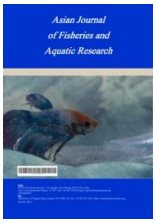

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First Record of the Ichthyofaunal Diversity of Bhagar Oxbow Lake, in Dumraon, South Bihar, India

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Fishes are very important food resources in developing countries, due to high protein content and its nutritional value. The present study deals with Ichthyofaunal diversity of Bhagar oxbow Lake, in Dumraon, District, Buxar. Total of 44 freshwater fish species were listed that belonging to 30 genera, 16 families and 7 orders, described in the present study from February, 2018 to January, 2020. Among them Cypriniformes was the dominant order in term of species diversity that represent (16 species) while the Puntius is the most dominant genus, and held a major portion of the lake. Siluriformes (11 species), Perciformes represented with 6 species, Channiformes (4 species), whereas Mastacembeliformes & Clupeiformes represented (3 species) each and Tetraodontiforme represented only (1 species). Fish of the family Cypriniformes was the most abundant 37.20% of the total fish species followed by the family Siluridae 25.58% and Perciformes 13.95% were reported. Order Channiformes represent 9.30%, followed by the family Clupeiformes 6.97%, Mastacembliformes, 4.3% and Tetrodontiform represented with 2.32% of the total fish species. In the Bhagar oxbow lake, a large number of fish species have edible as well as ornamental and medicinal values. The species composition of ichthyofaunal diversity can also be better understand by this paper. This is the first ever study on the fish diversity and would help in explore the fish fauna and to develop a sustainable fishery practices need to Bhagar oxbow lake in Dumraon.

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Keywords: Ichthyofauna; diversity; Oxbow lake; aquatic system; Dumraon; wetland.

1. INTRODUCTION

Freshwater fishes are important and exploited as a for food resources, sport and ornament. Wetlands are the natural ecosystems known by its high bioecological importance, not only to maintaining the regional and global ecological balances, but also providing living environment for wild animals and plants [1,2]. Fish diversity is one of the most important aquatic live supporting systems on the earth and it's also considerable as economic and scientific value. The worldwide fishes' diversity comprises 13,000 species and 2513 genera occurring in the freshwater, however, the oriental region harbour the majority of species [3]. India, retain massive biodiversity with approximately 2200 fish species and secured 9th ranks in the world [4]. As per available literature on Indian fishes especially identification and systematics of freshwater fishes which starts from Hora's contributing during 1920-1950s to very recent texts [5,6]. [7] has listed 852 species of freshwater fishes from the Indian region. Bihar is a state with diverse water resources' including river, wetlands, oxbow lakes, reservoirs and ponds encompasses good vegetal cover with the traditional source of fish and fisheries. It provides livelihood, support to number of fishermen, also an ideal habitat for wildlife mammals, migratory avian and potential for development [8,9]. Bihar is the fourth largest inland fish producing states in India, as many as 87 species of fishes belonging to 20 different families were recorded from this region [10]. Bhagar oxbow lake Dumraon, recently reported and determined structure and function by the author. It is an important wetland for the capture fishery of the district Buxar and have some unique ecological function only presently needs to be explored for better use of human bell-being and wildlife species [8]. Bhagar oxbow lake is meander of river Ganga and it had come into existence during 1970-1976 hydrological closed lentic and the main source for feeding of lake by the river Dharmawati dropping into the river Ganga. No attempted has been made to document the fish diversity along with their habitat especially in these species- rich areas of this region.

In this background, we have assessed for the first time, an effort has been done to study on fish diversity and also tried to study the economic importance of fish species available in the Bhagar Oxbow lake, Dumraon, District Buxar.

2. MATERIALS AND METHODS

2.1 Study Site Description

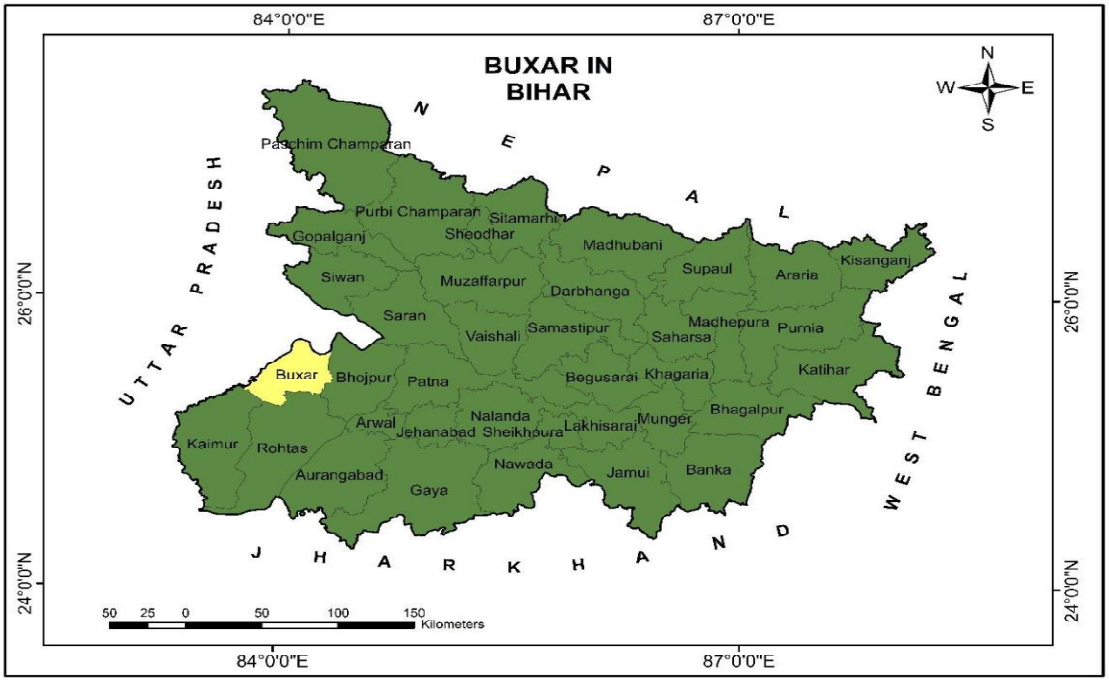
All municipalities of Bihar, among them Dumraon is one of the oldest and also oldest princely states of India. Bhagar oxbow lake, situated (Latitude: 25^{o}66'20 – 25^{o}68'90 N, Longitute: 84^{o}25'00 – 84^{o}33'30 E, located 15 km North–East from Dumraon railways station District Buxar, Bihar. It is a meander of the river Ganga typically U-shaped expansion from (Chakki to Nainijore) and hydrological closed type lentic oxbow lake having 20 km length and 1 km, width. Due to lapse of time and raising of an earthen embankment the connecting channel has become nonoperational. This lake is fed by the flood water from the river Dharmawati reported by [8]. Figs. 1 & 2:d.

2.2 Fish Sampling Method

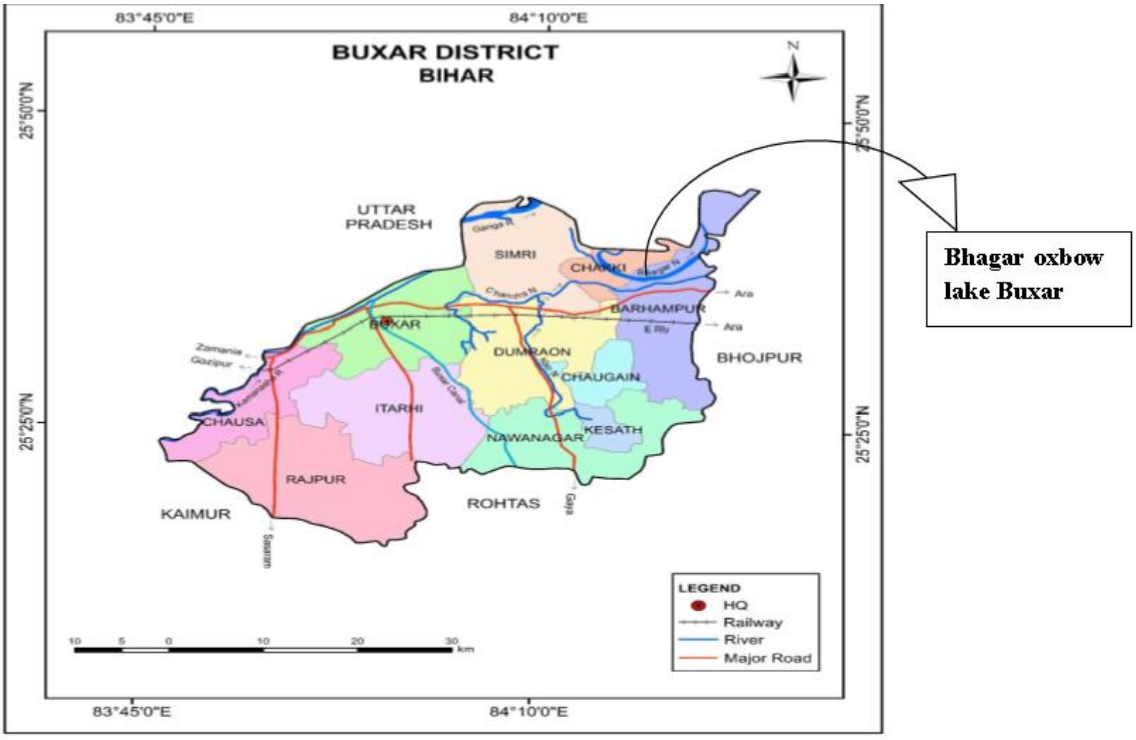
Month wise survey and fish samples were collected randomly from the different selected site, Viz. Gaighat, Pandepur, and Mahuar of Bhagar oxbow lake by the help of local fisherman using craft gear from February, 2018 to January, 2020 in the study area. The fishermen were mainly using local fishing gear and nets for fisheries and captured fishes were recorded. After collection fishes were preserved in 10% of formalin and transported to the Department of Entomology & Zoology at Veer Kunwar Singh College of Agricultural, Dumraon, (Buxar) for further investigation.

2.3 Fish Study

Identification of fishes was done on the basis of its external morphometric characters like total & standard length of the fish body, length of the head, position and diameter of the eyes, length of girth. Descriptive characters include size and shape of the body, colour of skin, position and shape of the mouth, lips, snout, Barbels, special marking of the body, Scales and lateral line system, tail & special marking, fin ray. Fishes are classified and arranged based on the work of [7,6,12]. A field kit, containing measuring tap, scale, rope, buckets, preservative, enamel trays, digital camera, etc was prepared for regular use. A boat was engaged and the Bhagar oxbow lake site was visited in the sequence. Apart from this the past history and some information regarding formation of Bhagar oxbow lake and fisheries



a) Map of Bihar indicated District Buxar



b) Map of District Buxar

Fig. 1. Map of study area in District Buxar, Bihar (a&b) [11]

production was also collected through formal communication with fisherman and local people.

2.4 Data Analysis

All the data were analyzed using M. S. Office (Excel) 2010 edition. The group structure, Order Family, Genus, Species of fish individual were recorded and tabular presentations of data were made for ease in understanding.

3. RESULTS

Our recent study to determine the structure and function of Bhagar oxbow lake in Dumraon, Buxar [8], report this lake as a shallow water body with depth ranging between 1.0 to 3 m in summer; however, a maximum depth of 4-6 m during the months has also been recorded in after the ingress of flood water from the river Dharmawati. The present study was carried out to determine the current status of freshwater fish diversity, taxonomy and preparation of an inventory of fortyfour (44) fish species recorded from the Bhagar oxbow lake in Gaighat, Dumraon, Buxar (Bihar). As per the available literatures most of the fishes recorded during the research work of the present studies are commonly found in the inland water bodies of India special reference to the Ganga river. Percentage contribution of family, genera and species under 7 orders is given in the Tables 1, 2 & 3 and Fig. 2. a, b & c.

In the present Ichthyofaunal study, diversity of fishes comprised of 30 genera and 44 species belonging to 16 different family. Cyprinidae, Cobitidae, Bagridae, Siluridae, Schilbeidae, Heteropneustidae, Claridae, Nandidae, Ambassidae, Anabantidae, Channidae, Mastacembelidae, Notopteridae, Clupeidae, Engraulididae, Tetraodontidae, of 7 orders. However, Cypriniformes order was with maximum Genera and species (10) and (17) respectively detail of these fishes along with their local name are listed in Tables 1 and 2.

On the basis of percentage composition and species richness, order Cypriniformes was dominant species (17), and percentage contribution of 37.2%, Siluriformes represented (11) species, and percentage contribution of 25.58%, which includes *Mystus tengra*, *M. cavasus*, *Sperata aor*, *S. senghala*, *M. vitatus*, *O. bimaculam*, *W. attu*, *E vacta*, *Ailia coilia*, *Clarius batrachus* and *H. fossilis*. Perciforms represented (6 species), and percentage contribution of 13.95% the six Perciformes species of included *N. nandus*, *B. badis*, *A. nama*, *A. ranga*, *C. fasciatus*, *A. testidunious*, followed by Channiformes represented (4) species, and percentage contribution of 9.30% the four species of Channiformes include *C. marulius*, *C. orientalis*, *C. straitus*, *C. punctatus* whereas, Clupeformes represented (3) species, and percentage contribution of 6.9 7% Mestacembeliformes represent (2) species whereas Tetraodontiformes represented only one species detail presented in the Table 3 and Fig. 2. a, b & c.

During the survey of Bhagar oxbow lake, the most catched fishes for commercial activities in this lake are Carp, Mystus and rest of them belonging to miscellaneous group. Small size many species shellfishes like gastropods, crabs & *Macrobrachium species* of freshwater prawns, were found in all season, *Clarias batrachus* and *Heteropneustes fossilis* carry high economic value though these are becoming rare. Besides the Carp species, *Mystus cavasius*, *Wallago attu* have reasonable economic value. We have reported 44 freshwater fish species, in which 31 species are commercially important as ornamental well as edible. 03 species have food and medicinal values. Some weeds were also found in this lake in the form of submerge (*Hydra, Vallisneria, Utricularia*), free-floating, rooted and floating (*Eichhornia crassipes*), and emergent vegetations. These vegetations may be create hypoxic environment unfavorable for obligate water breather fin fishes as well as shell fishes (Fig. 2. d). According to local people and fishermen that reside near the Bhagar Oxbow lake Dumraon and as a result, the distributional ranges of some fish species have shrunk tremendously over the last decades and restricted only to localized areas.

Table 1. Systematic list of economic important fish species of Bhagar Oxbow lake in Dumraon, district Buxar

Order	Family	No	Name of Fish species	Common name	Economic importance
Cypriniformes	Cyprinidae	1	*Catla catla*	Catla	Edible
		2	*Labeo rohita*	Rehu	Edible
		3	*Labeo gonius*	Kursa	Edible
		4	*Labeo dero*	Arangi	Edible
		5	*Puntius tico*	Pothia	Edible /ornamental sp.
		6	*Puntius conchonius*	Sindhari	Edible / ornamental sp.
		7	*Puntius sophore*	Pothia	Edible / ornamental sp.
		8	*Puntius sarana*	Dharhee	Edible / ornamental sp.
		9	*Puntius phutunio*	Sindhari	Edible / ornamental sp.
		10	*Cirrhinus mrigala*	Naini	Edible
		11	*Cirrhinus reba*	Reba	Edible
		12	*Oxygaster bacaila*	Chalhawa	Edible
		13	*Aspidoparia morar*	Chilwa	Edible
		14	*Laubuca laubuca*	Chelhwa	Edible / ornamental sp.
		15	*Esomus danricus*	Dendua	Edible / ornamental sp.
	Cobitidae	16	*Lapidocephalus guntia*	Nakati	Edible
		17	*Botia dario*	Baghua	Edible / ornamental sp.
Siluriformes	Bagridae	18	*Mystus tengara*	Tengra	Edible / ornamental sp.
		19	*Mystus cavasius*	Tengra	Edible / ornamental sp.
		20	*Sperata aor*	Daryai tengra	Edible
		21	*Sperata seenghala*	Tengra	Edible
		22	*Mystus vittatus*	Tengra	Edible / ornamental sp.
	Siluridae	23	*Ompok bimaculam*	Jalcapoor	Edible / ornamental sp.
		24	*Wallago attu*	Barari	Edible
	Schilbeidae	25	*Eutropichthys vacha*	Bachwa	Edible
		26	*Ailia coilia*	Patasi	Edible
	Claridae	27	*Clarias batrachus*	maguri	Edible/medicinal/ ornamental
	Heteropeustidae	28	*Heteropneustes fossilis*	Singhi	Edible, medicinal value
Perciformes	Nandidae	29	*Nandus nandus*	Dhebari	Edible / ornamental sp.
		30	*Badis badis*	Sumla	Edible / ornamental sp.
	Ambassidae	31	*Ambassis nama*	Chamwa	Edible / ornamental sp.

		32	*Ambassis ranga*	Chanari	Edible / ornamental sp.
	Anabantidae	33	*Colisa fasciatus*	cheli	Edible / ornamental sp.
		34	*Anabas testudineus*	Kabai	Edible /medicinal value
Channiformes	Channidae	35	*Channa marulius*	Saur	Edible / ornamental sp.
		36	*Channa orientalis*	Chenga	Edible / ornamental sp.
		37	*Channa striatus*	Sauri	Edible / ornamental sp.
		38	*Channa punctatus*	Garai	Edible / ornamental sp.
Mastacembeliformes	Mastacembelidae	39	*Mastacembelus armatus*	Bami	Edible / ornamental sp.
		40	*Macrognathus aral*	Gonchi	Edible / ornamental sp.
Clupeiforms	Notopteridae	41	*Notopterus notopterus*	moh	Edible / ornamental sp.
	Clupeidae	42	*Gadusia chapra*	Chapri	Edible / ornamental sp.
	Engraulidae	43	*Setipinna phasa*	Phasa	Edible
Tetraodontiformes	Tetraodontidae	44	*Tetrsdon cutcutia*	Gaphulmi	Edible / ornamental sp.

Table 2. Fish fauna diversity of Bhangar Oxbow lake, Dumraon, Buxar

S. No.	Order	Families	Genera	Species
1.	Cypriniformes	2	10	17
2.	Siluriformes	5	8	11
3.	Perciformes	3	5	6
4.	Channiformes	1	1	4
5.	Mastacembeliformes	1	2	2
6.	Clupeiforms	3	3	3
7.	Tetraodontiformes	1	1	1
Total	7	16	30	44

Table 3. Percentage contribution of number of families, genera and species under various orders of Fish fauna

S. No.	Order	Families%	Genera%	Species%
1.	Cypriniformes	12.5	33.33	37.20
2.	Siluriformes	31.25	26.66	25.58
3.	Perciformes	18.75	16.66	13.95
4.	Channiformes	6.25	3.33	9.30
5.	Mastacembeliformes	6.25	6.67	4.30
6.	Clupeiforms	18.75	10.00	6.97
7.	Tetraodontiformes	6.25	3.33	2.32
Total	7	100%	99.98	99.97

4. DISCUSSION

Asia supports over half of the global human population, with enormous consequent pressures on inland waters and freshwater fish biodiversity [13]. The diversity of fishes in the wetland in India specially in Bihar is reflected from the reports of another research also [9,10]. Gunasekar et al., [14] documented 25 species of freshwater fishes from Indrapuri dam district Rohtas in south Bihar, however, [9] documented 42 freshwater fish species from an Oxbow lake in Samastipur in north Bihar. Kumar et al., [15] documented total 33 freshwater fish species belonging to 6 orders from the Shershah Suri pond in Sasaram whereas, 40 species of freshwater fishes from Turkaulia Oxbow lake in north Bihar reported by [16]. Bhagar oxbow lake is hydrological lentic type meander of river Ganga, supports good diversity of freshwater capture fishery and contributes to economic of Brahampur, Dumraon and Buxar [17]. This lake interacted with climatic and geological events that have both isolated fish population and provided opportunities for migration and colonization of new habitats [8]. According to Briggs [18], reported that Cypriniformes and also Siluriformes originated in South America and migrated to Asia in late Jurassic (era 150-160 Myrs ago) along the northern shore of the Thethys sea, but for the long time Asia considered as the centre of origin for Cypriniformes. Thus, the result of the present study revealed that the large number of species in Bhagar Oxbow lake were belonging to the Cypriniformes and Siluriformes, orders which the fish species composition belongs to the others orders i.e., Tetraodontiformes, Mastacembeliformes and Channiformes was found to be least. Hence, the member of the family Bageridae, Siluridae and Cyprinidae were found to be highly abundant, in which the *Puntius* is the most dominant genus in Bhagar oxbow lake of Dumraon, district Buxar. Prasad *et al.,* [19] reported regarding the *Puntius* species is one of the important freshwater fish with high nutritional value and market demand because of its relatively little bit lesser cost and abundance in the fish market in Dumraon city, details presented in Tables 1, 2, & 3 and Fig. 2. a, b & c. Lundberg et al., [20] provides an excellent summary review of fish diversity and notes the compared with tropical regions species diversity in North America is relatively well documented. They reported regarding the present distribution of freshwater fishes has been shaped by millions of years of changes in the global water cycle. In Asia, an estimated total number of 3,000 species has been suggested in which 121 fish families recorded from inland waters including 34 primary and secondary division freshwater fishes. [21] 11 species under 10 genera belonging to cyprinidae family from Harsul Savangi dam in the district of Aurangabad (Maharastra). [22] that the dominant primary groups Cypriniformes (1,000 spp) Cobitidae (100 spp) and Balitoridae (300 spp), Siluriformes (100 spp) found in Oriental region.

[23] have also worked on the Ichthyofauna of Mahi River and its basin and recorded 15 species of fishes. [3] regarding fish inhabiting freshwaters comprise therefore 25% of living vertebrates and represent 13-15% of the 100,000 freshwater animal species currently known. Such wide-ranging distribution might be associated to physical factors such as temperature, foods during the rainy season, change in water level and size of wetlands and feeding habits of fish could also impact largely the species composition and their distribution [24].

The present study has been found that Bhagar oxbow lake is worst victim of the anthropogenic pressure and have ecological change. Out of 44 species, 31 are commercially important as ornamental as well as edible species. 03 species have food and medicinal values. According to local people and fishermen that reside near the Bhagar Oxbow lake Dumraon and as a result of the distributional ranges of some species have shrunk tremendously over the last few decades and restricted only to localized areas, because main channel of the lake is defunct or closed [25,26,27], reported that wetlands are the creation of the river in the flood plain area and facing multidimensional threats, under severe pressure in the face of ever-increasing human interference. The freshwater fish and shell fishes' diversity is in declining mode due to several anthropogenic threats and it also marked due to pollution, urbanization, scarcity of food, shelter, habitat destructions and progressive eutrophication of the water body reported by [14,28,29,30].

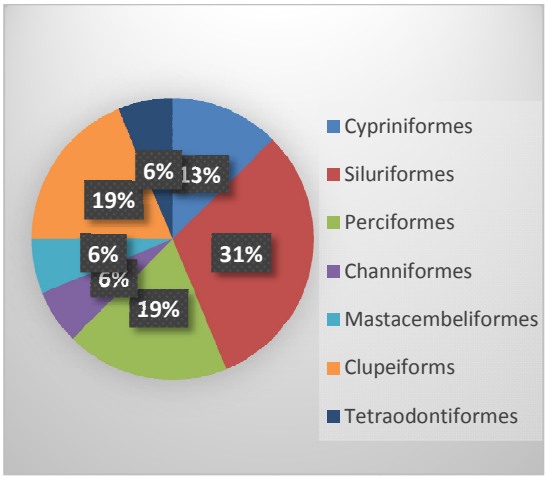


Fig. a. Showing percent contribution of families to the order

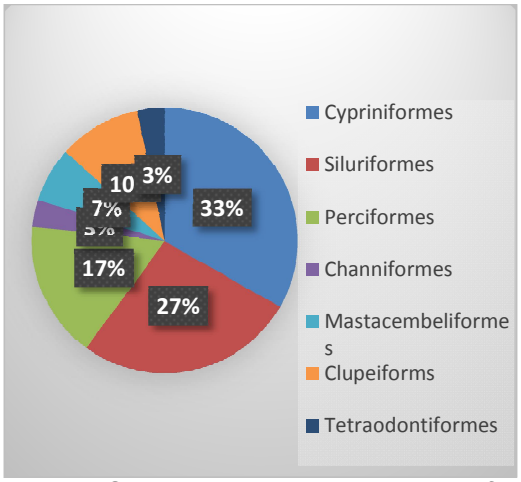


Fig. b. Showing percent contribution of genera to the order

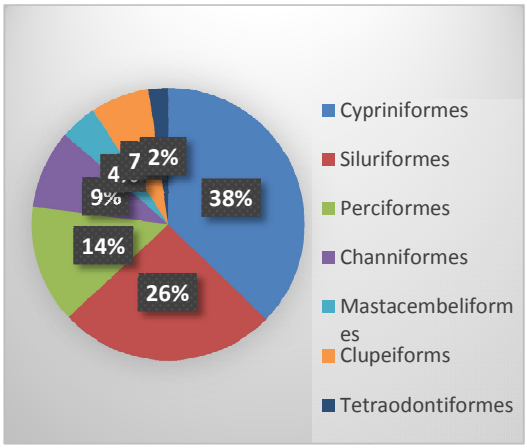


Fig. c. Showing percent contribution of Species to the order

Fig. d. Floating aquatic weeds in Bhagar Oxbow lake, near Mahuar village, Dumraon

Fig. 2. a, b, c &d Showing % contribution of families, genera, species to the order and floating aquatic weeds in Bhagar Oxbow lake

5. CONCLUSION

The Bhagar Oxbow lake, Dumraon supports a rich and diversified fish fauna. 44 species of fish belonging to 30 genera, 16 families and 7 orders were recorded. Cyprinids are the most dominant group which the Puntius is the most dominant genus in the lake. This is the first attempt to describe fish diversity of this oxbow lake Dumraon, South Bihar. So joint efforts are required by scientist, environmentalist, villagers and students for the further study like water quality, Invertebrates and vertebrate's diversity in order to conserve these valuable resources, a holistic approach, integrating the concept of sustainable development and conservation measures should be adopted.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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