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Comparative study of fish diversity with respect to physicochemical parameters of Dimna Lake and Jayanti Sarovar, Jamshedpur, Jharkhand

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Abstract- Fish farming in lentic ecosystems can provide a valuable source of food and income while minimizing pressure on wild fish populations. Dimna lake which is situated at latitude 22.7971 and longitude 86.18175 is an important source of fish farming and drinking water in and around Jamshedpur, Jharkhand, India. This lake is spread over an area of 36 hectares and is about 13 kms from the main town. Jayanti Sarovar is another lake situated at latitude 22.80975 and longitude 86.18775 in the main town. It covers an area of 40 acres. In the present study, comparative study of fish diversity along physicochemical analyses of water samples from both the lakes are being reported. The physicochemical analyses regarding water temperature, pH, turbidity, transparency, dissolved O_2, free CO_2, alkalinity, hardness, carbonate, bicarbonate, chloride, phosphate, silicate, Na^+, K^+, Ca^{++}, Mg^{++} were performed seasonally. The diversity of fishes was studied during the period March 2019 to December 2021. The water temperature and pH of Dimna Lake ranges from 33.0 ^{0}C to 19.6 ^{0}C and 7.8 to 7.6, respectively. Dissolved O_2 and free CO_2 content were found to be 5.9 mg L^{-1} to 6.5 mg L^{-1} and 3.5 mg L^{-1} to 4.5 mg L^{-1}, respectively. Hardness of water ranges from 122 mgL^{-1} to 147 mgL^{-1}. On the other hand, water temperature and pH of Jayanti Sarovar ranges from 19.0 ^{0}C to 33.5 ^{0}C and 7.8 to 7.9, respectively. Dissolved O_2 and free CO_2 content of this lake were found to be 6.7 mg L^{-1} to 9.2 mg L^{-1} and 5.6 mg L^{-1} to 21.0 mg L^{-1}, respectively. Hardness of water ranges from 89.0 mgL^{-1} to 127.0 mgL^{-1}. Fish diversity of Dimna Lake include members belonging to class Actinopterygii consisting of five families, six orders, 12 genera and 19 species. Highest species composition was observed in Cyprinidae family followed by Cichlidae, Claridae and Siluriformes families. Fishes belonging to class Actinopterygii consisting of three families, two orders, five genera and seven species were recorded from the Jayanti Sarovar. Highest species composition was observed in Cyprinidae family followed by Claroteidae. Thus, the fish diversity of Dimna Lake is more diverse as compared to Jayanti Sarovar. Both physicochemical parameters and diversity of fish indicate that this lentic ecosystem is well suited for fish culture and farming.

Key words: Fish diversity, physicochemical, Actinopterygii, Cyprinidae, Cichlidae.

INTRODUCTION

In the lake ecosystem, biodiversity is a key indicator of environmental quality. In lakes and ponds, a large portion of the species variety is concentrated in the littoral zone, which is close to the shore and is where algae and plants grow in abundance. The water quality of lakes, a crucial component of the global freshwater ecosystem, is influenced by a variety of seasonal and environmental factors. Water is the basic requirements of all living which is also a valuable natural resource. Water is the lifeblood of all living things on the planet. All terrestrial species, including humans, have an average body composition of 65% water. Lakes have been defined as a body of standing water occupying a basin or lacking continuity with sea. Lakes of all sizes provide fisheries, drinking water, scenic beauty, power generation, property value improvements,

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and serve as an excellent system for ecological studies. Lakes are an essential component of the natural environment, defining both the landscape and its ecological functioning. Lakes all around the world have become the focus of environmental research in recent decades due to their tremendous diversity based on genesis, geographical position, hydrological regimes, and substrate variables. Water quality is determined by a variety of abiotic and biotic elements related to the ecosystem. The physio-chemical qualities of water and biological variety are critical to the maintenance of a healthy environment. The lake has been rich in aquatic flora and faunal diversity, yet demands further investigation with regard to ichthyofaunal diversity and its association with the water quality. A general study on limnochemical parameters and assessment of the fisheries potential and monitoring of water quality at regular interval is an essential component for fish productivity in a given ecosystem.[1] Abiotic and biotic factors are interdependent and changes or fluctuations of abiotic factors frequently affects the biotic factors changing their quantity and biodiversity. Physical parameters like water, temperature, light intensity, transparency whereas chemical parameters like dissolved oxygen (DO), free CO_2, pH, alkalinity, hardness, phosphate, nitrate levels etc. of the lake water highly govern the aquatic life and determine the trophic status of the water body.[2] It is very pertinent to mention that the water quality parameters might have attributed great influence on fish assemblage in a given lake system.[3] Occurrences of the fishes and their distribution were recorded from each lake to understand its conservation status.

In India, artificial or man-made lakes are constructed for a variety of purposes, including aesthetic or recreational ones, hydroelectric power generation for household water supply, industrial or agricultural uses, or both. Artificial lakes, also referred to as man-made reservoirs, serve as virtual water sources for several countries worldwide. Fishes occupy all three levels of the aquatic food chain, namely primary, secondary, and tertiary consumers. Man is the top carnivore on the planet this food system since it is a great source of protein.

Dimna lake which is situated at latitude 22.7971 and longitude 86.18175 is an important source of fish farming and drinking water in and around Jamshedpur, Jharkhand, India. This lake is spread over an area of 36 hectares and is about 13 kms from the main town.

Jayanti Sarovar is another lake situated at latitude 22.80975 and longitude 86.18775 in the main town. It covers an area of 40 acres.

MATERIALS & METHODS

Sampling of water and fish were carried out during March 2019 to December 2021 from selected sampling sites of the lake Dimna Lake site A (main Dam area) and site Jayanti Sarovar (Jubilee Lake). Water samples were collected seasonally without disturbing the water column and survey were taken in between 7 a.m. to 1 p.m. in a day. The water samples were collected below 1.5 ft of the surface water. The samples were collected in dry and dried bottle. The samples collected from different sites are brought to lab for examination.

Physico-chemical analysis of water was done in Jamshedpur Women's College Laboratory, Bistupur and P.G. Department laboratory, Kolhan University, Chaibasa. pH meter had been used to measure pH, salinity, and total dissolved solids of water, dissolved oxygen (DO), biological oxygen demand (BOD) and free carbon dioxide (FCO_2), total alkalinity (TA), total hardness (TH), chloride (Cl^-), nitrate (NO^{3-}) and phosphate (PO_4^{3-}) following the different procedures of (APHA 2012)[4]. The period of water sample collection and survey within a year has been divided into four different seasons the seasons are specified as (i) March to May (ii) June to August (iii) September to November and (iv) December to February. A standard method suggested by APHA (American Public Health Association) was used for water analysis.

Fish samples were collected from Dimna Lake from March 2019 to December 2021. Samples were collected by the help of fishermen and were preserved in 10% formalin. Identification of fishes based mainly on external characters such as body shape, length, depth, mouth, nature of fish spines, scales etc.

RESULTS & DISCUSSION

The physio-chemical analysis of the water quality of both the lakes has been shown in the following tables 1 and 2:

Surface water temperature was noted highest at the month June 36.4°C and lowest during the month December 17.5°C of the study period at a range of variation 16.2°C to 36.4°C. Atmospheric temperature was noted highest at the month June 38.9°C and lowest at the month December 15.03°C of the study period at a range variation of 16.2°C

Table 1- Physico - chemical conditions of water at Dimna Lake site A - Main dam area (March 2019 to December 2021)

Sl. No.	Parameters	Unit	March (2019)	June	Sept	Dec	March (2020)	June	Sept	Dec	March (2021)	June	Sept	Dec
1	Water Temperature	ºC	25.3	34.6	31.4	17.4	27.8	33.5	30.2	18.9	27.8	36.4	29.5	16.2
2	Atmosphere Temperature	ºC	29.2	38.2	30.0	15.2	28.2	39.0	29.5	16.5	29.9	39.5	28.6	13.4
3	Transparency		65.7	66.7	69.7	73.0	66.6	65.2	66.2	74.4	66.7	66.5	68.5	75.3
4	Turbidity	NTU	69.0	74.0	113.0	37.0	76.0	109.0	142.0	38.0	72.0	93.0	143.0	41.0
5	pH		7.8	8.5	8.2	8.00	7.9	7.6	8.2	7.9	8.1	8.4	7.8	7.6
6	DO_2	mg/l	5.9	6.3	6.7	6.5	6.2	5.8	6.9	6.3	6.00	5.8	6.4	6.5
7	FCO_2	mg/l	3.5	4.5	5.2	4.3	4.5	3.9	4.6	4.2	3.8	4.4	3.9	4.3
8	Alkalinity	mg/l	142	123	102	129	133	118	98	128	138	119	99	153
9	Hardness	mg/l	122.0	77.0	122.0	155.0	124.0	88.0	123.0	142.0	92.0	88.0	120.0	147.0
10	CO_3,	mg/l	0.0	0.0	0.5	0.0	0.0	0.0	2.0	4.0	0.0	0.0	0.5	0.0
11	HCO_3	mg/l	142.0	123.0	92.0	140.0	142.0	104.0	98.0	135.0	136.0	105.0	100.0	139.0
12	Chloride	mg/l	32.4	38.9	35.6	30.3	34.5	40.0	29.8	33.2	31.2	37.5	34.7	32.2
13	Phosphate	mg/l	0.031	0.050	0.054	0.082	0.053	0.064	0.042	0.045	0.053	0.063	0.042	0.045
14	Silicate	mg/l	21.2	17.5	28.2	23.5	22.5	18.2	26.5	22.3	29.2	17.5	29.4	19.5
15	Na	mg/l	29.9	18.5	14.8	16.3	28.8	19.2	13.5	16.5	25.6	17.8	13.6	19.0
16	K^+	mg/l	1.8	0.86	0.91	1.8	1.8	1.9	0.90	1.9	1.8	1.15	0.70	1.15
17	Ca^{++}	mg/l	15.5	16.2	48.0	36.6	16.0	16.5	49.2	36.5	27.0	17.0	34.2	45.8
18	Mg^{++}	mg/l	13.3	12.6	7.8	13.9	14.5	15.5	13.5	13.5	14.3	11.4	6.5	8.5

Table 2- Physico -chemical conditions of water at site B- Jayanti Sarovar (March 2019 to December 2021)

Sl. No.	Parameters	Unit	March (2019)	June	Sept	Dec (2019)	March	June	Sept	Dec (2020)	March	June	Sept	Dec (2021)
1	Water Temperature	^{0}C	25.8	33.5	33.5	20	26.8	32.5	33.2	19.8	25	33	30	19
2	Atmosphere Temperature	^{0}C	28.3	35.5	34.0	14.9	29.3	35.5	34.2	18.2	27.3	37.6	33.4	16.5
3	Transparency	Cm	70.7	68.2	71.0	77.3	69.2	68.5	70.0	76.6	74.7	66.2	73.0	78.3
4	Turbidity	NTU	79.0	102.0	153.0	45.0	78.0	100.0	152.0	40.0	80.3	109.0	153.0	45.6
5	pH		7.8	7.2	7.9	7.8	7.6	7.3	7.8	7.9	7.8	7.2	7.0	7.8
6	DO_2	mg/l	9.2	7.6	7.5	8.0	6.7	7.8	7.8	8.2	8.9	8.2	7.4	7.8
7	FCO_2	mg/l	5.6	18.5	13.0	21.0	10.0	7.6	6.6	12.2	19.0	18.2	21	13.2
8	Alkalinity	mg/l	145	170	170	155	132	115	100	130	145	175	170	150
9	Hardness	mg/l	85.0	70.0	90.0	130.0	87.0	75.0	110.0	120.0	85.0	75.0	85.0	125.0
10	CO_3,	mg/l	4.0	0.0	0.4	0.0	4.5	0.0	0.5	0.0	5.0	0.0	0.5	0.0
11	HCO_3	mg/l	155.0	180.0	180.0	165.0	150.0	190.0	180.0	170.0	150.0	175.0	180.0	170.0
12	Chloride	mg/l	39.5	50.0	55.6	52.5	40.4	40.6	37.7	34.2	40.5	48.5	52.5	53.5
13	Phosphate	mg/l	0.035	0.070	0.056	0.090	0.058	0.067	0.082	0.060	0.037	0.075	0.060	0.085
14	Silicate	mg/l	25.6	14.8	31.3	30.1	25.8	16.8	32.0	30.5	24.6	13.8	30.5	29.5
15	Na	mg/l	39.8	27.8	21.7	23.8	39.8	29.8	22.7	24.8	38.8	25.5	22.5	22.8
16	K^+	mg/l	1.7	0.98	0.91	1.5	1.7	1.12	0.63	1.19	1.6	0.97	0.92	1.7
17	Ca^{++}	mg/l	23.4	16.2	33.0	45.0	25.4	15.2	31.0	45.5	24.4	17.2	32.0	44.0
18	Mg^{++}	mg/l	15.4	10.5	7.8	13.8	13.8	11.5	7.8	13.5	12.8	9.5	7.8	12.8

to 36.4ºC. The transparency of water ranged from 65.2 cm to 75.3 cm. The pH having a range variation 7.6 to 8.5 throughout the study period. The dissolved oxygen of water throughout the study ranged from 5.8mg/l to 6.9 mg/l. The free CO_2 of water ranged from 3.5 mg/l to 5.2 mg/l throughout the study period. The alkalinity ranged from 98 mg/l to 142 mg/l throughout the study period. The hardness of water ranged from 77.0 mg/l to 155.0 mg/l. Carbonate has been ranged from 0.0 mg/l to 4 mg/l throughout the study. Bicarbonate ranged from 92.0 mg/l to 142 mg/l. Chloride ranged from 29.8 mg/l to 40.0 mg/l throughout the study period. Phosphate and silicate ranged from 0.031mg/l - 0.082mg/l and 17.5 mgL^{-1} - 29.4 mgL^{-1} respectively. Sodium ranged from 13.5 mg L^{-1} to 29.9 mgL^{-1}. K^+, Ca^{++} and Mg^{++} ranged from 0.70 mgL^{-1} to 1.9 mgL^{-1}, 15.5 mgL^{-1} to 49.2 mgL^{-1} and 6.5 mgL^{-1} to 15.5 mgL^{-1} respectively.

Surface water temperature was noted highest at the month June 33.0ºC and lowest during the month December 19.6ºC of the study period at a range of variation 19.6ºC to 33.0ºC. Atmospheric temperature was noted highest at the month June 36.2ºC and lowest at the month of December 16.5ºC of the study period at a range variation of 16.5ºC to 36.2ºC. The transparency of water ranged from 66.2 cm to

78.3 cm. The pH having a range variation 7.8 to 7.9 throughout the study period. The dissolved oxygen of water throughout the study ranged from 7.4 mgL^{-1} to 8.9 mgL^{-1}. The free CO_2 of water ranged from 5.6 mgL^{-1} to 21.0 mgL^{-1} throughout the study period. The alkalinity ranged from 100 mg/l to 175 mg/l throughout the study period. The hardness of water ranged from 70.0 mg/l to 130.0 mg/l. Carbonate has been ranged from 0.0 mg/l to 5 mg/l throughout the study. Bicarbonate ranged from 150 mg/l to 190 mg/l. Chloride ranged from 34.2 mg/l to 55.6 mg/l throughout the study period. Phosphate and silicate ranged from 0.035 mg/l to 0.09 mg/l and 13.8 mgL^{-1} to 32 mgL^{-1} respectively. Sodium ranged from 21.7 mg L^{-1} to 39.8 mgL^{-1}. K^{+}, Ca^{++} and Mg^{++} ranged from 0.63 mgL^{-1} to 1.7 mgL^{-1}, 15.2 mgL^{-1} to 45.5 mgL^{-1} and 7.8 mgL^{-1} to 15.4 mgL^{-1} respectively.

Table 3- Systemic accounts of faunal diversity (Pisces) observed in Site A with common name

Sl. No.	Common name	Class	Family	Order	Genus	Species
1	Rohu	Actinopterygii	Cyprinidae	Cypriniforms	*Labeo*	*rohita*
2	Bata	Actinopterygii	Cyprinidae	Cypriniformes	*Labeo*	*bata*
3	Kalabagus	Actinopterygii	Cyprinidae	Cypriniformes	*Labeo*	*kalabasu*
4	Mrigal	Actinopterygii	Cyprinidae	Cypriniformes	*Cirrhinus*	*reba*
5	Mrigal	Actinopterygii	Cyprinidae	Cypriniformes	*Cirrhinus*	*mrigala*
6	Puthi	Actinopterygii	Cyprinidae	Cypriniformes	*Puntius*	*sarana*
7	Puthi	Actinopterygii	Cyprinidae	Cypriniformes	*Puntius*	*conchonius*
8	Mangur	Actinopterygii	Claridae	Siluriformes	*Clarias*	*batrachus*
9	Chela	Actinopterygii	Cyprinidae	Cypriniformes	*Salmostoma*	*phulo*
10	Catla	Actinopterygii	Cyprinidae	Cypriniformes	*Catla*	*catla*
11	Tengra	Actinopterygii	Siluriformes	Bagridae	*Mystus*	*tengara* (F. Hamilton)
12	Tilapia	Actinopterygii	Cichlidae	Cichliformes	*Oreochromis*	*mossambicus* (Linnaeus)
13	Tilapia	Actinopterygii	Cichlidae	Cichliformes	*Oreochromis*	*niloticus* (Linnaeus)

Table 4- Site A-Seasonal Fish collection in two years (March 2019 to December 2021)

Sl. No.	Genus	Species	March (2019)	June	Sept	Dec (2019)	March	June	Sept	Dec (2020)	March	June	Sept	Dec (2021)
1	*Labeo*	*rohita*	35	32	52	20	32	26	45	22	33	25	56	26
2	*Labeo*	*bata*	30	32	50	22	42	34	52	26	43	30	49	22
3	*Labeo*	*kalabasu*	40	28	60	40	35	22	62	40	35	25	67	39
4	*Cirrhinus*	*reba*	22	23	30	28	25	29	35	19	20	20	32	20
5	*Cirrhinus*	*mrigala*	52	48	60	49	50	35	63	42	43	35	62	51
6	*Puntius*	*sarana*	35	33	45	25	30	29	42	32	35	30	52	40
7	*Puntius*	*conchonius*	36	35	48	30	33	29	42	30	32	28	48	29
8	*Clarias*	*batrachus*	42	39	55	38	39	35	60	42	45	35	65	43
9	*Salmostoma*	*phulo*	22	19	42	28	29	18	45	35	34	30	50	40
10	*Catla*	*catla*	40	30	66	50	45	35	69	49	52	35	65	50
11	*Mystus*	*tengara* (F. Hamilton)	35	29	45	37	36	14	42	38	35	20	47	30
12	*Oreochromis*	*mossambicus* (Linnaeus)	39	25	55	39	35	25	48	34	35	22	49	30
13	*Oreochromis*	*niloticus* (Linnaeus)	35	32	50	30	32	18	52	35	32	17	39	30

Table 5- Site A-Total fish collection in two years (March 2019 to December 2021)

Sl. No	Genus	Species	Total collection of fishes in two years (2019-2021)	Mean	Percentage
1	*Labeo*	*rohita*	404	20±56	7.17
2	*Labeo*	*bata*	432	22±52	7.66
3	*Labeo*	*kalabasu*	493	22±67	8.75
4	*Cirrhinus*	*reba*	303	19±35	5.38
5	*Cirrhinus*	*mrigala*	428	35±63	7.6
6	*Puntius*	*sarana*	420	25±52	7.45
7	*Puntius*	*conchonius*	538	28±48	9.55
8	*Clarias*	*batrachus*	376	35±65	6.67
9	*Salmostoma*	*phulo*	408	19±50	7.24
10	*Catla*	*catla*	586	30±69	10.40
11	*Mystus*	*tengara* (F. Hamilton)	408	14±47	7.24
12	*Oreochromis*	*mossambicus* (Linnaeus)	436	25±55	7.74
13	*Oreochromis*	*niloticus* (Linnaeus)	402	17±52	7.14

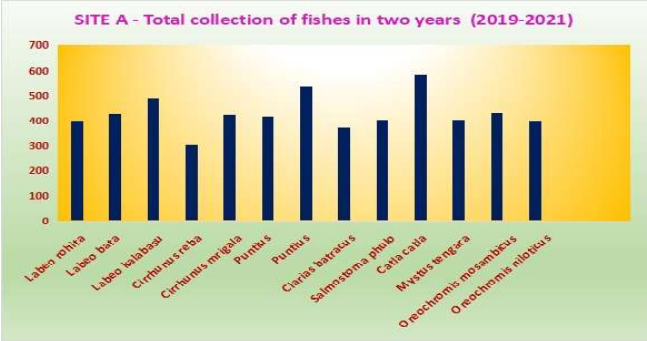

Fig. 1- Seasonal abundance of fish diversity in Site A-Dimna Lake

A total of from 5 families 12 genera and 6 orders had been sampled from Dimna Lake throughout the entire study period. The most abundant species was *Catla catla* (10.40%) followed by *Puntius conchonius* (9.55%), *Labeo kalabasu* (8.75%), *Oreochromis mossambicus* (7.74%), *Labeo bata* (7.66%), *Cirrhunus mrigala* (7.6%), *Punctius sarana* (7.45%), *Salmostoma phulo* (7.24%), *Mystus tengrara* (7.24%), *Labeo rohita* (7.17%), *Oreochromis niloticus* (7.14%) and *Clarias batrachus* (6.67%).

Table 6- Systemic accounts of faunal diversity (Pisces) observed in Site B with common name (December 2019 to December 2021a)

Sl. No.	Common name	Class	Family	Order	Genus	Species
1	Catla	Actinopterygii	Cyprinidae	Cypriniformes	*Catla*	*catla*
2	Rohu	Actinopterygii	Cyprinidae	Cypriniformes	*Labeo*	*rohita*
3	Mrigal	Actinopterygii	Cyprinidae	Cypriniformes	*Cirrhinus*	*mrigala*
4	Silver cat fish	Actinopterygii	Claroteidae	Siluriformes	*Chrysichthys*	*nigrodigitatus*
5	Puthi	Actinopterygii	Cyprinidae	Cypriniformes	*Puntius*	*sarana*
6	Puthi	Actinopterygii	Cyprinidae	Cypriniformes	*Puntius*	*conchonius*
7	Kalabagus	Actinopterygii	Cyprinidae	Cypriniformes	*Labeo*	*kalabasu*

Table 7- Site B- Seasonal fish collection in two years (March 2019 to December 2021)

Sl. No.	Genus	Species	March (2019)	June	Sept	Dec (2019)	March	June	Sept	Dec (2020)	March	June	Sept	Dec (2021)
1	*Catla*	*catla*	45	32	60	40	35	29	65	43	40	29	56	45
2	*Labeo*	*rohita*	46	32	56	40	43	34	57	45	43	30	58	45
3	*Cirrhunus*	*mrigala*	43	28	66	46	47	24	62	43	41	25	59	44
4	*Chrysichthys*	*nigrodigitatus*	32	23	48	39	37	29	55	40	42	20	50	35
5	*Puntius*	*sarana*	47	29	60	49	45	35	63	49	43	35	62	50
6	*Puntius*	*conchonius*	38	25	55	47	46	21	58	47	44	27	54	42
7	*Labeo*	*kalabasu*	42	22	50	40	38	20	55	40	38	18	52	38

Table 8- Site B-Total fish collection in two years (March 2019 to December 2021)

Sl. No.	Genus	Species	Total fish collection in two years	Mean	Percentage
1	*Catla*	*catla*	519	29±60	14.6
2	*Labeo*	*rohita*	529	30±58	14.9
3	*Cirrhinus*	*mrigala*	528	25±66	14.87
4	*Chrysichthys*	*nigrodigitatus*	450	20±55	12.67
5	*Puntius*	*sarana*	567	29±63	15.97
6	*Puntius*	*conchonius*	504	21±58	14.20
7	*Labeo*	*kalabasu*	453	18±55	12.76

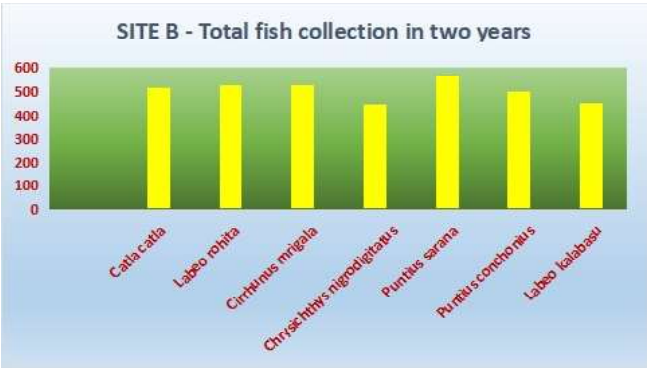

Fig. 2- Seasonal abundance of fish diversity in Site B-Jayanti Sarovar

A total of from one family, six genera and two orders had been sampled from Dimna Lake throughout the entire study period. The most abundant species was *Punctius sarana* (15.97%) followed by *Labeo rohita* (14.9%), *Cirrhunus mrigala* (14.87%), *Catla catla* (14.6%), *Punctius conchonius* (14.20%), *Labeo kalabasu* (12.76%) and *Chrysichthys nigrodigitatus* (12.67%.). The physical and chemical interactions, water qualities influence composition, distribution, quantity, and movement as well as the diversity of aquatic organisms.[5] Fish populations, in particular, are heavily reliant on changes in the physico-chemical properties of their watery environment that sustains their biological operations.[6]

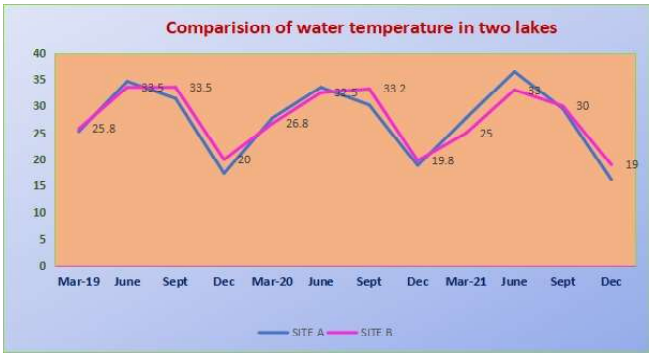

Fig. 3- Comparision of water temperature in two lakes

However, temperature is known by far as the most critical factor influencing both aquatic life and other physicochemical parameters in the water system.[7] Surface water temperature of site A was noted highest at the month June 36.4°C and lowest during the month December 16.2°C of the study period at a range of variation 16.2°C to 36.4°C. Surface water temperature of site B was noted highest at the month June 33.5°C and lowest during the month December 19.0°C of the study period at a range of variation 19.0°C to 33.5°C. Maximum water temperature recorded 36.4°C from site A and minimum temperature also from site A. The air temperature noted highest in pre monsoon (summer) and post monsoon and lowest in winter. This change leads to alteration in water storage level. High solar radiation and reduced level of water basically the cause of high-water temperature pre monsoon to winter.[8] Due to this fish diversity was maximum during pre-monsoon to winter in both the sites but comparatively site A was more diverse.

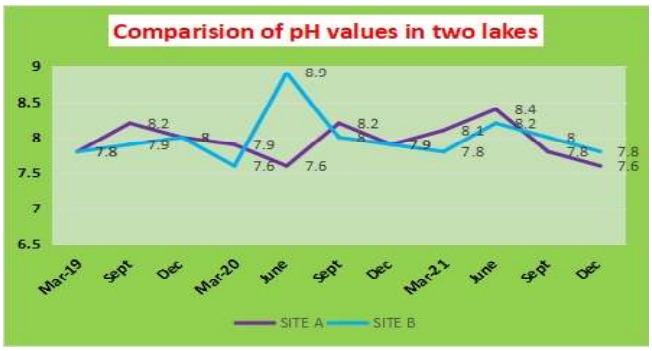

Fig. 4- Comparision of pH values in two lakes

The pH having a range variation 7.6 to 8.5 throughout the study period at site A. The pH having a range variation 7.8 to 8.9 throughout the study period at site B. However, the water was found to be alkaline in site A and site B. Hardness was slight less in site A which support more diversity.

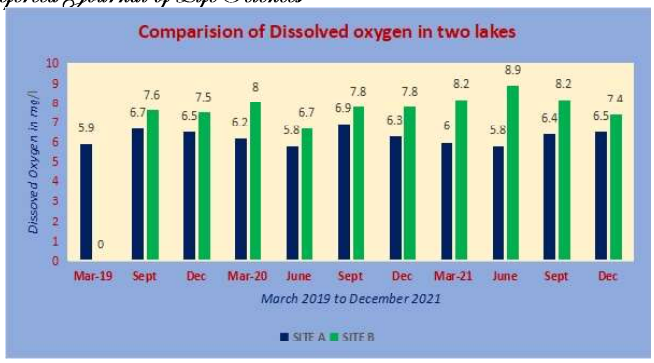

Fig. 5- Comparision of Dissolved oxygen in two lakes

Dissolved oxygen (DO) is the relative amount of oxygen dissolved in water. Oxygen enters the water by diffusion from the atmosphere or through plant photosynthesis.[9] Oxygen availability throughout the year has well been influenced by other chemicals present in the water, biological processes, and temperature.[10] As per Table 1, the dissolved oxygen of water throughout the study ranged from 5.8mg/l to 6.9 mg/l. in Site A and the dissolved oxygen of water throughout the study ranged from 6.7 mgL^{-1} to 9.2 mgL^{-1} of site B.So both the sites are suitable for fish diversity.

Fish abundance and rich diversity have been able to be projected throughout the monsoon season, Because O_2 distribution is a reliable indicator of environmental quality and productivity, a link supporting fish abundance may be extended.[11]

Table 9- Site wise Simpson Index of two years fish diversity in Dimna Lake and Jayanti Sarovar

Sl. No	Study Year	Mar 2019-June2020	Sept 2020-Dec 2021	Mean
1	Site A	0.921	0.793	1.317
2	Site B	0.857	0.856	1.285

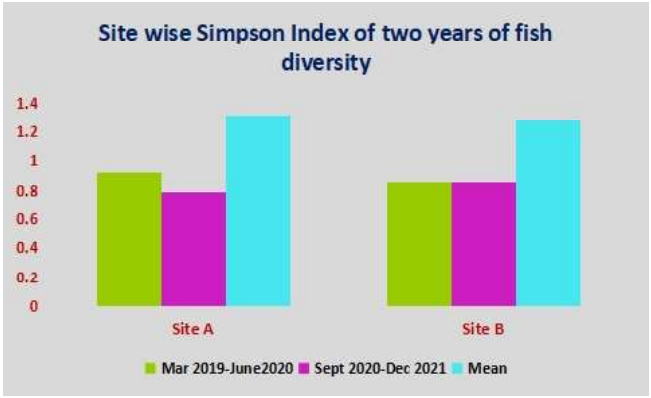

Fig. 6- Site wise Simson Index of two years of fish diversity

The ichthyofauna diversity, in terms of Simpson index has been presented in the Table 9. The Simpson index shows the Site-A presented higher value (0.921) compared to another site B. As observed the year Mar 2019 - June 2020 showed the highest Simpson diversity (1-D) index value (Table 9). The Simpson dominance index ranged between 1.285 to 1.317.

According to Simpson Index of Dominance Site A was showing more diversity compare to site B. Both biotic and abiotic variables always influence the variety and distribution of ichthyofauna in a particular lake. With respect to the number of species and abundance in each category of species at each site, the two lakes have been able to demonstrate a greater diversity index (Site A-0.921) (Table 9). There were eight orders during the monsoon (July-Sept) season, and the most abundant were the Cypriniformes >Siluriformes (Table 5).

In Jayanti Sarovar there were two orders during the monsoon (July-Sept) season, and the most abundant were the Cypriniformes >Cichliformes (Table 8). It demonstrates that the diversity is supported by the fish breeding season in Jubilee Lake during the monsoon and the spawning of these numerous fish (Fig 2).

CONCLUSION

This study provides an assessment and comparison of biotic and abiotic indices-based approaches for the two lakes. The two sites A and B of the Dimna Lake and Jayanti Sarovar, water quality assessments showed that the lake's water quality is sufficient to support a variety of fish, particularly those in the *Cyprinidae* family, and is at an ideal level.

According to the study, fish in both lakes spawn during the monsoon, and their abundance contributes to their diversity. Comparing these to other important fish groups, it was discovered that in Site A the biggest numbers of Cypriniformes and Cichliformes occurred during the monsoon season. The two primary groups that make up the abundance of ichthyofauna in the winter are the Cypriniformes and Cichliformes. In site B the biggest number Cypriniformes and Siluriformes occurred during the monsoon season. In summer season fish diversity was not abundant in both the lakes. The fish which are major component of fishery resource in the two lakes is supported by observed physico-chemical parameters during the study period.

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