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## LIMNOLOGICAL STUDIES OF GHUNGHUTTA DAM SURGUJA (C.G.)



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**Editor - In - Chief - Ashok Yakkaldevi**

*Smt. Deepika Toppo*



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## LIMNOLOGICAL STUDIES OF GHUNGHUTTA DAM SURGUJA (C.G.)

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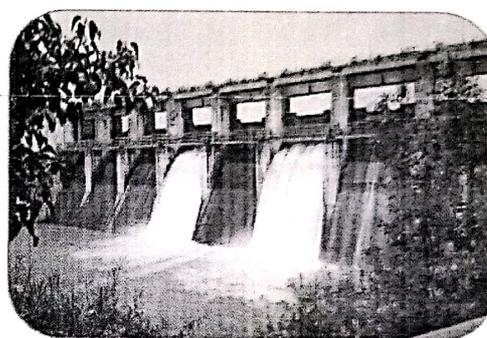
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### ABSTRACT

The present investigation deals with limnological studies of Ghunghutta Dam to assess its suitability for aquaculture. The water quality status of Ghunghutta dam in Surguja district were determined during January 2020 to December 2020. The Ghunghutta dam is located in Surguja district (22094N latitude & 830164E 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 water use is domestic purposes, irrigation, aquaculture etc. The surrounding area of dam semi urban semi agricultural and to generate electricity. Present study is aimed at investigating the main factors responsible for water pollution in Ghunghutta Dam. The monthly intervals during the year 2020 with an objective to estimate the water quality of the dam on various physico-chemical parameters like pH, dissolved oxygen (DO), alkalinity, nitrate, nitrite, phosphate, and sulphate have been study. Total dissolve solids, and turbidity values were maximum on all the sites in rainy months, which may be due to the gradual disturbances in sedimentation of solids as well as dust particles deposited along with runoff rainwater. The alkalinity varied during different months. The values of pH, conductivity, hardness, dissolved oxygen C.O.D. and biological oxygen demands were higher during summer months. These parameters determined, revealed that the fluctuations in water but within the desirable limits for aquaculture and high level of phosphate were need to be modifying in order to favour aquaculture.



**KEYWORDS :** Limnological parameters, Monthly variation, Ghunghutta dam.

### I. INTRODUCTION

Main's desire to conquer nature for resources puts in him on a collision course with natural environment. Nevertheless, the nature is remarkable resilient to human insults and man has not yet learnt what are nature's dynamic capacities. As the human population has expanded man, the greatest predator in the globe has exerted natural resources especially on aquatic ecosystems for multiple purposes. The belief that aquatic resources which cover about 71% of the total surface of the globe will never become extinct and will support the ever increasing dimorphic growth is becoming paradoxical and "malthusian pessimism" still prevails in the world. Knowledge on the basic structure and metabolic response are necessary in order to confront and offset. The effects of alterations and to achieve maximum meaningful management of aquatic ecosystems. Further, human growth and utilization of

aquatic resources on a sustained exponential basis are also predominant components of any analysis of ecosystems.

Water like other abiotic components (air and soil) is equally important for sustenance of life and to maintain ecological process of the bio-system. But relentless increase in the demand of water for multi-purposes brought about by the two interdependent and parallel line of forces i.e. industrialization and urbanization, which in one hand usually, reflects the all-around development and progress but on the other hand possess strong concern about the fate of fresh water habitats.

Surface water acts as a receptor of pollutants, which are washed out and carried by surface runoff from urbanized catchments or watersheds. Rapid urbanization leads to degradations upon water quality via eutrophication and pollution. Polluted surface water includes river and lakes as well as agricultural drains. Nearly all water bodies, including ground water, are affected by pollution. Polluted water loses its economic and aesthetic value. Resultantly, in many developed countries, water pollution is a major problem and many river basins have been found to show high organic matter concentration.

The interaction of physical and chemical factors of any aquatic system determines the nature of the aquatic organisms inhabiting it. The hydrobiological investigation of inland water bodies is absolutely necessary and provide proper and complete spectrum, which can play an important role in the economy of every country of the world. Fishes are cold blooded animals and primarily dependent on water as a medium in which to live. All the vital functions of fishes like digestion, growth, reproduction and responses to stimuli are dependent on water. The most important aspects of water for the fish are temperature, penetration of light, dissolved oxygen, dissolved salts and food materials present in water. The microscopic plants of water are collectively called phytoplankton which utilize light energy and dissolved CO<sub>2</sub> to manufacture organic matter that eventually becomes food for fish. In the development of the fisheries, the ecology of water plays the most important role because it determines the habitability and abundance of the flora and fauna in its different parts.

The biota flourishing in natural water are influenced to a large extent by many interlinked physico-chemical factors. Some important ones are temperature, pH, transparency, hardness, total alkalinity, dissolved O<sub>2</sub>, free CO<sub>2</sub>, nitrates, phosphates, BOD, COD and potassium contents etc.

Environmental pollution is caused by the addition of undesirable substances in the environment, which alter the physico-chemical and biological characteristics of the environment. Odum (1971) defined the pollution as undesirable change in the physical, chemical and biological characteristics of our land, air or water that may or will harmfully affect human life or that of desirable species.

Today, the water, which is an essential components for all of the living beings for their metabolic activities. The main cause of surface water pollution are discharged of industrial, domestic, municipal wastes and agriculture water like irrigation return flow, animal wastes fertilizers, crop residue, dead animal, pesticides residues, disposal of municipal and industrial wastes, sewage leakage, septic tank, cesspools and urbanization.

A number of large anthropogenically constructed fresh water impoundment have come in to existence in India. During the last four decades earlier various multipurpose river-valley projects have been existed. Fish production in Indian reservoirs varies from water to water depending upon its fisheries development.

Present study is going to centralize on Ghunghutta Dam Surguja. The Ghunghutta dam is located in Surguja district (22°09'4N latitude & 83°16'4E 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. Their flows in township, industrial, domestic and municipal discharge merge into it at different points. The water of the reservoir is used by urban and peripheral rural population directly at many stations for domestic and agriculture uses.

## OBJECTIVES

The objectives of the present study are following:

1. To the Study limnological characteristic of the dam water.
2. To improve the aquaculture and water quality of dam.
3. To examine the causes of water pollution and their impact the aquatic life

## II. MATERIAL AND METHODS:-

The quality of Ghunghutta dam water is deteriorated because of in-stream uses of water in the following ways. During survey it was observed that rural areas are situated on both the side of Surguja, which are engaged mainly in the agriculture and cattle farming. These cattle's while wading in the river transfer fecal matter and other types of pathogens in the dam. Also the vigorous movement and activities of the cattle inside the water disturb the river bed where the pollutants are settled in the form of sludge. This ultimately deteriorates the quality of the dam water to a considerable extent. The present study conducted from January 2020 to December 2020.

Water samples were collected monthly in the morning at 8 am to 10 am from surface layer of the dam. Physico-chemical analysis of water samples were made following standard methods suggested by APHA, AWWA, WPCI (2005).

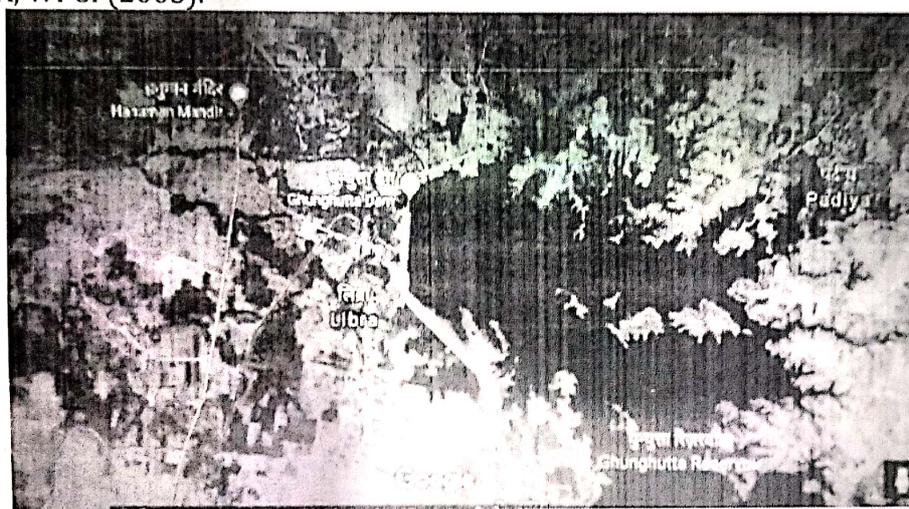


Fig. 1 Satellite Map of Ghunghutta Dam Surguja (C.G.)

## III. RESULT AND DISCUSSION:-

Water is one of the important sources to sustain the life and has long been suspected of being the source of much human illness. Water is the elixir of life and abounds on earth, but this vast natural resource has been depleted and turned into scarce commodity with increased usage catering to the needs of ever-expanding population. There is almost a global shortage of water and the world's most urgent and front rank problem today is supply and maintenance of clean drinking water. The climate change and spells of droughts have even stressed regional water tables. There are strides to fight the grim battle of acute shortages of water. The problems relating to water attract the attention to the urgency for investigating causes and suggest remedies in a bid to prepare future plan of action for maintenance of potable waters and related development issues.

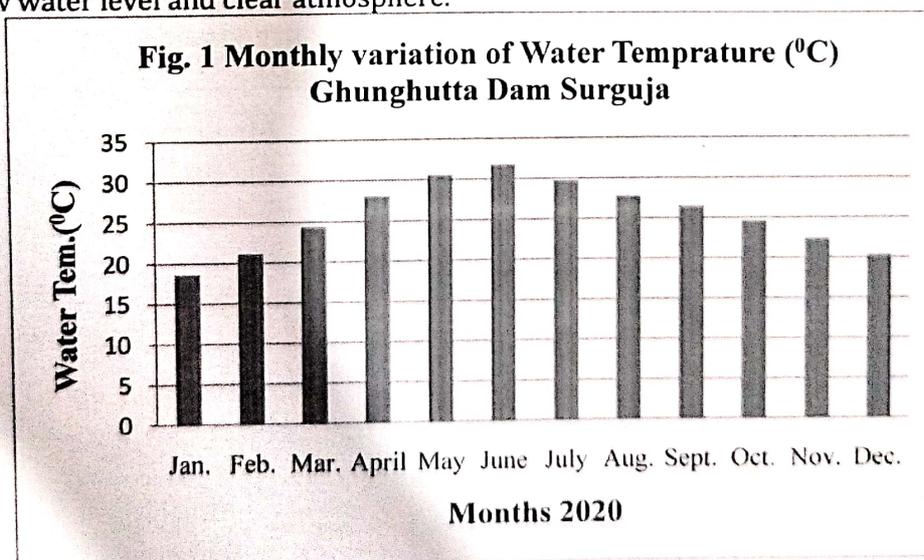
The data on physico-chemical analysis of water Surgujadam has been given in table no. 1

**Table No. 1 Monthly variation of water quality parameters during the year January 2020 to December 2020 of Ghunghutta dam Surguja (C.G.)**

Months	W.T.	Transp.	Turb.	E.C.	pH	T. Alk.	T.D.S.	T. H.	D.O.	C.O.D.	B.O.D.
	°C	cm	NTU	µs/cm		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Jan.	18.60	94.50	14.40	68.4	8.40	91.40	580	150	7.48	14.0	4.54
Feb.	21.16	86.00	12.80	78.2	7.84	123.50	605	165	8.14	18.0	5.38
Mar.	24.40	80.20	18.20	87.0	8.10	155.20	635	180	7.18	20.8	6.22
April	28.10	77.30	20.20	94.4	8.25	158.50	620	192	7.20	27.2	6.45
May	30.60	72.00	23.40	103.8	8.50	168.00	625	196	5.80	25.8	6.74
June	31.80	60.60	24.60	112.4	7.80	150.40	650	200	6.18	28.0	7.14
July	29.70	30.10	29.60	122.0	7.60	156.60	660	203	7.25	36.0	6.40
Aug.	27.80	24.00	32.20	133.6	7.50	144.50	680	180	7.10	44.0	5.68
Sept.	26.50	33.40	25.40	124.4	7.90	142.60	670	170	7.24	38.0	5.65
Oct.	24.60	40.60	23.20	118.0	8.00	127.00	645	154	8.05	27.0	5.42
Nov.	22.50	65.80	20.80	107.4	8.10	146.20	610	135	8.22	25.0	5.24
Dec.	20.40	80.60	15.60	90.4	8.25	101.20	600	125	8.50	22.0	5.18
Mean	25.51	62.09	21.70	103.33	8.02	138.75	631.66	170.83	7.36	27.15	5.83
Min	18.60	24.0	12.80	68.40	7.50	91.40	580	125	5.8	14	4.54
Max	31.8	94.5	32.2	133.6	8.5	168	680	203	8.5	44	7.14

**Water temperature (°C):-**

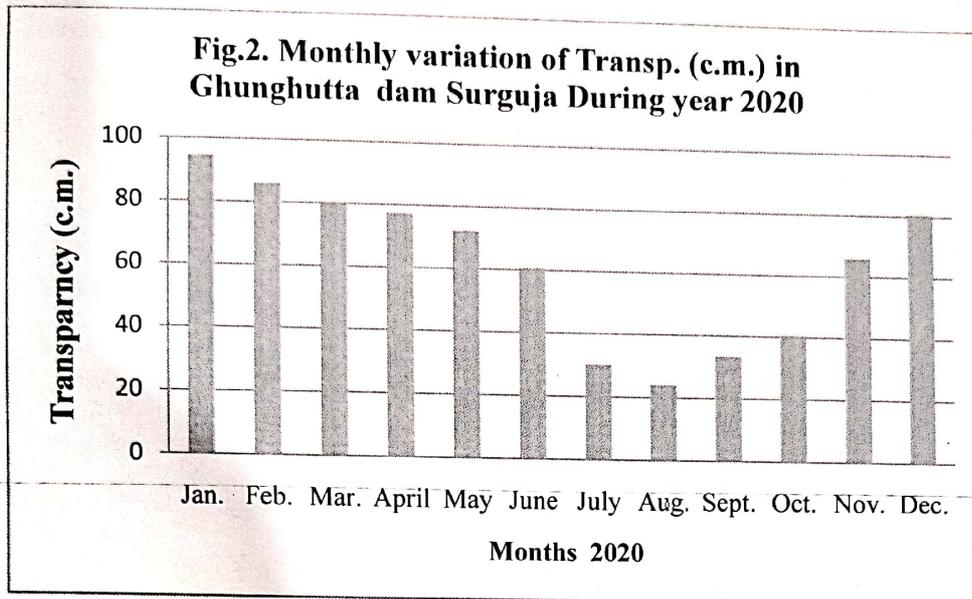
Temperature is a critical water quality and environmental parameter because it governs the kinds and types of aquatic life, regulates the maximum dissolved oxygen concentration of the water, and influences the rate of chemical and biological reactions. The larger water bodies one arose to change the atmospheric condition around then self. During the presents study period water temperature ranged from 18.60 °C to 31.80°C. Similar results were found by Singhai et al. (1990) Jayabhayeet. al; (2006), Salve and Hiware (2006) and BaghelR.K.(2017), observed that during summer, water temperature was high due to low water level and clear atmosphere.



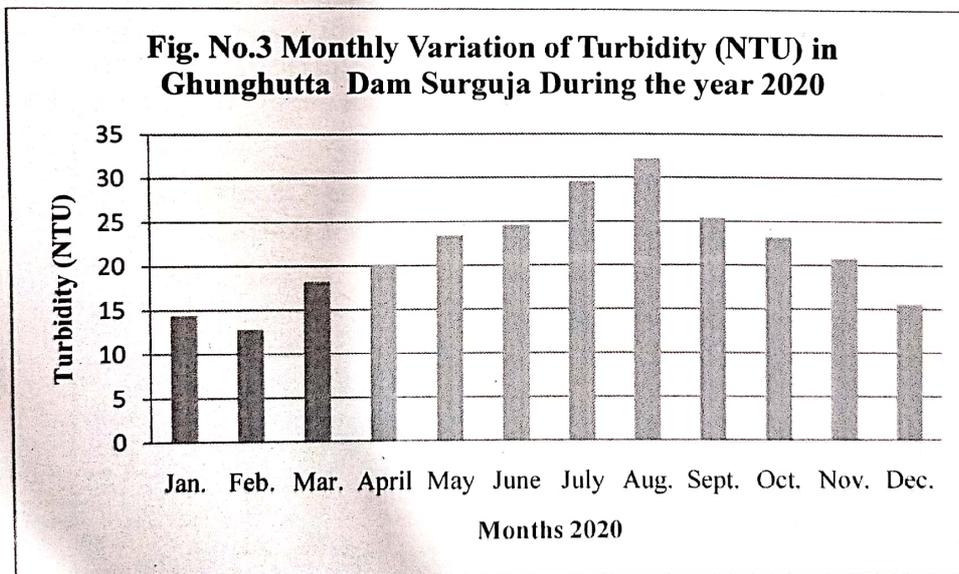


**Transparency:-**

Transparency is a measure of how clear the water is. It is important, because aquatic plants need sunlight for photosynthesis. The clearer the water, the deeper sunlight will penetrate. During the present study period transparency ranged from 24.0 to 94.5 c.m..

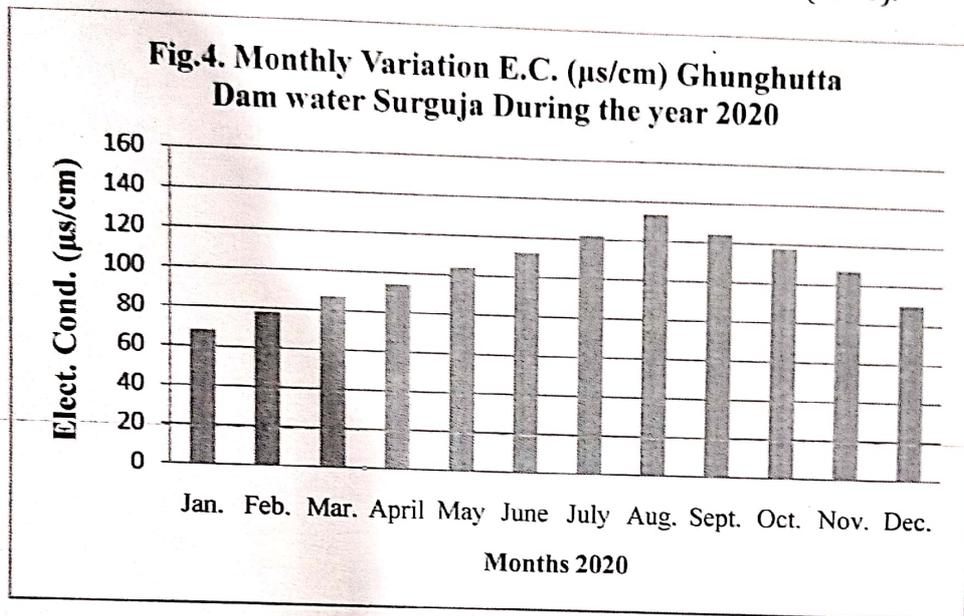
**Turbidity (NTU):-**

Turbidity is an optical characteristic or property of a liquid, which in general terms describes the clarity, or haziness of the liquid. Turbidity has always been based on human observation and while this phenomenon is quantifiable by many different means, much discussion still exists around the various techniques used to measure turbidities of fluids. The turbidity values range from 12.80 to 32.20 NTU. The maximum value was recorded from the rainy season in August 2020 and the minimum in the winter season in January 2020.



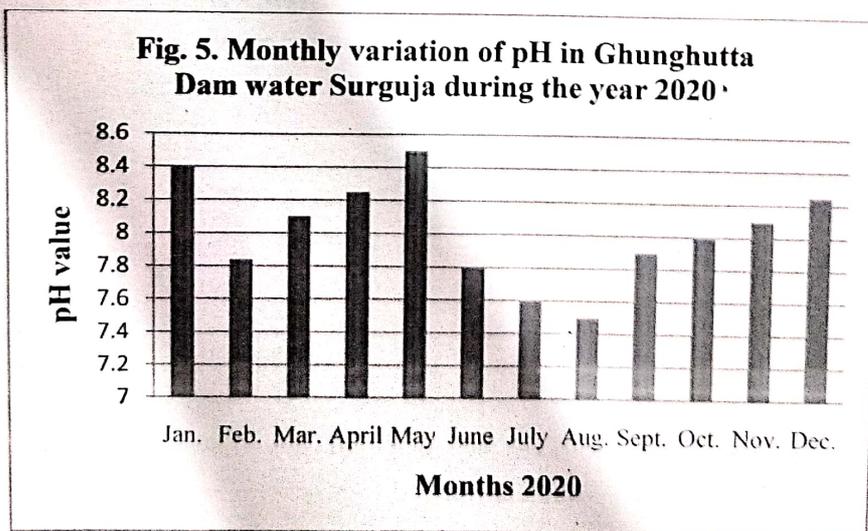
**Electrical Conductivity:-**

The electrical conductance of water denotes the capacity of conductance of electrical current. If the conductivity of a cube of each side of 1c.m at 25°C is called the specific conductance. In aquatic habitats it is a property caused by the zone present in water. Electrical conductivity value ranges 68.4 to 133.6  $\mu\text{s}/\text{cm}$ . The maximum value was recorded from rainy season August 2020 and minimum in the winter season January 2020. Similar results were found by Iqbal and Kataria (1995).



**pH:-**

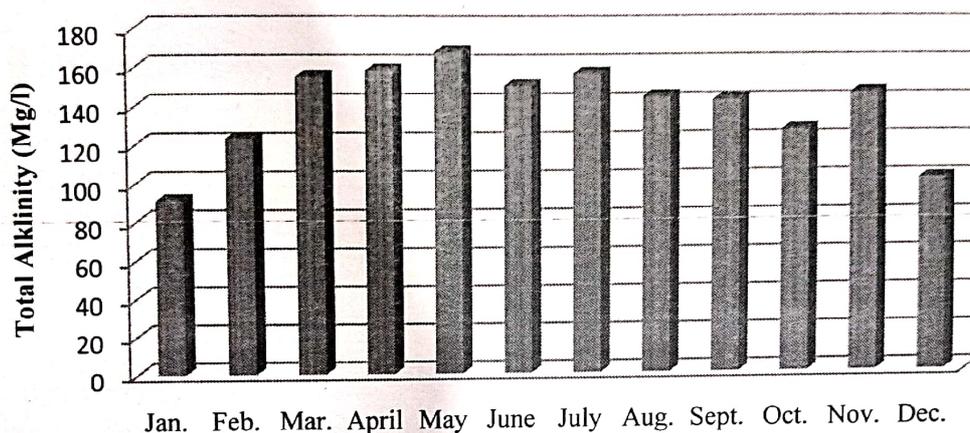
pH is a scale indicating the acidity or alkalinity of aqueous solutions. pH value is designated as a number from 1 to 14. Which represents a logarithmic scale indicating the concentration of hydrogen ions. The pH values ranges from 7.50 to 8.50. The maximum value was recorded from Summer months May 2020 and Minimum in the rainy season August 2020. High pH was observed during summer season due to influence of biological activity and uptake of carbon-dioxide by photosynthesing organisms of Ganga river water generally above 8 in all seasons except in rainy season. Similar results were also reported by Pawar and Pandakar (2011). Saxena et al. (1996) noticed pH of pH was alkaline throughout study period. Similar results were found Radhika et al. (2004) and Baghel R. K. (2017).



**Alkalinity (mg/l):-**

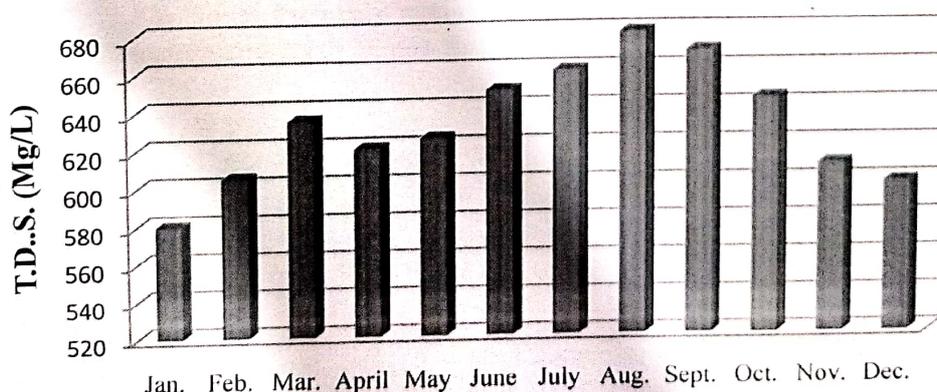
Alkalinity provides an idea of the nature of salts present in water. The values of alkalinity show fluctuations lower in rainy season and higher in summer season. The alkalinity is inversely related to the water level. This character is due to the presence of all the hydroxyl ions, which are able to have the combination the hydrogen ion. Total alkalinity ranges from 91.40 to 168.0 mg/l. The maximum value was recorded in summer season May 2020 and minimum value in the winter season December 2020. Similar results were found Garg SS (2003). These results are in good agreement with that reported by Sita Rama swamy (1995), Rajput (1999) and Biswas et al (2012).

**Fig. 6. Monthly variation of Total Alk. (mg/l) in Ghunghutta Dam water Surguja During the year 2020**

**T.D.S. (mg/l):-**

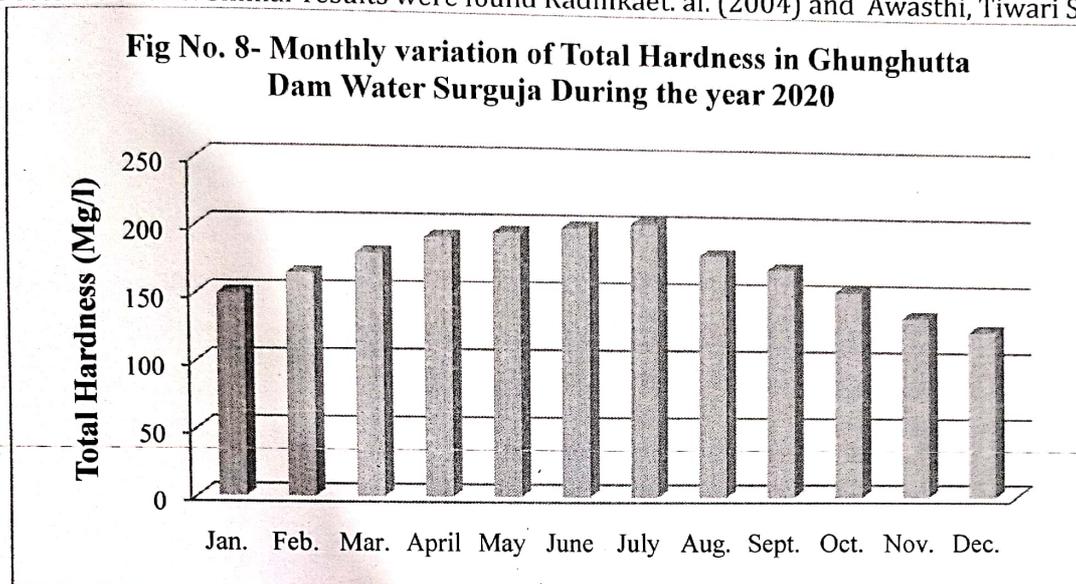
Solids are found in streams in two forms, *suspended* and *dissolved*. Suspended solids include silt, stirred-up bottom sediment, decaying plant matter, or sewage-treatment effluent. The total dissolved solid value ranges from 580 to 680 mg/l. The maximum value was recorded from August 2020 and minimum in the January 2020. Similar results were found Radhika et. al. (2004) and Baghel R. K. (2017).

**Fig.7 - Monthly variation of T.D.S. (mg/l) in Ghunghutta Dam water Surguja During the year 2020**

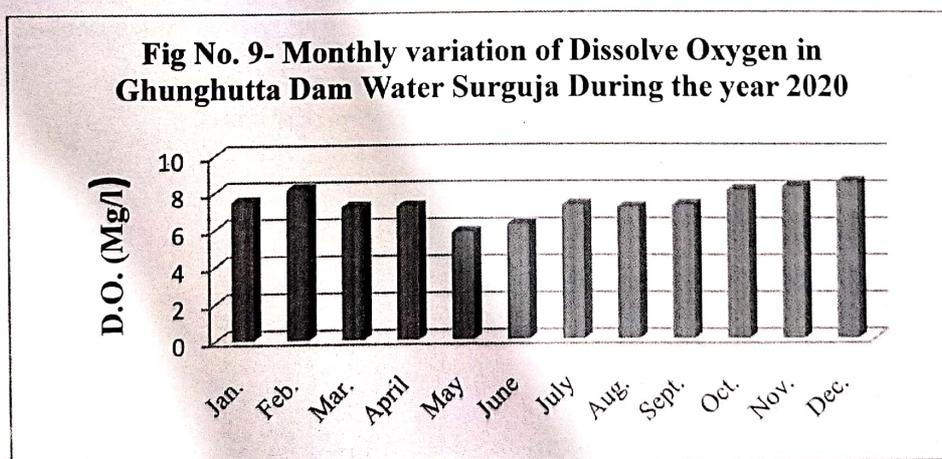


**Hardness (mg/l):-**

Water hardness is of interest to aquarists for two reasons: to provide the proper environment for the fish and to help stabilize the pH in the aquarium. Hardness of the natural water is mainly caused by cations such as calcium and magnesium. The value of hardness fluctuates from 125.0 to 203.0mg/l. The maximum value was recorded in the month of summer June 2020 and minimum in the month of winter December 2020. Similar results were found Radhika et. al. (2004) and Awasthi, Tiwari S. (2004).

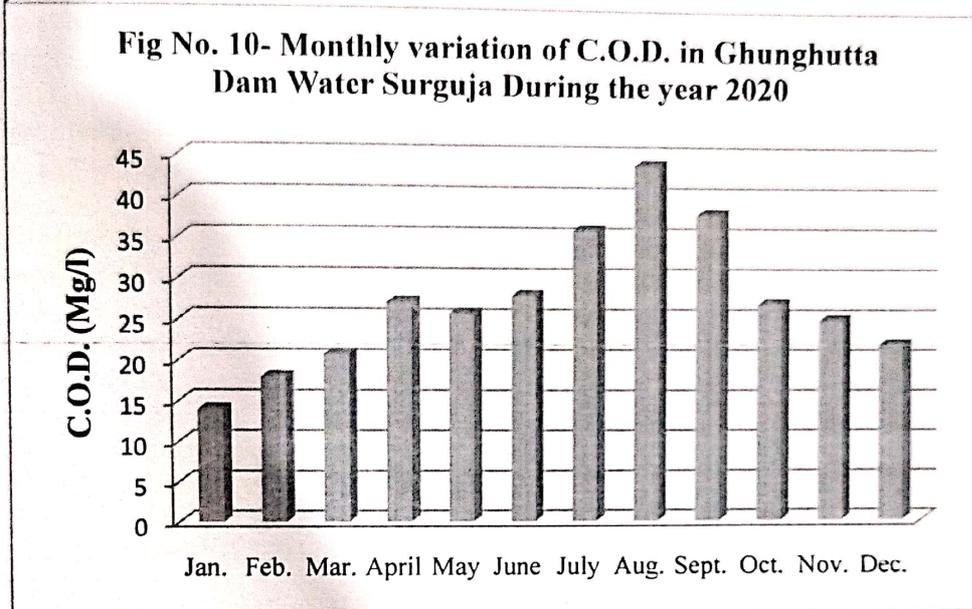
**Dissolved Oxygen(mg/l):-**

Dissolved oxygen is an important parameter in assessing water quality. In natural water, oxygen is probably one of primary importance both as regulator of metabolic process of plant and animal community and an indicator of water conditions. The value of DO fluctuate from 5.8 to 8.5mg/l. The maximum values were recorded in the month of winter December 2020 and minimum value in the summer month May 2020. Similar trend of dissolved oxygen in fresh water lakes also observed by Bhatt *et al.* (1998), Pandey (1993). The high DO in summer is attributed to increase in temperature and duration of bright sunlight. The long days and intense sunlight during summer seems to accelerate photosynthesis by phytoplankton's, utilizing CO<sub>2</sub> and giving off oxygen. This accounts for the greater quality of O<sub>2</sub> recorded during summer. The quantity is slightly less during winter as reported by Masood Ahmed and Krishnamurthy (1990). Pawar et al. (2005) reported that minimum 3mg/l dissolved Oxygen is essential for aquatic life. Salluet *al.* (1995) observed 0.60 to 1.70mg/l-dissolved oxygen in Ganga river.

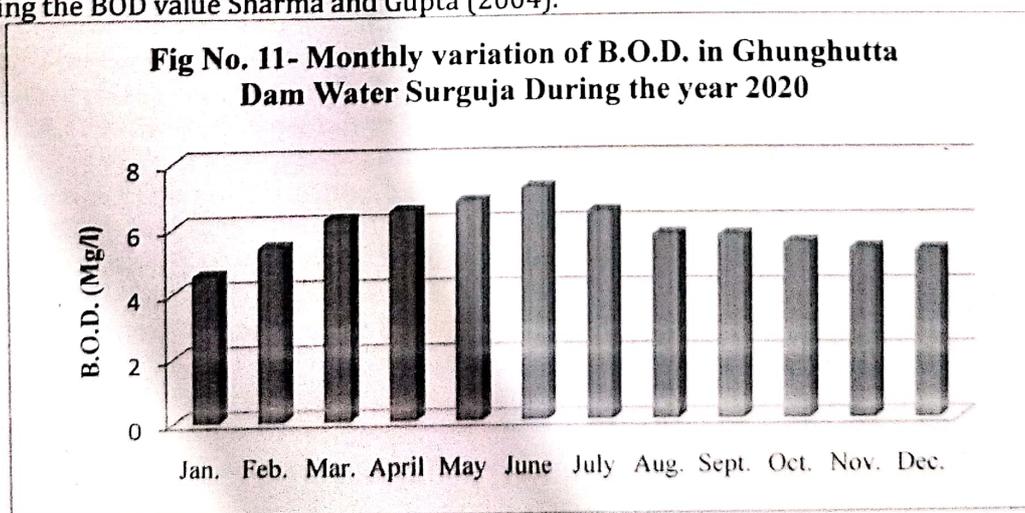


**C.O.D. (mg/l):-**

The Chemical Oxygen Demand (COD) test is used widely to estimate the amount of organic matter in wastewater. It is a measurement of the oxygen equivalent of the materials present in the wastewater that are subject to oxidation by a strong chemical oxidant, in this case, dichromate. Chemical oxygen demand (COD) value range between 14.0 and 44.0 mg/l. The maximum values were recorded in the month of August 2020 and minimum value in the winter season January 2020. There was no statistical difference in COD between the one year of study. APHA (1995), however, recommended COD levels of <2 mg/L in drinking water. High COD has been linked with pollution (Tepeet al., 2005).

**B.O.D. (mg/l):-**

Biochemical oxygen demand is a test which determines the amount of organic material in wastewater by measuring the oxygen consumed by microorganisms in decomposing organic constituents of the waste. Biological oxygen demand (BOD) value range between 4.54 and 7.14 mg/l. The maximum values were recorded in the month of June 2020 and minimum value in the January 2020. These findings are also in accordance with Ahmad (1989), Parashshar et al (2008), Sharma and Capoor (2010) and Arya et al (2011). The heavy human settlements around the pond are responsible for adding municipal waste water thus creating organic pollution in the pond. It is also an important factor in enhancing the BOD value Sharma and Gupta (2004).



**IV. CONCLUSION:-**

Water along with land is the most important natural resource gifted to man by nature. It is concluded from the present investigation that the quality of water Ghunghutta dam is deteriorating day by day due to inflow of domestic sewage, municipal waste, agricultural runoff and effluents of organic waste of animal and human origin into the lake. Therefore it can be concluded through this study that the Ghunghuttadam with social and cultural importance is degrading at an alarming rate.

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