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PHYSICO-CHEMICAL PARAMETERS AND CLIMATE CHANGE IMPACT ON ALGAL GROWTH

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ABSTRACT

Identifying the biological processes that influence algal growth is essential for ecosystem management. Algae are little aquatic plants that exist either as solitary cells or in regions of diverse dimensions. Zooplankton rely on them as a crucial component of the aquatic food chain, since they provide as their primary source of nutrition. Algae, via the process of photosynthesis, produce oxygen that is subsequently released into the water, serving as a vital resource for fish and other aquatic organisms. This work presents a methodology for estimating the biological characteristics of algae, which play a crucial role in the regulation of eutrophication, via the use of modelling and exploration methodologies. The estimation of algae growth and respiration rates was conducted by using a one-dimensional water quality model and two-dimensional regionally distributed water quality data taken from Lower Manair Dam of Karimnagar District, Telangana. A total of 24 algae were detected in the sample. The most abundant types of algae include Green algae, Flagellate algae, Cyanobacteria, and Diatoms. In the summer season, 17 types of algae were found, while in the spring season, 20 types were detected. The estimation of biological characteristics of algae in natural freshwater environments may be achieved by a physico-chemical technique, which offers an alternate option to sampling and in situ testing.

KEYWORDS: *Algal growth, biological parameters, Lower Manair Dam, eutrophication, in situ testing*

1.INTRODUCTION

The presence of water is crucial for all forms of life on Earth and for maintaining a stable climate.

There are few chemicals with such a significant impact on the natural world as this one. The physicochemical and biological characteristics of water are often used to define its quality.(Bajic, S.J., et.al 1985). The hasty adoption of modern farming practices, including the overapplication of chemical fertilisers and Heavy and diversified aquatic contamination is caused by pesticides in agriculture, which in turn causes the decline in water quality and loss of aquatic habitats. People get water-borne infections as a result of drinking polluted water. That is why regular water quality checks are essential. Things like temperature, pH, salinity, turbidity, nitrate, and phosphate are among the testable parameters. (Bhateria, R., & Jain, D. 2016). In biological monitoring programmes, algae play a significant role in determining the water quality. For a long time, algae have been seen as a good way to measure the effects of climate change, eutrophication, water management, and changes in land use at the watershed scale. (Gokce, D.,et.al. 2011). Because of their hyper-reactivity to changes in their environment, algae provide a promising bioindicator for the fast evaluation of water quality. (Bellinger, E. et.al. 2010). Unfortunately, there are some time and expense limitations that make continuous analysis useless. Biological measures, on the other hand, may immediately and continuously show all features of water quality.

Evaluate how different factors in the ecosystem affect the environment. Using biomonitoring, conditions may be reliably and affordably recorded at several sites. Because of their low life cycle, rapid reproduction rate, and nutrient needs, algae are suitable for water quality monitoring. (Beck, M. 1987). As a direct result of changes in water quality, such increasing pollution, algae respond to changes in the quantitative and qualitative composition of species across a wide range of water parameters, making them important markers of environmental health.(Jagdish Prasad, T. 2014).

2.MATERIALS AND METHODS

StudySite-Lower Manair Dam also known as LMD was constructed across the Manair River, at lugunur, Thimmapur mandal, Karimnagar District, in the Indian state of Telangana during 1974 to 1985. It provides irrigation to a gross command area of 163,000 hectares. The Lower Manair Dam is located on the Manair River at 18°24' N latitude and 79° 20' E longitude in Karimnagar District at Km.146 of Kakatiya Canal. The Manair River is a tributary of the Godavari River and

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the dam is built across the river at the confluence with Mohedamada River.(Fig 1).

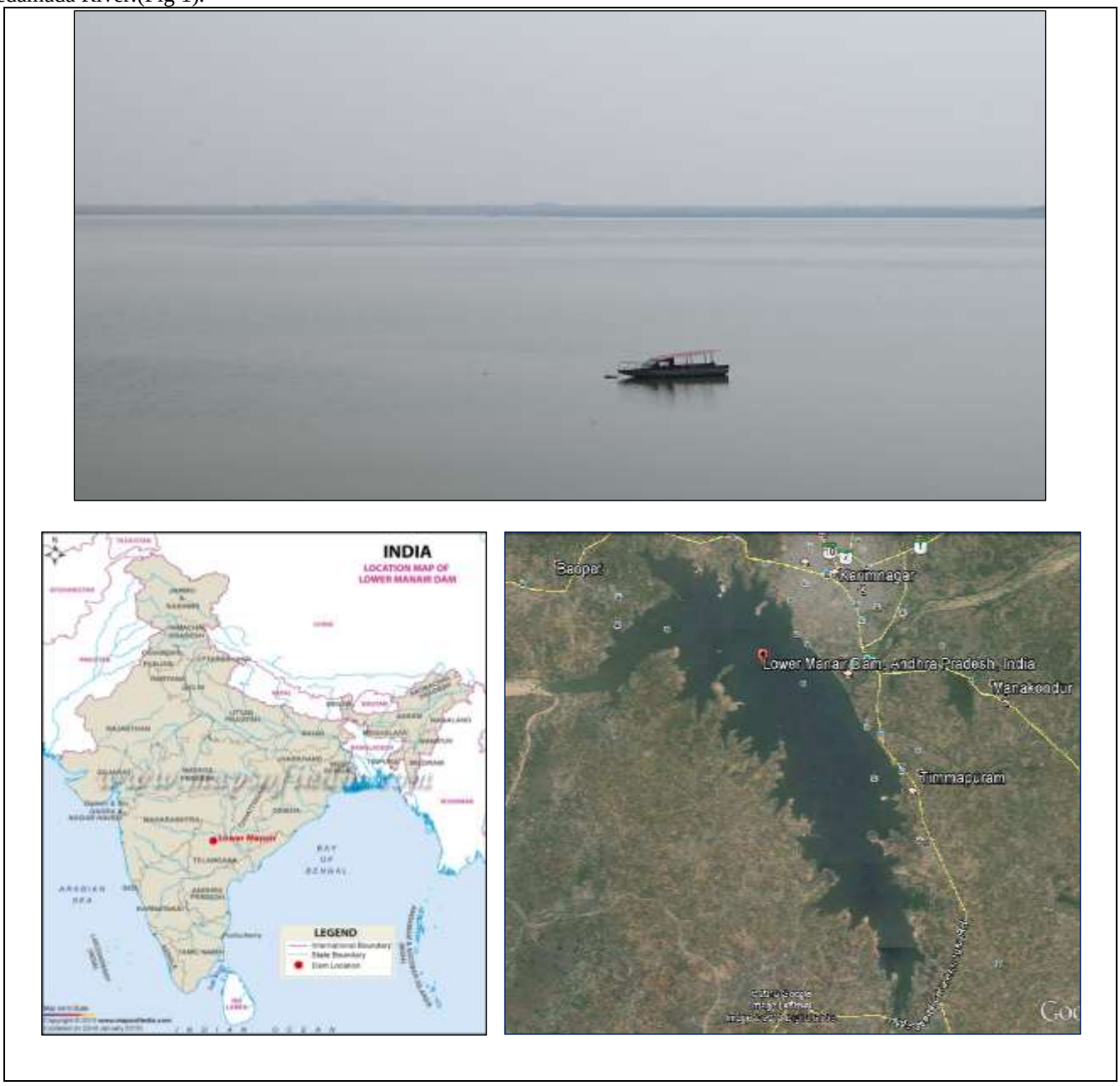

Fig .1 Indicating Lower Manair Dam over view- Google Map

Water sample Collection

The water will be collected from the Lower Manair Dam once a month at 8 a.m. in a 1-liter container for physical-chemical examination. As per the American Public Health Association (APHA 2012), Water Pollution Control Federation (WPCF), and American Water Association (A.W.A.), certain physicochemical characteristics will be studied on-site while others will be.

Laboratory work

Over the course of one year, we will examine the physicochemical properties of the water from the dam. Chemical parameters like pH, alkalinity, hardness, dissolved oxygen (D.O.), biochemical oxygen demand (B.O.D.), chemical oxygen demand (C.O.D.), salinity, and physical factors like colour, odour, temperature, electrical conductivity (E.C.), and total suspended solids (T.S.S.). The pH, fluoride, phosphate, and nitrate levels were measured.

(a) Temperature-by use of a thermometer calibrated in Celsius.

(b) Turbidity–using turbidity meter.

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(c) Using a pH meter to determine the concentration of hydrogen ions.
(d) The release of CO2 using titrimetric analysis.
Using a 0.1 N NaOH solution and phenolphthalein indicator, titrate 100 ml of the sample.

Dissolved Oxygen
The Winkler modified technique is used to measure dissolved oxygen (D.O). 300 ml sample in B.O.D. container plus 2 ml .Manganese sulphate + 2 mL. To dissolve alkali-iodideazide reagent, shake the container for 15 minutes, then add 2 mL of concentrated H2SO4. Then, titrate the 100 ml solution with 0.025 N. Sodium thiosulphates. With a starch indication.

Biological oxygen demand (B.O.D.) – By using Winkler's modified method

Algae sampling.
We will collect the algal samples using a plankton net made of No. 18 nylon bolting cloth with a mesh size of 0.072 mm. Then, we will transfer the samples to a glass container and preserve them in a 4% formalin solution. Morphological features will be used to identify algae up to the species level, according to literature from laboratory and microscopic studies.

Analysis of microalgae using quantitative methods
The quantitative microalgae analysis included the filtration of 100 litres of sea surface water using the conventional plankton net. The filtrate obtained in the collecting bucket was used for quantifying both viable and fixed cells utilising a Sedgwick Rafter Cell.

Preservation of the sample
The samples for qualitative and quantitative analysis were preserved using a solution of 10% formalin, which is comparable to a 4% concentration of commercial formaldehyde. Hexamethylene diamin (Hexamin) was added to the solution for further analysis.

3.RESULTS AND DISCUSSION
It is required to do a chemical analysis of water quality, including organic and inorganic contaminants, salinity, inorganic and organic nutrients, and so on. However, due to the unique time and cost constraints, continuous analysis is not useful. But biological assessments can show you how water quality changes over time and how ecosystem factors affect the environment in a direct way. Using biomonitoring, conditions may be reliably and affordably recorded at several sites**.**

As many as 24 different types of algae were identified in the specimen. The most abundant types of algae have been found to be green algae, flagellate algae, cyanobacteria, and diatoms; 17 and 24 algae, respectively, were found in the summer and spring seasons. (Srivastava, N. et.al.2018).

Algae are ideal for biological monitoring due to their unique features compared to other ecosystems.
A. Algae are autotrophs that exist between the habitat and the food chain.
B. Because algae lack stems, they are unable to move away from contamination, leading to their demise.
C. Algal communities have diverse species with unique tolerances.(Roka, D. et.al.2022).
D. Algae have short life cycles and are susceptible to change, while communities can withstand influences over time.(Lüning, K. et.al.1989).
E. Algae are densely packed and simple to sample and store.
F. Algae are smaller than other creatures, making them more vulnerable to pollution at low quantities.

The key aspects of each segment are listed below
Result 1: Overflow from the Lower Manair dam leads to improved surface water quality and algal development, higher ion and oxygen concentrations, and lower phytoplankton density. Substances' harmful effects on algae are decreased.(Meena, S. K. et.al.2020).

Result 2: Deepwater quality is characterised by poor algal growth and oxygen content, as well as a strong nutritional component mostly in the form of ammonia nitrogen. Eutrophication or super nutrient systems are also present. (Das, M. et.al. 2022). The prevalence of tiny central diatoms and Chlorella is dominant, but the concentrations of heavy metals much beyond the threshold that ensure the protection of aquatic life.(Baykal, T.et.al. 2002).

Result 3: Enhanced water depth, width, velocity, and dissolved oxygen levels; enhanced water quality by restoring oxygen concentrations; increased nutritional value and chlorophyll levels associated with the eutrophication process; indications of harmful impacts on algae.

4.CONCLUSION
In this work, we used the algal growth potential (A.G.P.) test to anticipate changes in water quality and assess the danger of algal development in Manair Dam after water transfer. Our research found an 8.7% reduction in algal growth in dam water.

Depth of Secchi Disc
The depth at which the Secchi Disc is submerged has a role in determining the water's quality, both in terms of its appearance and visual clarity. The average measurements recorded by Secchi in the spring and summer are 3.96 meters and 4.23 meters, respectively. Consequently, the reservoir has limited clarity due to the presence of algae.

The research of the Lower Manair Dam was made possible by analysing the water's physical and chemical properties, the structure of phytoplankton, the variety of algae, and the fundamental hydrological data. We engaged in a period of academic pursuit lasting three months. The impact of highly contaminated dam perimeters, as well as the quality of both

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surface and deep water, is acknowledged. The hydrodynamic behavior of the lake ecosystem system was determined by physical and chemical factors, as well as the variability caused by algae growth.(Reynolds, et.al. 2009).

Compliance with Ethical Standards

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