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ASSESSMENT OF TROPHIC STATUS USING PHYTOPLANKTONS AS BIOMONITORS IN BANGO DAM, DISTRICT KORBA (C.G.)

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ABSTRACT :- The water environment is being polluted by anthropogenic sources. Various methods of study pollution, either identifying the type of pollutants by analytical techniques or indirect method i.e. impact on water quality have been developed. Phytoplankton are useful to assess long-term impact of pollution in dams and reservoirs. Assessment of trophic status water is presently practiced by analyzing the phytoplankton. In order to assess the trophic status of Bango dam, a perennial freshwater dam influenced by various anthropogenic activities, a survey of algal flora present in the shallow margins was conducted at distinct places seasonally. In all, 66 algal species belonging to Cyanophyceae (20), Chlorophyceae (28), Centric Diatoms (01), Pennate Diatoms (11) and Euglenophyceae (06) were identified. The Nygaard's Trophic State Indices were calculated and the values of indices for various classes when compared with the ranges assigned for various eutrophication levels showed varied eutrophication states in respect to different classes of algae. The CQ is a very sensitive and useful index of organic pollution, also indicative of eutrophic nature of this dam. Therefore, algal taxa have been used for biomonitoring of eutrophication and to assess the quality of water.

KEYWORDS:- Nygaard's Trophic State Indices, Biomonitoring, Eutrophication, Algae, Bango Dam Korba.

INTRODUCTION:-

Fresh water plankton is an important biological component in aquatic ecosystems, whose main function is to act as a primary and secondary links in the food chain and they play a vital role in energy transfer of aquatic ecosystems. Planktons can also be used as "bioindicators" for water pollution studies, because their occurance, vitality and responses, change under adverse environmental conditions. Phytoplankton plays a very important role in aquatic ecosystems, where—as a group of principal primary producers—it integrates mineral chemicals into the biological cycle. Phytoplankton research focuses mainly on the functioning of this community in stagnant waters.

Unplanned urbanization, rapid industrialization and indiscriminate use of artificial chemicals in agriculture are causing heavy and varied pollution in aquatic environments leading to deterioration of quality and depletion of aquatic biota (Yeole and Patil, 2005). Chemical analysis of water provides a good indication of the chemical quality of the aquatic systems, but do not necessarily reflect the ecological state of the system (Karr et.al., 2000). Biological assessment is a useful alternative for assessing the ecological quality of aquatic ecosystems, since biological communities integrate the environmental effects of water chemistry, in addition to the physical and geomorphological characteristics of rivers and lakes (Stevenson and Pan, 1999; Dora et.al., 2010).

The present study dam water climatic condition, variety of fishes is found in abundance for a small period of time whereas fish species and its quantity get drastically reduced during most of the time. Human factors like encroachment of water bodies, its pollution and unscientific way of fishing also seem to play remarkable role in the reduction of their species and volume. Keeping the above problem in mind, fish fauna diversity has been chosen for micro level research by taking up Korba District of Chhattisgarh India, as a case study. The study area is largely inhabited by backward and tribal people which sizable section is directly and indirectly related with fishes. The aim of the present work is to fill a knowledge gap on the diversity status of fish fauna of the selected Bango dam of Korba district and its identification.

Korba district was accorded the status of a full-fledged revenue district with effect from 25 May, 1998. The district headquarter is Korba city, which is situated on the banks of the confluence of rivers Hasdeo and Ahiran. Korba is the power capital of Chhattisgarh. The district comes under Bilaspur division. The headquarter of Korba districts situated about 200 KM. from the capital city Raipur. Its lies between 22° 21' 49.8528" N and 82° 44' 5.4240" E. (Fig. 1). Bango Dam is a dam constructed in 1961-62 across the Hasdeo river in Chhattisgarh, India. It is the longest, widest dam in Chhattisgarh and the first multi-purpose water project in Chhattisgarh. It is located 70 km from Korba, Korba district. It has a catchment area of 6,730 km2. The dam has a large effective storage capacity of 2.89 cubic kms (102.07 tmc ft). It has the capacity to generate 120MW electricity. Hasdeo Bango Dam is constructed across Hasedo river. The river originates about 910.0 m (2,985.6 ft) above sea level, at a place about 10.0 km (6.2 mi) from Sonhat in Koriya district. The total length of the river is 333.0 km (206.9 mi), Among the above-mentioned water resources many are perennial and annual.

REVIEW OF LITERATURE:-

Phytoplanktons are an ecologically important group in most aquatic ecosystems but are nevertheless often ignored as appropriate indicators of aquatic ecosystem changes (Sharma and Shaily, 2011).

The reports on water quality assessment have been recorded (Patil, et al. 2012; Shukla, et al. 2013; Kumar and Khare, 2015; Pushkar and Gupta, 2019 and Patel & Dubey, 2019a).

However, because of their nutritional needs and their trophic position at the base of aquatic food web, phytoplankton indicators can provide relatively unique information concerning ecosystem conditions compared to commonly used animal indicators (Omar and Maznah, 2010). Various workers have identified many algae as indicators of particular type of pollution (Palmer, 1969). However, due to multifold pressure of pollutants from various sources on urban water bodies, algal diversity increases and under such conditions instead of using individual algae as an indicator of pollution, whole community is considered to assess the water quality (Patrick, 1965). On the basis of number of algal species belonging to various groups, Nygaard (1949) has devised an index to assess the eutrophication state of lakes. Various researchers have employed Nygaard's phytoplankton indices (Myxophycean Index, Chlorophycean Index, Diatom Index, Euglenophycean Index and Compound Coefficient Index) reliably and extensively to study the trophic status of different water bodies in the past (Gunale and Balakrishnan, 1981; Sharma and Sharma, 1991; Mishra et.al., 2001 and Sharan and Rekha, 2010). However, no serious studies have been carried out on the ecological and trophic status of this water body except studies made by Singh (1979) and Sharma et.al. (1988) on the aquatic marshland plants of Jhalawar district. Accordingly, this study focuses on the results of biomonitoring of this urban polluted lake using Nygaard's Indices as biomonitoring is a reliable and economical means of water quality monitoring (Kohlmann et.al., 2018 and Pham, 2020). Growth of phytoplankton is influenced by the presence of limiting nutrient caused by the inflow of fresh water (Sabita, et al. 2018). Phytoplankton's small size and ability to provide strong response to environmental changes are being routinely used for biomonitoring especially for trophic state of the water (Allende et.al., 2019 and Wu et.al., 2017). In the present study Nygaard's Indices were used to assess the degree of eutrophication in terms of trophic state of the water body.

OBJECTIVES:-

The phytoplanktonic community is considered as a major component of aquatic biota that often exhibits dramatic changes in response to different types of pollution. Phytoplanktonic abundance in a water body also reflects its ecological state. Hence, diversity of phytoplanktonic component in the aquatic ecosystem serves as a reliable index for biomonitoring of pollution load. The aim of the present study is to determine the diversity of phytoplanktonic flora and also to determine the water quality of Bango dam using algae as bioindicators.

MATERIAL AND METHODS:-

Study Area: Bango Dam, situated near the town of Korba in Chhattisgarh, India, is an eminent multipurpose dam built on the Hasdeo River, a tributary of the Mahanadi River. This dam is a critical source of both irrigation and hydroelectric power generation for the region. With a catchment area that spans a considerable expanse, it creates a substantial reservoir, which is not only functional but also scenic. The serene atmosphere and picturesque beauty make it a popular spot for picnics and leisure outings. The reservoir is also a favored spot for anglers. With the industrial city of Korba in the vicinity, the dam provides a much-needed respite from the bustle of urban life, offering a unique blend of natural beauty and industrial significance.

Sampling and data collection were done for one-year January 2024 to December 2024. Two traverses have been selected for the field survey Bango dam Korba district (C.G.).

Phytoplankton Identification

Algal samples were collected in acid washed plastic tubes and preserved in 5% formalin. The samples were identified with the help of standard references (Prescott, 1951; Desikachary, 1959; Randhawa, 1959; Philipose, 1967 and Gonzalves, 1981).

Nygaard Trophic State Indices Nygaard (1949) has devised an index to assess eutrophication state of lakes. The algal samples were identified upto species level and then grouped into various classes to calculate Nygaard's five indices as described by Gunale and Balakrishnan (1981). Generally, Cyanophyta, Euglenophyta, Diatoms and members of Chlorococcales are resistant to higher nutrient levels and thus are found more commonly in eutrophic waters while Desmids and many Pennate Diatoms are sensitive to nutrients and found in oligotrophic waters (Patrick, 1965; Palmer, 1969; Gunale and Balakrishnan, 1981).

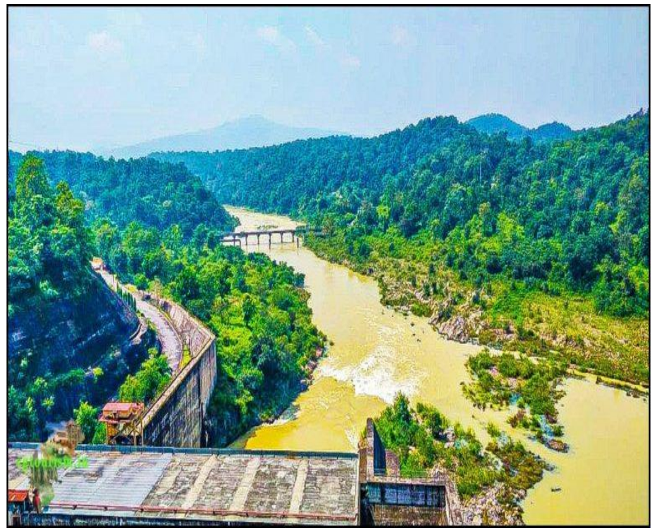

FIG-1. A VIEW OF BANGO DAM KORBA (C.G.)

RESULT AND DISCUSSION:-

In the present study total 66 algal species were identified belonging to Cyanophyceae (20), Chlorophyceae (28), Centric Diatoms (01), Pennate Diatoms (10) and Euglenophyceae (06). Chlorophyceae was reported as a most dominant group in the water body. Van Den Hoeck et.al. (1995) also reported Chlorophyceae as a large and important group of freshwater algae. Members like Chlorella vulgaris, Schizomeris and Stigeoclonium tenue showed a wide range of tolerance to various pollutants. Rai (1978), Rai and Kumar (1979), Gunale and Balakrishnan (1979) have also shown these species as indicators of eutrophication. Dominance of Chlorococcales and Desmidiales indicating highly eutrophicated state of water body. Presence of Cyanophycean members like Oscillatoria, Microcystis aeruginosa and Arthrospira in the lake water show their tolerance to high degree of pollution as also noted by Palmer (1957) and Brook (1965). Taylor et.al. (1981) stated that Microcystis is an indicator of pollution. Diatoms and Euglenophyceae are present in a low numbers in the water body.

Values of Nygaard's Trophic State Indices presented in table 1 indicates that Diatoms and Euglenophytes are the least sensitive as their index values are 0.06 and 0.225, respectively. For Chlorophycean and Cyanophycean comparatively higher values of indices were calculated i.e., 1.75 and 2.25, respectively. The CQ which has the highest value on the other hand is a very sensitive and useful index of organic pollution. The values of indices for various classes when compared with the ranges assigned for various eutrophication levels showed varied eutrophication state in respect to different classes of algae. On account of higher number of species belonging to Cyanophyceae (20) and Chlorophyceae (only Chlorococcales and Desmideae) (28), the dam is eutrophic, while on the other hand low number of species belonging to Diatoms (01) and Euglenophyceae (06) it is oligotrophic. The value of CQ is > 6 i.e. 6.22 which is indicative of highly eutrophic nature of this lake. The results were in accordance with earlier reports (Taylor et.al, 1977; Williams et.al., 1977; Gunale and Balakrishnan, 1982 and Sharma and Sharma, 1991). Several researchers have proposed temperature as a vital factor responsible for the growth of algae (Ramkrishnaiah and Sarkar, 1982; Verma and Datta 1987; Bohra and Kumar, 1999 and Patel and Dubey, 2019a). Therefore, on the basis of ratios of indicator planktonic algal groups present in water, Nygaard's Indices could be used as reliable biomonitoring tool for monitoring trophic status of an urban water body influenced by various anthropogenic activities.

Table 1 Nygaard's Trophic State Indices of Bango Dam of Korba District (C.G.).

Index	**Calculation**	**Range of index for**		**Trophic Index**
		Oligotrophic	**Eutrophic**	
Myxophycean	$= \frac{\text{Myxophyceae}}{\text{Desmideae}}$	**0.0—0.4**	**0.4—3.0**	**2.25**
Chlorophycean	$= \frac{\text{Chlorococcales}}{\text{Desmideae}}$	**0.0—0.7**	**0.7—9.0**	**1.65**
Diatom	$= \frac{\text{Centric Diatoms}}{\text{Pennate Diatoms}}$	**0.0—0.3**	**0.0—1.75**	**0.06**
Euglenophycean	$= \frac{\text{Euglenophyta}}{\text{Myxophyceae}+\text{Chlorococcales}}$	**0.0—0.2**	**0.0—1.0**	**0.225**
Compound	$= \frac{\text{Centric Diatoms}+\text{Euglenophyta}}{\text{Desmideae}}$	**0.0—1.0**	**1.2—2.5**	**1.25**
Compound Quotient (CQ)	$= \frac{\text{Myxophyceae}+\text{Chlorococcales}+\text{Centric Diatoms}+\text{Euglenophyta}}{\text{Desmideae}}$	**<2**	**>6**	**6.22**

CONCLUSIONS:-

In the present investigation is concluded from the study that composition of phytoplankton communities is greatly influenced by various anthropogenic activities in the surrounding land areas and the algae may serve as good indicator of these activities and they can be used as a potent criterion for biomonitoring of eutrophication. Present study also indicates that Bango dam has become eutrophic and this condition may lead to further deterioration of this precious water body.

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