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Fish diversity of Atal Sagar Dam in Shivpuri distrit, Madhya Pradesh, India

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Abstract
The aim of the study was to explore the fish fauna of Atal Sagar Dam in Shivpuri district Madhya Pradesh.The study was conducted during Feb 2018 to Jan 2019. Fish diversity was assessed by calculating the various diversity indices such as Shannon Weiner index (H), Simpson Dominance Index (D), Simpson index of diversity (1-D), Gibson's Evenness (E) and Margalef index of species richness. The survey indicated that the fish fauna of Atal Sagar Dam consists of 22 species belonging to 6 order and 11family Out of them Cypriniformes order is the most dominant group with recorded 10 species, Siluriformes consists of 5species,Perciformes 4 species, Osteoglossiformes consist 1 species, Beloniformes followed1species, Synbranchiformes consist1species during studyShannon-Weiner diversity index of five different sampling sites showed variation and ranged from 2.77 to 1.97.The highest fish diversity was recorded at site 2 and lowest fish diversity at site 4. Maximum species richness was observed in site 2 as compared to other sites of Atal Sagar Dam.

Keywords: Fish fauna, diversity, richness, atal sagar dam.

Introduction
Biodiversity is essential for stabilization of ecosystems, protection of overall environmental quality for understanding intrinsic worth of all species on the earth (Ehrlich and Wilson, 1991). Fishes are the most important aquatic fauna which is directly related to human well-being. The diversity among fishes is very high and includes 33,900 species Froese and Pauly (2018) [3] constitutes half of the total number of vertebrates in the world. The aquatic ecosystem has a large number of economically important animals especially fish, which is an important source of food as proteinand occupied a significant position in the socio-economical fabric of South Asian countries. Fishes exhibit enormous diversity in their morphology, in the habitats they occupy and in their biology.Study of biodiversityof fish fauna and their identification is one of the interesting field of biological research, which gives us an idea about the morphological variations and population diversity of fauna in polluted and non-polluted site of any particular habitat (Napit, 2013) [9]. Fish havebeen regarded as an effective biological indicator of environmental quality and anthropogenic stem in aquatic ecosystem (Vijayasree and Radhakrishnan, 2014) [18]. The objective of present investigation was to give recent data regarding fish diversityin relation abundance, richness, relativeabundance and diversity status of thereservoir system, aiming to contribute a better knowledge of the fish diversity profile of Atal Sagar Dam.

Study area
Atal Sagar Dam is located about 30 Kms in eastern side from Shivpuri district Madhya Pradesh. Geographically lies between 26°29'15" N latitude and 78°7'30"E longitude near the Madikhada village. It is constructed on Sindh River for hydroelectricity and irrigation purpose. The reservoir has been named on the name of village Manikheda as Manikheda Dam know called as Atal Sagar Dam. It is used for fishing, drinking, bath-washing by human being as well as also support for large number of wild fauna and flora.

Material Methods
Fish specimens were collected from five fishing spots (S1, S2, S3, S4 and S5) during the study period. The fish were caught by local fishermen by operating cast nets and drag nets which varied from 10 to 100 mm during the study. After obtaining the fish from the site photographs were taken for taxonomic study, fish samples were preserved in 5% formaldehyde solution. Plastic jars were used to collect and preserve the fishes. The identification of the species was done mainly on the basis of the colour pattern, specific spots or marks on the surface of the body, shape of the body, structure of various fins, mouth shapes confirmation were carryout by using the standard keys of Qureshi and Qureshi (1983) [13], Talwar and Jhingran (1991), Dutta and Shrivastava (1988) [1], Jayaram (1999) [8]. The scientific names of the identified fishes were also checked by referring the website of fishbase. Species diversity was assessed using five different indices namely, Shannon Wiener index (H) given by Shannon and Weiner, 1963), Simpson index (1-D), Margalef index (d) and Gibbson'sindex (E) and Simpson's dominance index (D) has a direct relationship with the species diversity, whereas index of dominance has an inverse relationship.

Result and Discussion
The Fish diversity of Atal Sagar Dam is restricted to 22 species belonging to 6 order and 11 families. (Fig. 1) The composition of species and their percent under various orders has shown that 10 species are available under Cypriniformes with (45%), 4 species under Siluriformes with (22%), and 2 species Perciformes with 18.18%, 1 species each under Synbranchiformes, Osteoglossiformes and Beloniformes with (4.54%). However, similar result observed by Uchchariya *et al.*, (2012) reported order Cypriniformes was found to be a major order with percent contribution of 55.0%, followed by Siluri-formes with 20.0%, Perciformes with 15.0%, Synbranchiformes with 5.0% and Osteoglossiformes and Beloniformes each with 1.5%.
During the present investigation the order of dominance

showed respectively Cypriniformes (45%), > Siluriformes (22%) > Perciformes (18.18%) > Synbranchiformes = Beloniformes = Osteoglossiformes (4.54%).

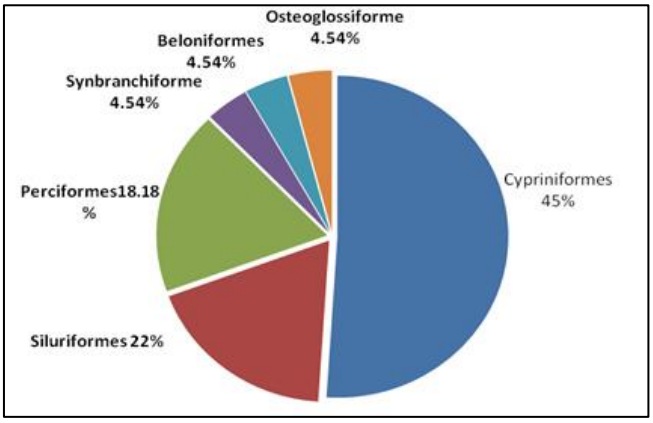

Fig 1: Order wise Fish species percentage composition of Atal Sagar Dam

Out of 22 fish species maximum number of 10 fish species belongs to family Cyprinidea with (45%) of share followed by family Channidea and Siluridae having 2 species each with (9.09%) share,The family Ambassidea, Belonidea, Clariidea, Notopteridae, Sisoridae, Heteropneustidae, Cichlidae and Mastacembelidae represented by one species each with a share of (4.54%) recordedduring the present investigation, similar data also observed by Vishwakarma & Vyas, (2014) study conducted on Species diversity and assemblage fish fauna of Jamner River recorded 17 species of Cyprinidae family and 1 species each from Ambassidae, Bagridae, Gobiidae and Siluridae.

Jancy and Jobiraj (2017) observed 40 species of fishes belonging to 7 order,17 families from Karamana river, Kerela out of which Cyprinidae was the most dominant (41.55%), followed by Cichlidae (25.98%), Mugilidae (14.66%) Bagridae (3.33%), Channidae (3.13%), Siluridae (2.31%), Nandidae (1.79%), Godiidae (1.71%), Clariidae (1.41%), Ambassidae (0.91%), Aploecheilidae (0.80), Heteropneustidae (0.61%), Mastacembelidae (0.61%), Balitoridae (0.60%). The least were observed in Anguillidae (0.30%), Belonidae (0.20%) and Cobitidae (0.10%).

The sequence of dominance of encountered families is as respectively Cyprinidae (45%) > Channidae = Siluridae (9.09%) > Ambassidae = Belonidae = Notopteridae = Heteropstidae = Sisoridae = Cichlidae = Clariidae = Mastacembelidae (4.54%)

The present study on fish diversity abundance and percentage contribution of different fishing Sites S1, S2, S3, S4 and S5 (Table 4). Among the total enlisted species, the dominant ones includedCypriniformes order have 1 family Cyprinidae which was represented by 10 species *Labeo gonius, Labeo Rohita, Labeo bata, Labeo calbasu, Catla catla, Cirrhinus mrigala, Cirrhinus reba, Osteobrama cotio, Rasbora daniconius, Puntius sarana,* Beloniformes order have 1 family Belonidae was represented by 1species *Xenentodon Cancila,* Osteoglossiformes Order have 1 family Notopteridae was represented by 1 species *Notopterus Notopterus*, Siluriformes Order have 4 family Siluridae was represented by 2 species *Wallago attu, Ompok bimaculatus*, Claridae was represented by 1species *Clarias batrachus*, heteproidae represent by 1 species Sisoridae was represented by1 species *Mystus cavasius*, Perciformer Order have 3 family Channidae was represented by 2 species *Channa Marulius* and *Channa striatus*, Ambassidae was represented by 1 species Parambassis ranga, Cichlidae was represented by 1 species *Nandus Nandus*, Synbranchiformes order have 1 family Mastacembelidae was represented by 1 species Mastacembelus armatas**.** Cyprinid is the most abundant and dominant group similarly cyprinid dominance has been observed from Indus River by Iqbal *et al*., (2013) as well as from Swat River, Pakistan. The family Cyprinidae is dominant among other families as they are fast growing, pollution tolerant, hardy fishes and have faster growth rate as also said by various workers Patra *et al*., (2011).

Table 4: Distribution of individual encoutered with abundance and percentage contribution of fish species in Atal Sagar Dam

Family	Scientific Name	Local name	S-1	S-2	S-3	S-4	S-5	Abundance	%Contribution
Cyprinidae	*Labeo rohita*	Rohu	+	+	+	+	+	112	10.87%
	Labeo gonius	Kursa	-	+	+	-	-	24	3.20%
	Labeo bata	Bata	-	+	+	-	-	33	2.33%
	Labeo calbasu	Kariya	-	+	+	-	-	26	2.52%
	Catla catla	Katla	+	+	-	+	+	104	10.09%
	Cirrhinus mrigla	Mrigla	+	+	-	+	+	89	8.64%
	Cirrhinus reba	Naren	-	+	+	-	-	09	0.87%
	Osteobroma cotio	Gudgudi	-	+	+	_	+	21	2.03%
	Rasbora doniconius	Zhan zara	+	-	+	+	-	53	5.14%
	Puntius sarana	Puthia	+	+	-	+	-	11	1.06%
Belonidae	*Xenentodon cancila*	Khadia	+	+	-	+	+	78	7.57%
Notopterdae	*Notopterus Notopterus*	Suja	+	+	_	-	+	83	8.05%
Siluridae	*Wallago attu*	Lonch	-	+	+	-	-	12	1.16%
	Ompok bimaculatus	Pauda	+	+	+	-	-	47	4.56%
Claridae	*Clarius batrachus*	Mangur	+	+	-	+	+	49	4.75%
Sisoridae	*Mystus cavasius*	Kitua	+	-	+	_	+	37	3.59%
Heteropsidae	*Heteropneuteus fossilis*		+	+	-	-	+	18	1.74%
Channidae	*Channa striatus*	Durkasol	+	+	+	-	+	61	5.92%
	Channa Marulius	Sol	+	+	+	-	-	39	3.78%
Ambassidae	*Parmbassis ranga*	Kakhai	+	-	+	+	+	44	4.27%
Cichlidae	*Nandus nandus*	Tilapia	+	+	+	-	-	41	3.98%
Mastacedae	*Mastacembelus*	Baam	-	+	+	-	+	39	3.78%
Total								1030	

Species richness, evenness, and diversity indices as Shannon-Weiner and Simpson Index and Margalef's index were calculated to evaluate the fish species diversityOut of 22 species of fishes, maximum 19 species were recorded from Site 2 with (29%) followed by 15 species from site 1 (26%) and site 3 (18%), 12 species from site 5 (18%) minimum 8 species from site 4 (9.20%) (Fig. 3). Highest number of individuals (303) was encountered at site 2 followed by (270) individuals at site 1, 190 at site 3, 172 at site 5 rest of all 95 individuals at site 4. The Shannon Wiener Index (H) value was high at site 2 (2.77) and low at site 4 (1.97) as compared to the site 3 (2.61) and site 5 (2.27). The value of Simpson - dominance index (D) was indicating high diversity at site 2 (0.93) and low at site 4 (0.86). Simpson's index of diversity (1-D) value was shown as 0.13, 0.11, 0.07, 0.06 and 0.06 at site 4, site 5, site 3, site 2 and site 1 respectively Gibson's evenness (E) maximum value was high at site 1 (0.94) followed by site 4 (0.90), site 3 (0.90), site 2 (0.84) and minimum value at site 4 (0.81). The Margalef's richness value at site 2 (3.15), site 3 (2.66), site 1 (2.50), site 5 (2.13) and site 4 (1.53) were respectively Equitability (J) varied from 0.97 (S1) to 0.91 (S5) (Table 6). Galib *et al*., (2013) in their study found about 63 species from Choto Jamuna river and calculated values of Shannon- Weiner index (H), Margalef's index and evenness (E) were 3.717, 6.954, and 0.897, respectively. Rahman *et al.*, (2015) also studied four sites S1, S2, S3 and S4 of Bishkhali River, Jhalakathi district of Bangladesh showed Shannon-Weiner index (H) in site1 was (3.16) followed by site2 (3.05), by site 4 (2.94) and lowest in site 3 (2.93). The Simpson's dominance index (D) value was high at site-1, site-3 and site-4 (0.08) low at site-2 (0.07). Simpson's index of Diversity (1-D) was (0.92), at site 1, Site 3 and site 4 at site 2 (0.93)

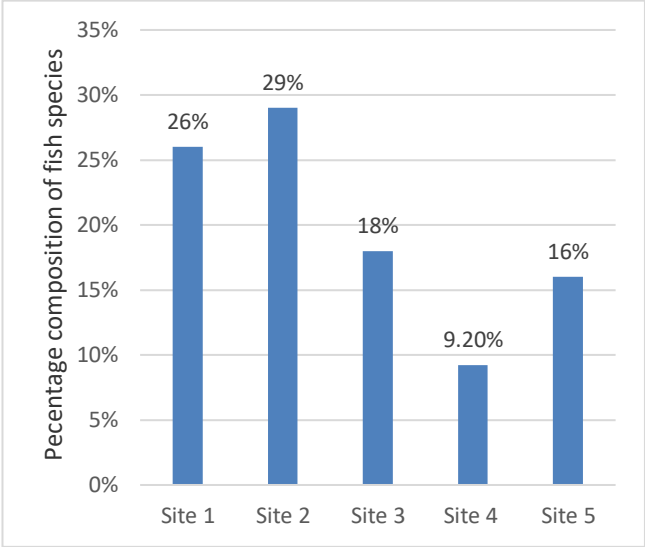

Fig 3: Composition of fish species during study period in Atal Sagar Dam

Table 6: Different Site wise species diversity indexes used to understand species of fish fauna in Atal Sagar Dam

Diversity indices	S 1	S 2	S3	S 4	S5
Total no of species	15	19	15	8	12
Individuals	270	303	190	95	172
Shannon-Wiener Index (H)	2.64	2.77	2.61	1.97	2.27
Simpson's index (1-D)	0.06	0.06	0.07	0.13	0.11
Simpson's dominance index (D)	0.93	0.93	0.92	0.86	0.88
Gibson's evenness (E)	0.94	0.84	0.90	0.90	0.81
Margalef's index (d)	2.50	3.15	2.66	1.53	2.13
Equatability_J	0.97	0.94	0.96	0.95	0.91

The variations in species richness and diversity in relation to different sampling periods and months have beenobserved in several studies (Ornellas and Coutinho, 1998; Pires *et al.*, 1999; Reichard *et al.*, 2002) [10, 12, 14]

The present study elucidates the ecological significance of water bodies to increasefish productionand provide future strategies for development of fish fauna Out of 22 fish species found in the Atal Sagar Dam 10 species belong to the Cypriniformes order which was most dominant. Maximum number of species recorded at Site 2 show good indication of species rich diversity therefore, the present study will help to save the fish fauna diversity of the reservoirs from further decline.

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