notopterus notopterus* and *Mastacembelus armatus* belonging order Osteoglossiformes representing 10.52%. (Table1&figure 1)

According to family wise classification showed that Cyprindae family has 9 species and constitutes about 47.36 % of total fish fauna, Chandidae has 3 species constitute about 15.78%. Bagridae and Clariidae have 2 species each constitute 10.52%. Heteropneustidae hora, Mastacembelidae and Notopteridae families have 1 species each constitute about 5.26 %. (Table 2 &Figure 2)

3.2 Junapani pond

In this pond total 16 fish species was recorded. These were *Catla catla, Cirrhinus mrigala, Labeo calbasu, Labeo rohita, Ctenopharyngodon idella, Hypophthalmichthys molitrix, Mystus seenghala, Wallago attu, Claris batrachus, Mystus bleekeri, Heteropneustes fossilis (Bloch), Channa punctata, Channa marulius, Oreochromi mossambicus, Notopterus notopterus, Mastacembelus armatus*. (Table 3)

Among these fish species *Catla catla, Labeo calbasu, Hypophthalmichthys molitrix and Channa marulius* are dominant species. *Labeo rohita, Channa punctata, Oreochromi mossambicus, Mystus seenghala and Notopterus notopterus* were common species. *Cirrhinus mrigala, Ctenopharyngodon idella, Wallago attu, Claris batrachus Mystus bleekeri, Heteropneustes fossilis (Bloch)* and *Mastacembelus armatus* were rare fish species. *Cyprinus carpio, Labeo bata and Puntius saphore* were absent fish species in this pond. (Table 3)

Out of 16 species, 6 species *Catla catla, Cirrhinus mrigala, Labeo calbasu, Labeo rohita,Ctenopharyngodon idella* and *Hypophthalmichthys molitrix* belonging to order Cypriniformes constitutes about 37.5.% of total fish fauna, 5 species *Mystus seenghala, Wallago attu, Claris batrachus, Mystus bleekeri* and *Heteropneustes fossilis* (Bloch) belonging to order Siluriformes constitute about 31.25%, 3 species *Channa punctata, Channa marulius* and *Oreochromis mossambicus* from order Perciformes 18.75%

and 2 species *Notopterus notopterus* and *Mastacembelus armatus* belonging order Osteoglossiformes representing 12.5%. (Table1, figure 1&2)

According to family wise classification showed that Cyprindae family has 6 species and constitutes about 37.5 % of total fish fauna, Chandidae has 3 species constitute about 18.75%. Bagridae and Clariidae have 2 species each constitute 12.5%. Heteropneustidae hora, Mastacembelidae and Notopteridae families have 1 species each constitute about 6.26 %. (Table 2 & Figure 2)

3.3 Bhojapura pond

In this pond total eleven (11) fish species was recorded. These were *Catla catla, Labeo calbasu, Labeo rohita, Hypophthalmichthys molitrix, Channa punctata, Channa marulius, Oreochromi mossambicus, Mystus seenghala, Wallago attu, Claris batrachus* and *Notopterus notopterus* fish species. (Table 3)

Among these *Hypophthalmichthys molitrix was* dominant species. *Catla catla, Labeo calbasu, Labeo rohita, Channa marulius* and *Mystus seenghala* were common fish species.

Channa punctata and *Oreochromi mossambicus* were rare species. (Table 3)

Cyprinus carpio, Cirrhinus mrigala, Labeo bata, Puntius saphore and Ctenopharyngodon idella were absent fish species. (Table 3)

Out of 11 species, 4 species *Catla catla, Labeo calbasu, Labeo rohita* and *Hypophthalmichthys molitrix* belonging to order Cypriniformes constitutes about 36.36.% of total fish fauna, 3 species *Mystus seenghala, Wallago attu* and *Claris batrachus* belonging to order Siluriformes constitute about 27.27%, 3 species *Channa punctata, Channa marulius* and *Oreochromis mossambicus* from order Perciformes 27.27% and 1 species *Notopterus notopterus*

belonging order Osteoglossiformes representing 9.09%. (Table1& figure 1)

According to family wise classification showed that Cyprindae family has 4 species and constitutes about 36.36 % of total fish fauna, Chandidae has 3 species constitute about 27.27%. Bagridae has 2 species constitute about 18.18 %. Clariidae and Notopteridae have 1 species each and constitute about 9.09 % each of total fish fauna. (Table 2& Figure 2)

The present investigation has similar finding with previous studies of Madhya Pradesh. Meena *et al.,* (2013**)** [26] have studied the fish Divrsity in water bodies of Bhopal district in Madhya Pradesh. They found that a total of 45 fish species belonging to 18 families, 7 orders and 32 genera were recorded from the District Bhopal. Order cypriniformes was dominant (19species) followed by Perciformes (10species), Siluriformes (8species), Synbranchiformes (2species), Osteoglossiformes, Beloniformes and Clupeiformes.

Paunikar *et al*., (2012) [12] have recorded 33 fish species under 5 order and 10 families from Gour River in Jabalpur. They identified 16 species of Cypriniforme, 7 species of Siluriformes, 3 species of Synbranchiformes, 6 species of Perciformes and 1 species of Belonifrmes. The Cyprinidae family is dominant followed by Channidae and Bagriidae. (1 species) each.

Nisha (2014) [27] has identified 13 fish species from Roop Sagar Talab, Distt. Satna (M.P.) in which maximum seven species belonging to the order *Cypriniformes.*

Solanki *et al.,* (2015) [13] have done studied on Diversity of Satpura Dam of Sarni of Betul District (M.P.). This investigation was under taken to study the fish diversity of Satpura dam of Betul district. About 41 fish species were identified in this dam, which was represented by 16 families and 32 genera. The family Cyprinidae dominated the other groups of fish in the river.

Rana *et al*., (2015) [20] have studied comparative biodiversity of Lower and upper lake of Bhopal. They identified 43 species from upper lake and lower lake of Bhopal district. The order Cypriniformes formed the major portion of fish species.

Meena *et al.,* (2016) [21] has reported Fish Biodiversity of District Bhopal at Phanda and Berasia Block (M.P) on 18 water bodies and showed that fish species of order Cypriniformes was dominant. The present investigation found relevant to above study.

Ghulam *et al.,* (2017) [15] have observed 23 fish fauna at Halali reservoir at Raisen/Vadisha Cypriniformes formed the major portion of the Icthyofauna. The sequence of the species abundance was Cypriniformes > Siluriformes > Perciformes > Anguilliformes >Beloniformes > Osteoglossiformes. 12 species of order Cypriniformes, 4 species of order Siluriformes, 4 species of order Perciformes, 1species of order Anguilliformes, 1 species of order Beloniformes and 1 species of Osteoglossiformes was recorded.

Saini *et al.,* (2017) [14] have identified 29 fish species from river Narmada at Jabalpur region. Cypriniformes is the most dominant order with recorded 22 species of fishes.

The present investigation also shown that the diversity of fish fauna of order Cypriniformes and family Cyprinidae were dominant in selected ponds of Berasia Block of Bhopal district (M.P.).

Table 1: Showing Number and Percentage composition of fish in an Order of three ponds

S. No	Name of Order	Birah shyam khedi pond		Joonapani pond		Bhojapura pond	
		No. of Species	% of species in an order	No. of Species	% of species in an order	No. of Species	% of species in an order
1	Cypriniformes	9	47.36	6	37.5	4	36.36
2	Siluriformes	5	26.31	5	31.25	3	27.27
3	Perciformes	3	15.78	3	18.75	3	27.27
4	Osteoglossiformes	2	10.52	2	12.5	1	9.09

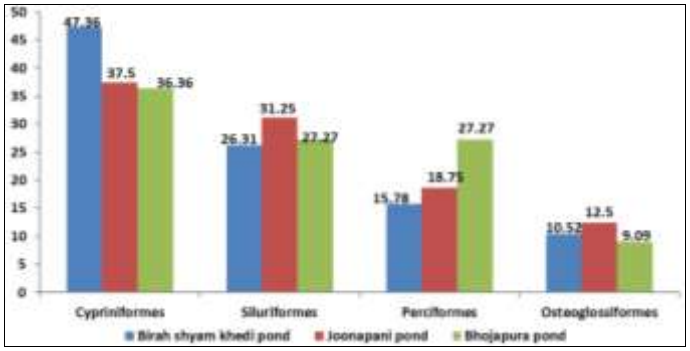

Fig 1: Percentage of fish species in an order

Table 2: Showing Number and Percentage composition of fish in a family of three ponds

S. No	Family	Birah Shyam khedi pond		Joonapani pond		Bhojapura pond	
		No. of species	% of species in family	No. of species	% of Species in family	No. of species	% of species in family
1	Cyprindae	9	47.36	6	37.5	4	36.36
2	Chandidae	3	15.78	3	18.75	3	27.27
3	Bagridae	2	10.52	2	12.5	2	18.18
4	Clariidae	2	10.52	2	12.5	1	9.09
5	Heteropneustidae hora	1	5.26	1	6.25	-	-
6	Mastacembelidae	1	5.26	1	6.25	-	-
7	Notopteridae	1	5.25	1	6.25	1	9.09

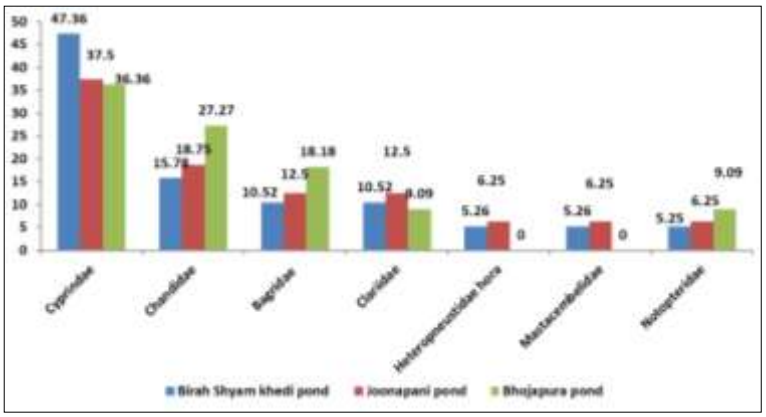

Fig 2: Percentage of fish species in a family

Table 3: List of fishes identified during present Investigation from three rural cooperative managed ponds of Berasia Block of Bhopal district during April 2018- March 2019

S. No	Order	Family	Scientific name	Common name	Birah Shyam khedi	Joona pani	Bhoja pura
1.	Cypriniformes	Cyprindae	*Catla catla*	Catla	+++	+++	++
			Cyprinus carpio	Badhas	++	_	_
			Cirrhinus mrigala	Mrigal	+++	+	_
			Labeo calbasu	Kalaunt	++	+++	++
			Labeo rohita	Rohu	++	++	++
			Labeo bata	Rahia	++	_	_
			Puntius saphore	Kharpata	+	_	_
			Ctenopharyngodon idella	Grasp carp	++	+	_
			Hypophthalmichthys molitrix	vikit	+++	+++	+++
2.	Siluriformes	Bagridae	*Mystus seenghala*	Singhara	++	++	++
			Wallago attu	Padhin	+	+	+
		Clariidae	*Claris batrachus*	mangur /cat fish	+	+	+
			Mystus bleekeri	(Kittu, Kaitiya)	+	+	_
		Heteropneustidae Hora	Heteropneustes fossilis (Bloch)	Singhi	++	+	
3	Perciformes	Chandidae	*Channa punctata*	Gaidiya	++	++	+
			Channa marulius	Sawal	+++	+++	++
			Oreochromis mossambicus	Tilapia	++	++	+
4	Osteoglossiformes	Notopteridae	*Notopterus notopterus*	Patola	+++	++	+
		Mastacembelidae	*Mastacembelus armatus*(Lacepede)	Bam	+	+	_

+++ = Dominant, + + = Common, + = Rare, _ = Absent

4. Conclusion

The present investigation mainly focuses on fish diversity at Birah Shyam khedi pond, Joona pani pond and Bhojapura pond of Berasia Block of Bhopal District. These are fresh water bodies and perennial ponds. The results of the investigation indicate that Berasia block of Bhopal district remains very rich in terms of fish diversity. Over all the investigation showed that these ponds contain rich abundance of fish species and therefore the conditions of the water bodies are still conducive to the expansion of those fish species. The fishermen sold collected fish in local market of Berasia, earning their lively hood for his or her lifestyle. The fish species in water bodies includes the native species and therefore the introduced species for purpose of fish production. This investigation would open new ways for incoming Ichthyofaunal research in rural areas. For Sustainable fish production it is necessary to conserve these water bodies of Berasia block. Chourey *et al* (2015) [17] has highlighted problem of pond fish culture in Bhopal district like bathing & washing, water pollution and maintenance of ponds. Some necessary steps should be taken by concern management/authority to prevent amalgamation of sewage water from nearby villages and to prohibit cattle entry in ponds. Farmers should be made aware of using fertilizer and pesticides in appropriate amount in their agriculture lands so that the natural habitat of these ponds remains unaffected.

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