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A Study on Diversity of Planktons in Water Body of Baglihar Dam- A Review

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Abstract - Zooplankton is a vital component of an aquatic environment and is critical for the transmission of energy. Plankton production depends critically on the physicochemical properties and nutritional state of a water body. Many fish species naturally eat plankton, especially zooplankton. Baglihar Dam is a freshwater body of water that is notable because of its high commercial value and is situated in the Ramban region of Jammu and Kashmir, India. The region's high agricultural activity continues to have an influence on the water's quality even if the water is changed often. Additionally, it offers the necessary amount of protein for the rapid development of larval carps. Phytoplankton is the main producer and the lowest trophic level in the food chain in freshwater environments. Studies on planktonic composition and morphometric, physical, and chemical characterization of water bodies are necessary to get a fundamental knowledge of a region's biodiversity. In order to better understand the variety of phytoplankton and zooplankton in the Baglihar Dam reservoir, a current study is being conducted.

Keywords: Zooplankton, Phytoplankton. Baglihar Dam, Biodiversity, Aquatic ecology, Ecological implications, Conservation strategies

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INTRODUCTION

Water is one of the valuable natural resources that make up our nation. Water makes up the majority of living matter and is not only necessary for life but also makes up close to three-quarters of the weight of each living cell. There is a phrase that goes, "No life without water," which refers to the fact that water is one of the naturally occurring necessary requirements for all life-supporting processes. Resources like water are vital to the growth of both the natural world and the human race. The physical environment's characteristics are mostly used to categorize aquatic habitats. Water has been a worry for man since the beginning of time (Abbasi, 1998).

When making decisions on issues like building reservoirs, irrigation, industrial usage, home use, pollution management, and fish and aquaculture methods, limnology is crucial (Muley and Gaikwad, 1999). The study of limnology focused on organisms, particularly plankton (Hensen, 1887 and Fritsch, 1907). The Baglihar Dam, strategically situated on the Chenab River in Jammu and Kashmir, has not only provided hydroelectric power but has also converted the surrounding terrain into a distinctive aquatic habitat. The construction of the dam has resulted in the development of a reservoir that exhibits unique biological circumstances, such as fluctuations in water flow, temperature, and nutrient availability. The reservoir's planktonic communities have been greatly impacted by these forces, resulting in notable changes in their composition and behavior.

Plankton, which includes a wide range of tiny creatures including phytoplankton and zooplankton, are crucial for preserving the biological equilibrium of freshwater ecosystems. Phytoplankton, which include algae, diatoms, and cyanobacteria, are organisms that carry out photosynthesis and create oxygen as a result. They serve as the foundation of the aquatic food chain, supplying vital nutrients and energy to higher trophic levels. Zooplankton, such as rotifers, copepods, and cladocerans, function as consumers by feeding on phytoplankton and transmitting energy to fish and other creatures.

Comprehending the variety of plankton in Baglihar Dam is essential for efficient ecosystem management and preservation. Planktonic organisms play a crucial role in the cycling of nutrients, namely carbon, nitrogen, and phosphorus, throughout the water column. Through the process of photosynthesis, they have the capacity to capture carbon dioxide, which aids in carbon sequestration and assists in reducing the effects of climate change. Furthermore, planktonic communities function as bioindicators of water quality, accurately reflecting changes in environmental circumstances such as pollution levels, nutrient enrichment, and temperature swings. through the examination of plankton variety in Baglihar Dam, scientists and environmentalists may get significant knowledge

about the well-being, adaptability, and consistency of the ecosystem. Tracking fluctuations in plankton populations over time offers timely indications of ecological disruptions and enables the implementation of adaptive management approaches. Efforts to conserve plankton variety entail ensuring appropriate habitat conditions, reducing pollution, and advocating for sustainable water management methods.

The complex interconnections among planktonic creatures, nutrient cycling, and food web dynamics highlight the need of comprehending and safeguarding the variety of plankton in the water body of Baglihar Dam. These efforts not only help protect the variety of aquatic life but also guarantee the responsible use of water resources for present and future generations.

1.1 Diversity of phytoplankton:

The phytoplankton populations in the Baglihar Dam are varied, consisting of diatoms, green algae, and cyanobacteria, each fulfilling a distinct function within the ecosystem. The populations are greatly influenced by seasonal fluctuations, including variations in water temperature, nutrition availability, and light intensity. Diatoms flourish in colder seasons because of their silica cell walls, but cyanobacteria, which fix atmospheric nitrogen and thrive in nutrient-rich settings, often see rapid development during warmer seasons. Nevertheless, an overabundance of blooms may do significant damage to the quality of water and the overall health of ecosystems. This includes reducing the quantities of dissolved oxygen, generating toxic substances, and disturbing the balance of the aquatic food chain. The fluctuations in phytoplankton populations in Baglihar Dam are influenced by a complex interplay of environmental conditions, nutrition availability, and species interactions. Phytoplankton composition and abundance may be further influenced by nutrient inputs from nearby land regions, such as agricultural runoff or urban pollution. Comprehending these fluctuations in seasons is essential for the management of ecosystems and the preservation of biodiversity. Monitoring phytoplankton populations may provide useful information about the quality of water, cycling of nutrients, and possible disruptions in the ecosystem. To maintain a healthy phytoplankton population and preserve the biological integrity of Baglihar Dam's aquatic environment, it is important to implement strategies that address nutrient contamination, manage water flow, and promote balanced ecosystem dynamics.

1.2 Diversity of Zooplankton:

The zooplankton populations in Baglihar Dam exhibit a wide range of species and have a vital function in the aquatic ecology. They play a crucial role in the recycling of nutrients, the transmission of energy, and the maintenance of ecological equilibrium. Nevertheless, the population dynamics of these organisms are impacted by a multitude of environmental conditions. The development, reproduction, and survival of organisms are influenced by factors such as water temperature, dissolved oxygen levels, and food availability. The metabolic rates and developmental processes of organisms are influenced by water temperature, while their distribution and abundance may be constrained by amounts of dissolved oxygen. The abundance of food, particularly for organisms that mainly consume plants or both plants and animals, has a significant impact on the numbers of zooplankton, which are organisms that primarily consume plants or both plants and animals. The act of zooplankton feeding on phytoplankton has a direct influence on the clarity of water and the cycling of nutrients. Zooplankton grazing has a crucial role in controlling blooms, preventing excessive algal development, and maintaining water clarity, therefore impacting water quality and ecosystem dynamics. This mechanism also aids in nutrient recycling, since zooplankton emit fecal pellets that are abundant in nutrients. Comprehending the intricate interconnections of zooplankton populations, environmental factors, and phytoplankton dynamics is crucial for the successful management and preservation of ecosystems. Observing zooplankton populations may provide vital information about the overall condition of an ecosystem, the relationships between different organisms in the food chain, and how the environment is affected. To maintain the health of zooplankton populations and preserve the resilience of Baglihar Dam's aquatic environment, it is important to implement measures that safeguard water quality, reduce pollution, and promote balanced food web dynamics.

1.3 Environmental factors that impact the diversity of plankton:

The variety of plankton in the water body of Baglihar Dam is greatly influenced by environmental conditions. Crucial factors like as pH, temperature, and nutrient concentrations have a significant impact on the composition and behavior of planktonic communities. The availability of nutrients and the physiology of plankton are influenced by pH levels, while metabolism and growth rates are affected by changes in temperature. The presence of dissolved oxygen is crucial for aerobic organisms and has the potential to impact the composition of biological communities. Human activities like as farming and urban development add excessive nutrients to the water in the dam, causing eutrophication and the growth of large amounts of algae. This may disturb the communities of little organisms called plankton. Climate change introduces additional intricacy by modifying the distribution of rainfall, temperature trends, and occurrences of severe weather events, which may exert pressure on plankton populations and disturb the equilibrium of ecosystems.

Comprehending the interdependence of various environmental elements is crucial for efficient management and conservation efforts. Implementing strategies such as nutrient management, enhanced wastewater treatment, and climate resilience measures may effectively reduce the negative effects of human activities and climate

change on the variety of plankton in Baglihar Dam. This will help maintain the long-term well-being of the aquatic environment.

Surface water is naturally supplied by precipitation and evaporation, and it is naturally lost by discharge to groundwater and subsurface seepage. According to Kumar and Ravindranath (1998; Mulani et al., 2009), water assessment typically entails the examination of physico-chemical and biological parameters in an aquatic environment and represents the abiotic and biotic condition of that ecosystem. Numerous experts have conducted extensive study on the aquatic ecology in India (Sharma, 1982; Saxena, 1982; Jha and Verma, 2000; Borse, Lohar and Bhave, 2003; Singh and Gupta, 2004, Barai and Kumar, 2012). Any aquatic ecosystems' physico-chemical properties, as well as the kind and distribution of its biota, are directly connected to, impact, and are all under the control of several natural regulating systems. Freshwater's chemical composition affects the medium's physical characteristics as well as the distribution and metabolic processes of the resting life, among other things. Natural ecosystems, industrial or man-made ecosystems, and human progress all depend critically on water supplies. Reservoirs in man-made ecosystems offer water for drinking, industry, and agriculture. These essential components of life cannot be produced or made by humans in the necessary quantities. Numerous physical, chemical, and biological factors are required for water supplies to be of high quality. These traits can detect specific ecological conditions affecting living things and provide suitable conservation and management tactics. Up to this point, several studies have been conducted (Adoni, 1985; Bhatnagar et al., 2009; Cole, 1975; Garg et al., 2006; Saxena, 2001).

Water quality in reservoirs is declining as a result of several environmental issues. Due to overuse and water contamination, fresh water is become a precious resource. Surface and subsurface water quality have declined as a result of growing population and its needs (Vyas et al., 2007; Bhatnagar and Sangwan, 2009; Gupta et al., 2011). Aquatic ecosystems are a natural resource that may be used by man to meet his agricultural, industrial, household, recreational, and aesthetic requirements. Due to limited water retention times and the physical makeup of these systems, the impact of pollution on lentic water bodies is substantial (Dhar et al., 2004). A freshwater body of water called Baglihar Dam is significant due to its great commercial value and is located in the Ramban area of Jammu and Kashmir, India. Even if the water is changed often, the water's quality is still being impacted by the area's intense agricultural activity. Studies have been done to determine how this water body and others like it are affected by mass bathing and religious activities.

Plankton diversity and physicochemical properties are crucial factors in determining whether water is suitable for irrigation or drinking. Water quality evaluation typically entails the measurement of physicochemical, biological, and microbiological factors and reflects on the ecosystem's abiotic and biotic state (Rajagopal et.al., 2010). Zooplankton are one of the most significant biotic components in an aquatic ecosystem, impacting all functional elements such as food chains, food webs, energy flow, and matter cycling. Zooplankton plays an important function as a bio indicator and is an excellent instrument for determining the state of water pollution. However, there is relatively little evidence on the link between physicochemical characteristics and planktonic fauna (Rajagopal et.al., 2010).

Extensive studies on seasonal change of zooplankton are common in temperate freshwaters, but research on freshwater zooplankton in India is limited. Few studies on zooplankton population abundance in various types of wetlands have been conducted (Patra et.al., 2011). An early phenomenon in limnology was an interest in the physical elements that impact zooplankton. *Diaphanosomabrachiurum* was widely known to be a warm-water species found only in temperate lakes during the summer, whereas *Diaphnialongiremis* was a cold-water species found only in the chilly hypolimnion in the southern half of its range (Brien et.al.,2004). The discovery that shallow lakes had higher productivity and fish output than deep lakes sparked interest in the influence of lake morphometry (Brien et.al.,2004).

Reservoir and pond dynamics as a natural system are governed by biotic and abiotic processes. Monitoring of the surface waters and the creatures living there is necessary due to the changes in the aquatic environment brought on by anthropogenic contamination. One of the top environmental goals is to assess the quality of surface waters using hydrological metrics. The plankton community is a sensitive indication of the condition of the monitoring water objectives since it is intimately associated to all other biota components (Vandysh, 2004).

The zooplankton is an important component of an aquatic environment and plays an important role in energy transmission. Freshwater zooplankton is essential to the environment and food chain of ponds, lakes, and reservoirs (Manickam et.al., 2015). Zooplankton consume phytoplankton. They are in charge of consuming millions of tiny algae that would otherwise grow out of control. Inadequate understanding of plankton and their dynamics is a key impediment to a better understanding of the life processes of fresh water bodies (Manickam et.al., 2015). The zooplankton is an important component of an aquatic environment and plays an important role in energy transmission. Freshwater zooplankton is essential to the environment and food chain of ponds, lakes, and reservoirs. Zooplankton consume phytoplankton (Manickam et.al., 2015). They are in charge of consuming millions of tiny algae that would otherwise grow out of control. Inadequate understanding of plankton and their dynamics is a key impediment to a better understanding of the life processes of fresh water bodies (Manickam et.al., 2015). The primary issues affecting standing water

bodies have been recognised for at least two decades, but quantifying and categorising them for environmental managers has proven difficult (Rajagopal, Thangamani, &Archunan, 2010). The condition of Indian freshwater resources and their management has recently been described as a prominent environmental problem, with nutrition enrichment, acidification, and domestic waste, sewage, agricultural, and industrial effluents contamination by toxic substances identified as major impacts (Rajagopal, Thangamani, &Archunan, 2010). Water is essential for all living species, from microorganisms to humans, but it is a severe concern today because all water supplies are contaminated as a result of uncontrolled development and industrialisation. Water quality has been assessed using qualitative and quantitative phytoplankton investigations (Rajagopal, Thangamani, &Archunan, 2010).

The variety and density of zooplankton are determined by the nutritional status of the water body, abiotic variables, DO, food chain, soil-water chemistry, and claimed that zooplankton have been employed as bio-indicators to assess aquatic ecosystems and water integrity (P. Jakhar, 2013). The rotifer population was favoured by water temperature, turbidity, clarity, and dissolved oxygen. Interspecific and intraspecific variables control zooplankton distribution and abundance, while phytoplankton availability influences zooplankton via influencing female reproduction. Maximum zooplanktons were seen in the winter, most likely because to low temperatures, high DO concentration, and low velocity (P. Jakhar, 2013). Therefore, Zooplankton has been proposed as a bio-indicator of lake eutrophication, acidification, and agricultural disturbances at the regional level. Rotifers are zooplankton that respond to environmental changes more quickly and are used to test water quality. Zooplanktons are the chosen bio-indicators for identifying anthropogenic pollution dispersion patterns and comprehending the incorporation and transit of waste nitrogen into pelagic and benthic food chains (P. Jakhar, 2013). Temperature, light penetration, and water movement all play essential roles in plankton dispersal and lake stratification. These elements interact to impact water quality and, as a result, community. Human activities such as various agricultural practises and irrigation, as well as natural dynamics, can significantly alter lake physicochemical characteristics, affecting water quality and quantity, species distribution and diversity, production capacity, and even disrupting the balance of the lake's ecological system (Dhanam et.al., 2016).

To gain a basic understanding of a region's biodiversity, studies on planktonic composition and morphometric, physical, and chemical characterization of water bodies are required. As a result, the current effort aims to investigate the physicochemical features and phytoplankton species diversity in order to assess pollution levels (Pandey et.al., 2009). The best predictor of an ecosystem's health has been shown to be its biodiversity. The distribution of the planktonic community is influenced by a number of variables, including changes in the climate, physical and chemical characteristics, and the presence of vegetation. The distribution of the majority of planktonic organism species was global.

Nearly all bodies of water have phytoplanktons, which are minute, photoautotrophic organisms with chlorophyll in their cells that live in the upper, sunny layer. While zooplankton play a crucial part in the aquatic food chain and serve as the major food supply for aquatic invertebrates and vertebrates, phytoplankton are the primary producers and maintain productivity and oxygen levels via photosynthesis in water bodies. There has previously been several helpful research on the planktonic fauna of desert and semi-arid water (Agrawal et al., 2010; Sharma and Saxena, 1995; Arora and Saxena, 1997; Modi and Saxena, 2001).

The primary producer and lowest trophic level in the food chain of the fresh water environment is phytoplankton. Additionally, the amount and type of phytoplankton are used to gauge the quality of the water (Janagal, 2016). Diverse zones have different phytoplankton distributions that are influenced by the physiochemical characteristics of the water. The study of phytoplankton offers a pertinent and practical starting point for research into the mechanism of eutrophication and how it affects aquatic ecosystems. As the main source of income for the majority of the people, agriculture is a key industry in India's economic growth. A significant river in Haryana, the Chenab, rises in the Himachal Pradesh and Haryana Siwalik Hills. The Chenab River travels in a southwesterly direction after flowing east to west. Numerous streams, streamlets, drains, and tributaries discharge their burden into the Chenab as it travels west. The Chenab River joins the Kaushalya Nadi in the foothills region after passing through the Morni Hills and before entering the plains.

The little streams, such as The major Chenab River is formed by the combination of the Kaushalya, Jhajra, and Chenab rivers close to Chandimandir. Additionally, several point and non-point sources are joining the Chenab river in downstream locations and discharge their untreated effluents into it. When water is utilized for residential purposes, such as drinking, or for irrigation of agricultural regions, its quality is crucial. Water contamination can alter the physico-chemical characteristics of water, making it unsuitable for both uses. The aquatic biota is put in peril when industrial effluents are carelessly dumped into river water, which eventually upsets the ecological equilibrium. It seems obvious that communities with more pollution have less variety, and as pollution levels rise, more tolerant species gradually replace the sensitive ones. In aquatic environments, benthic macroinvertebrates serve as a gauge for total biodiversity.

1.4 Importance in the ecosystem and implications for conservation:

The variety of plankton is of great ecological importance, as it plays a crucial role in the operation and well-being of aquatic ecosystems, such as the one found in Baglihar Dam. These little creatures serve as the foundation of the food chain, acting as primary producers that transform solar energy into organic matter via photosynthesis. Phytoplankton play a vital role in producing oxygen and storing carbon, which has a direct impact on global biogeochemical cycles.

Plankton has ecological significance that goes beyond basic production. Zooplankton, which are organisms that devour phytoplankton, play a vital role in connecting primary producers to higher trophic levels. They serve as a crucial nourishment for a range of aquatic creatures, such as juvenile fish, tiny invertebrates, and species that feed by filtering water. The number and variety of planktonic communities have a direct influence on the productivity and biodiversity of fish populations, which in turn affects the yields of fisheries and the ability of ecosystems to withstand disturbances. Ensuring the preservation of robust plankton populations in Baglihar Dam is of utmost importance for several compelling reasons. Plankton have a crucial function in regulating water quality by filtering and converting organic materials, which helps with the recycling of nutrients and maintaining water clarity. Additionally, they play a crucial role in maintaining the biological equilibrium of the environment by regulating the occurrence of algal blooms and inhibiting the accumulation of excessive nutrients. Furthermore, planktonic organisms possess a high degree of sensitivity to environmental changes, making them invaluable as bioindicators for the purpose of monitoring ecosystem health and identifying possible stressors.

Efforts to conserve plankton diversity in Baglihar Dam should use a comprehensive strategy. It is essential to address pollution sources, such as agricultural runoff and industrial discharges, in order to decrease nutrient inputs that might cause eutrophication and dangerous algal blooms. Adopting sustainable land-use practices and advocating for appropriate waste management may effectively reduce the negative effects of human activities on water quality and plankton populations. Ensuring the quality of the environment is another crucial element in preserving plankton. Preserving coastline vegetation, maintaining riparian buffers, and limiting habitat degradation are crucial for guaranteeing optimal environments for the development and reproduction of plankton. In addition, the regulation of water flow regimes and the reduction of sedimentation may aid in the preservation of the specific physical and chemical conditions required for the survival and multiplication of plankton.

Regularly monitoring plankton populations is crucial for evaluating the efficacy of conservation efforts and identifying any ecological shifts or imbalances. Integrated monitoring projects that merge conventional sample methods with cutting-edge technology, including as remote sensing and molecular approaches, may provide vital insights on the dynamics of plankton and the way communities respond to environmental changes.

1.5 Directions for the Future of Research:

The long-term trends of plankton diversity in Baglihar Dam should be investigated in future study. This should be done against the backdrop of changing environmental circumstances. It is possible to improve species identification and community structure analysis by combining molecular approaches with more conventional methods. In addition, the study of the interactions that occur between plankton and other biotic components will bring to an improvement in our comprehension of the dynamics of ecosystems.

CONCLUSION

The study comes to the conclusion that aquatic ecosystems are subject to a variety of health stressors that have a significant adverse effect on biodiversity. It is a reflection of the intricate interactions that take place between environmental conditions and biological populations that the Baglihar Dam is home to a wide variety of plankton. In order to maintain healthy plankton populations and guarantee the ecological integrity of the water body that is contained inside the dam, it is required to continue doing research and conservation initiatives. According to future forecasts, aquatic ecosystems will suffer from biodiversity loss and its effects more than terrestrial ones. The hydrological cycle is one of the many environmental natural processes that reservoirs are vulnerable to. Humans are to responsible for the death of many lakes owing to storm water runoff and sewage discharge into reservoirs, which are two major ways that various nutrients enter aquatic ecosystems and create pollution. This is because of remarkable expansion.

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