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Limnological study of Ghunghutta Dam of Surguja District Chhattisgarh India

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Abstract
The present investigation has been made to investigate the limnological aspects of Ghunghutta reservoir from June 2016 to May 2017 in Surguja district Chhattisgarh. The reservoir constructed for the irrigation and its also utilized for pisciculture. The physico-chemical parameters of reservoir varied seasonally such as Turbidity (16.46 to 35 cm) pH (7.2 to 8.8) TDS (119 to 236 mg/l) Dissolved oxygen (6.6 to 9.8mg/l) Total alkalinity (251 to 368 mg/l) Total hardness (71 to 128 mg/l) Chlorides (30 to 69 mg/l) A total of 13 sp. of phytoplankton and 12 sp. of zooplanktons were identified. The Chlorophyceae and Rotifers recorded dominance phytoplankton and zooplanktons respectively. The physicochemical characterstics and planktonic diversity showed the reservoir water is suitable for irrigation as well as pisciculture.

Keywords: physico-chemical, ghunghutta reservoir, plankton

1. Introduction
Limnology is the study of inland waters. It covers all the biological chemical & physical attributes of inland waters. It is closely related to aquatic ecology & hydrobiology. Its sometimes equated with fresh water science. Water is one of the prime necessities of life water is plays important role in any ecosystem. Its provides the habitats for migratory birds aquaculture, plants animals & microbes. Its one of the major Components of environmental resources (Efa 2002) [1]. The requirement of water in lives reached to a point of crisis due to industrialization & urbanization. The assessment of water Quality in lives the analysis of physico-chemical & biological parameters and reflects on abiotic & biotic status of the ecosystem [2, 3]. Several studies have been made on the limnology of fresh water bodies in India. (Nagahandi, & Hosamani 1998 pandey etal 2000 and Bhadja and Vaghela) [4-6] Limnology was studied with reference to the organism especially Plankton. Zooplanktons are extremely responsive to change in the environment and thus indicate environmental changes and fluctuations that may occur zooplanktonic community fluctuates according to physico-chemical parameters of the environment [7]. The present studies deals with the results of limnological investigation of man made fresh water reservoir Ghunghutta situated at Surguja district of northern Chhattisgarh. The Dam has typical rural environment which is enriched with the growth of variety of flora and fauna. The impact of anthropogenic pressure on the reservoir seems quite high and hence a constant monitoring of this water body is highly essential. A number of limnological studies were carried out on man made reservoirs in India but there is a lack of baseline data on limnological characteristics of Ghunghutta reservoir Surguja which is used for irrigation and pisciculture activities. Therefore the present study was undertaken.

2. Material and methods
The Ghunghutta reservoir is located in Surguja district ($22^0$94N latitude & $83^0$164E Longitude) of northern Chhattisgarh in India. Ghunghutta is a medium irrigation project which was constructed in 2002 across the river Ghunghutta which is a tributary of Rehar Sub basin Sone in the Ganga basin. The Dam is 14km. from the district head quarter Ambikapur. The Dam is 242.20 meter long and 31.50 meter high. The live storage capacity of the reservoir is 62.05 MCM. Mainly reservoir water is used for irrigation but it is also utilized for pisciculture practices. The present study was conducted for one year i.e. June 2016 to May 2017 for the analysis of physico-chemical parameters water samples were collected from all the sampling station by using standard methods as described by Adoni (1985) [8] & APHA (2005) [9] Plankton samples were collected by using a truncated cone shaped net by filtering known volume of water. The plankton sieving net is the common equipment used of bolting silk cloth no. 25 for phytoplankton and no. 13 for zooplankton and samples preserved in 5% formaline 3-4 drops of glycerine were added to it. The plankton samples were examined under the inverted microscope (Metzer made) and their identification was done following the taxonomic references of Needham & Needham (1962) [10] Sharma (1999) [11] and Dhanpati (2003) [12]

3. Results & Discussion
Physico-chemical parameters recorded at Ghunghutta reservoir were depicted in table (1 & fig. 1 to 4) The atmospheric & water temperature ranged from 18.C to 39.C during the study period. The minimum 20.C and the maximum 39.C atmospheric temperature were recorded during the winter and summer seasons respectively. The water temperature was maximum 32.1.C during summer and minimum 18.C during winter. Over all there were fluctuations in the water temperature of water bodies as atmospheric temperature of the locality. Similar results were found by

Singhai *et al.* (1990) [13]

The transparency of reservoir ranged from 16.46 to 35cm. during investigation periods the highest transparency was recorded during summer and lowest values were recorded during rainy season.

pH is an important factor which regulates the species composition and the metabolic activities of living organism inhabiting the water body. The pH values variable between 7.2 to 8.8. The highest values were recorded during summer (8.8) and lowest during rainy season (7.2). The pH of reservoir remained alkaline during the study period. The water having pH range of 6.5 and 9.0 are most suitable for pond aquaculture [14]. At Ghunghutta reservoir the value of conductivity was ranging from 209 µs/cm to 422 µs/cm.The maximum value (422 µs/cm) were observed during summer and minimum (209 µs/cm) in monsoon.

TDS is a very useful parameter for determining the productivity of the reservoir. In the present investigation the value of TDS varied from 119 to 236 mg./lit. during monsoon and summer respectively. In the present study concentration of TDS was found influenced by physical forces such as evaporation which is evidenced by the fall of TDS in rainy season. A notable relationship was found between conductivity and TDS. The similar observation was made by Radhika *et al.* 2004 [14]. The electrical conductivity and TDS were found to be low during monsoon and high during summer this finding were in agreement with Iqbal and Kataria (1995) [15]. In the present investigation all the value of TDS in Dam indicates the general nature of water quality.

The value of acidity varied from 14.5 to 27.8 mg./lit. which was minimum (14.5 mg./lit.) in summer and maximum in monsoon (27.8mg./lit.) respectively. The values obtained in the present investigation indicative of productive nature of reservoir. In the present study the values of free CO_2 fluctuated from 2.9 to 5.4 mg./lit. which was the maximum in the withdrawal phase of monsoon and least in summer. It may be due to the intense sunlight during winters and summers seem to accelerate photosynthesis by phytoplankton there by utilizing carbon dioxide and giving off oxygen [18] The dissolved oxygen concentration ranged from 6.1 to 9.8 mg/lit. Dissolved oxygen was minimum in July and maximum in December respectively. Similar trend of dissolved oxygen in fresh water lakes also observed by (Bhatt *et al.* 1998 Pandey 1993) [16-17]

The value of total alkinity varied from 162 to 368 mg./lit. The seasonal variation shows that it was declined in rainy season while increased up to summer season. It may be due to in summer concentration of salts in water as a result of evaporation. While in monsoon heavy monsoon showers that result in dilution of water[19]. The value of present study shows productive nature of reservoir. The total hardness of Ghunghutta reservoir fluctuates from 71 to 128 mg./lit. The minimum value was observed during monsoon and maximum in summer. Its may be due to in summer higher temperature increases the solubility of calcium and magnesium salts [20]. While in monsoon the heavy rains can be responsible for lower value of total hardness of water [21]. In the present study obtained value indicates productive nature of reservoir. The chloride value of reservoir varied from 30 to 69 mg./lit. Which was observed maximum in summer while minimum value recorded in October. Rise in the level of chlorides may be due to increased temperature and evapotranspiration [22]. Observed value indicates the productive nature of reservoir.

Plankton sp. composition and abundance are functions of interaction with environmental conditions including temperature dissolved oxygen pH and turbidity. In the present study 13 sp. of phytoplankton recorded.(table 2) Among these Chlorophyceae includes 8 sp. followed by Bacilliriophyceae 2 sp. The Euglenophyceae and Myxophyceae recorded 1and 2 sp.respectively.Throught the study Chlorophyceae was the most dominant class (fig.5). It contributed about 62% of the total phytoplankton population. On the other hand a total 12 sp. of zooplankton recorded recorded. (table 3) Among these Rotifer includes 6 sp. Copepod 3 sp. Cladocer 2 sp. Followed by Ostracoda single sp. recorded. Among zooplankton Rotifer was the most dominant group (about 50%) during investigation. (fig.6)

It was observed that the planktonic population showed bimodal fluctuations [23] The species composition of phytoplanktons exhibit seasonal variations. It was recorded maximum in spring and monsoon the troughs were discernible during summer and autumn. The density and compositions of zooplankton also exhibit a monthly variations. Zooplankton exhibited higher density March, July, October and January [24]. The above seasonal fluctuation of planktonic population may be due to the fact that the planktonic sp. Concerned either become to scarce or occur as spores resting eggs etc. which are not easily detectable. Upon the return of favourable conditions spores germinate and the plankters multiply.

Table 1: Physico-chemical Characteristics of Ghunghutta Dam during 2016-17

Month	AT	WT	Transp.	pH	EC	TDS	Acid	CO_2	DO	T. Alk.	TH	Chlo
	^{0}C	^{0}C	cm		µs/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
June	32	30.1	32	7.9	374	212	14.5	3.6	6.6	254	96	62
July	28	23	19.82	7.2	328	181	22.8	3.8	6.1	162	60	55
August	27	23.3	16.46	7.5	209	119	24.3	4.4	6.9	182	71	43
September	30	25.2	23.25	7.6	256	151	27.8	5.4	8.9	202	82	44
October	29	24.5	26.37	7.8	288	165	26.5	5.1	9.2	228	86	30
November	26	24.1	28	8.2	326	173	22.1	4.5	9.5	251	98	39
December	20	18	28.27	8.3	349	183	20.8	4.2	9.7	281	102	42
January	23	16.1	29.82	8.2	361	195	17.2	4.1	9.8	290	112	51
February	31	20.2	31	8.4	375	198	15.8	3.7	9.1	317	118	56
March	35	23	32	8.6	387	207	15.4	3.3	7.1	239	122	65
April	37	28.2	33.22	8.5	408	222	15.1	2.9	7.2	348	125	68
May	39	32.1	35	8.8	422	236	15.6	3.1	6.8	368	128	69

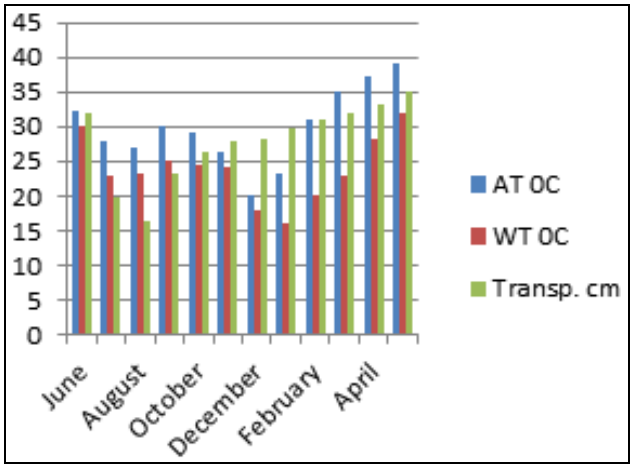

Fig 1: Physico-chemical Characterstics of Ghunghutta Dam during 2016-17

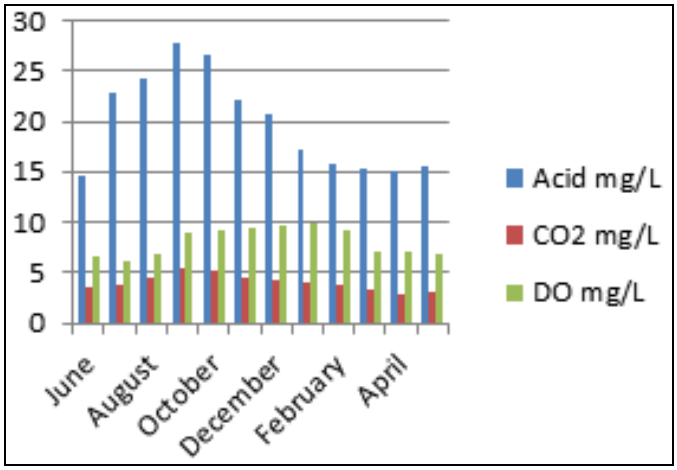

Fig 3: Physico-chemical Characterstics of Ghunghutta Dam during 2016-17

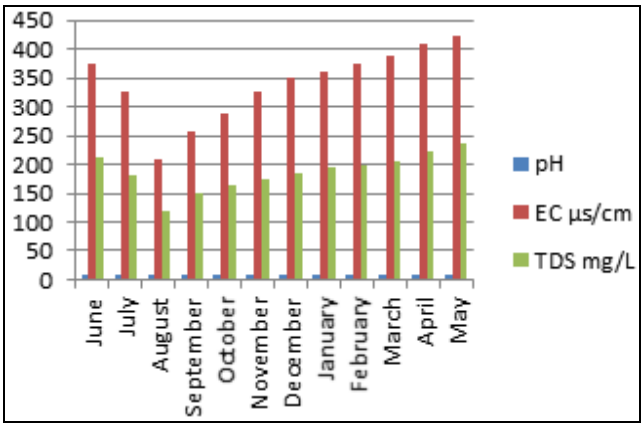

Fig 2: Physico-chemical Characterstics of Ghunghutta Dam during 2016-17

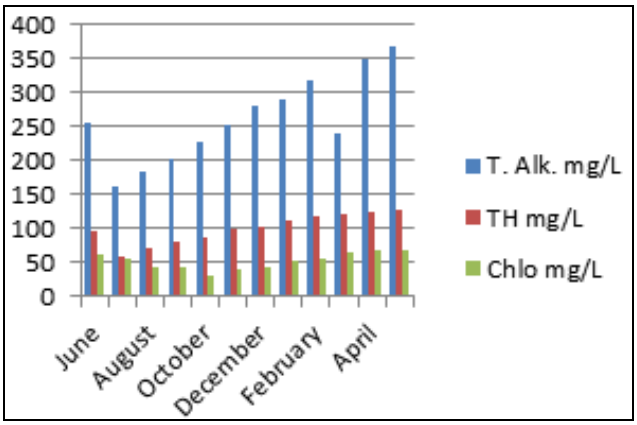

Fig 4: Physico-chemical Characterstics of Ghunghutta Dam during 2016-17

Table 2: Monthly Distribution of phytoplankton

Phytoplankton	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb.	Mar	Apr	May
Cholorophyceae												
Chlamydomonas	+	++	+++	+++	+++	+	+	+	+	++	+	+
Volvox sp.	-	+	++	++	+	-	-	-	+	+	+	-
Cholorella sp.	-	+	++	++	+	+	-	-	+	+	+	-
Cholorogonium sp.	-	+	++	++	+	-	-	-	+	+	+	+
Eudorina sp.	-	+	++	+++	+	+	-	+	+	+	+	+
Chlosterium sp.	+	++	++	+++	+	+	-	-	-	+	+	-
Scendesmus sp.	+	+	++	++	+	-	-	+	+	+	+	+
Pandorina sp.	-	++	++	++	+	-	-	-	+	+	+	+
Euglenophyceae												
Euglena sp.	++	++	+++	+++	++	-	-	-	+	++	+	-
Bacilliriophyceae												
Navicula sp.	++	+++	+++	+++	+	+	-	-	+	+	+	-
Ulothrix	++	++	+++	+++	+	+	-	-	+	+	+	-
Myxophyceae												
Microcystis sp.	-	++	++	++	+	+	-	-	+	+	+	
Anabena sp.	-	++	+++	++	++	+	+	-	+	++	+	-

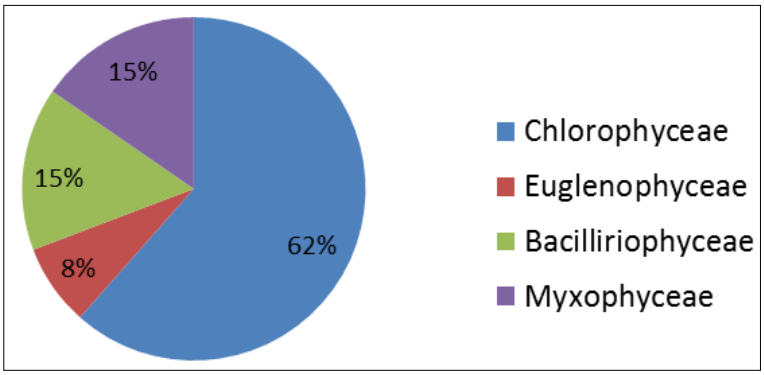

Fig 5: Classwise percentage of phytoplankton

Table 3: Monthly Distribution of Zooplankton

Zooplankton	June	July	Aug	Sept	Octo	Nov	Dec	Jan	Feb.	Mar	Apr	May
Rotifera												
Asplanchna sp.	+	++	+	+	+++	+	+	++	-	+++	-	-
Branchionus sp.	-	+++	+	+	+++	+	+	++	-	++	-	-
Keratella sp.	+	+++	+	-	+++	+	+	++	-	+++	+	+
Philodina sp.	+	+++	+	+	+++	-	-	++	+	++	-	-
Trichocera sp.	+	++	+	-	+++	-	+	++	-	++	-	-
Filinia sp.	+	+	+	+	++	-	-	++	-	++	-	+
Cladocera												
Daphnia sp.	-	++	+	+	++	-	-	++	+	++	-	+
Moina sp.	-	++	+	+	+++	+	+	++	-	++	-	+
Diaptomus sp.	+	++	+	+	++	+	+	++	-	+++	-	-
Copepoda												
Cyclops sp.	+	+++	+	+	++	+	+	++	-	++	-	-
Nauplli sp.	+	+++	+	+	++	+	+	++	-	++	-	-
Ostracoda												
Cypris sp.	+	+++	+	+	+++	+	+	++	+	++	-	-

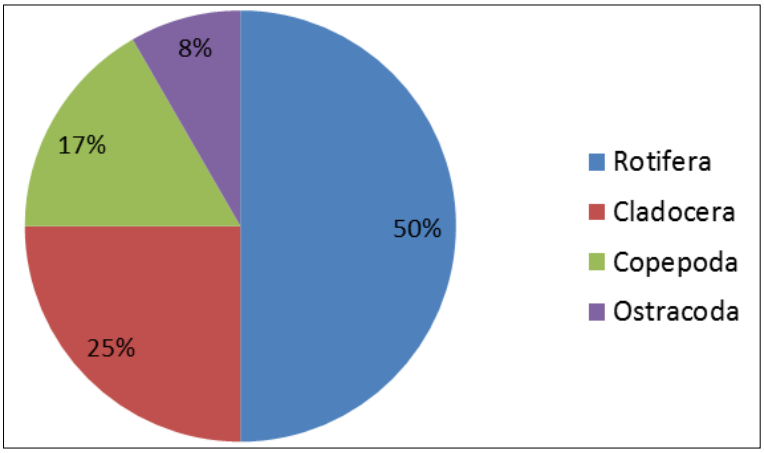

Fig 6: Classwise percentage of Zooplankton

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