

A Physicochemical Assessment of Pili Dam, Bijnor, Uttar Pradesh

Hemlata Rajput¹, Rajesh Singh²

^{1,2}Department of Zoology, School of Applied Sciences, Shri Venkateshwara University, Uttar Pradesh, India
Corresponding author: [srajsingh77\[at\]gmail.com](mailto:srajsingh77[at]gmail.com)

Abstract: *The river's importance for industrial, agriculture, and human usage is widely recognized; nonetheless, it is contaminated by a variety of routes such as heavy metals, nitrate, fertiliser, and micropollutants. The present investigation was conducted on a regular basis at several locations of the Pili dam. It was found that the maximum temperature was recorded in summer season (29.9 ± 1.2 °C) followed by monsoon (23.0 ± 0.6 °C) and winter season (19.5 ± 0.1 °C). The recorded temperature showed significant variation in different climatic season varied seasonally ($r = 0.7$). The floral and faunal diversity are highly varied at the water dam due to fluctuations in the different parameters of water. Hence, a long - term monitoring of physicochemical meters may explore more possible clues for diversity alteration of the Pili dam.*

Keywords: Physicochemical parameter, water characteristics, seasonal variations

1. Introduction

River is well known for manufacturing, irrigation and human use of water supplies. The water is polluted by all conventional toxins, such as heavy metals, nitrate, fertiliser, chemical substances and micropollutants (Scannapieco *et al.*, 2012). Several studies have found that the water quality of the country's water rivers is specific in different areas. Industrial and household waste products containing many toxic contaminants which can be threaten to water bodies in several ways and the living atmosphere and which have placed a significant burden on water and land populations may be noticeable impacts (Liang *et al.*, 2018). In ecological services and energy, anthropogenic stress plays a vital role. However, such research attempt are highly significant to explore about the seasonal based modifications in the physicochemical components of the water and associated sites (Naddeo *et al.*, 2007; Kumarasamy *et al.*, 2014).

Seasonal fluctuations of the physicochemical parameters, including polluted water impact, cause additional strain and obstruction in several forms in plant development as the phenological changes in the reproductive cycle was commonly reported (Yadav *et al.*, 2015). Changes in plant phenology can affect the fruiting and even productivity can be hindered during the flowing seasons (Mannina & Viviani, 2010). Plant growth changes and phenological changes impact crop development. Contamination of the river water may be more important if the aquatic flora and fauna are not affected by the effluents and heavy metals accumulations.

2. Materials and Methods

Prior to the sampling, a stock of plastic containers and sterile bottles have been taken for sampling. It was planned to visit Pili dam regularly with a periodical interval. Based on the collected information about the study site, an approval has been taken from the concerned bodies and they were allowed for periodical sampling and observations. Before the scheduled of sampling and observations, each container was

purged with deionized water or in case of unavailability, dilute nitric acid was also used for sample collection and research outcomes.

It is a common practice to rinsed containers with tap water several times for washing purpose. The washed containers were dry at room temperature while sometimes, it is also heatedly dried but drying temperature i. e. under room temperature was consistently monitored. In general, all containers were rinsed by tap water several times and then it was kept for dry under room temperature. Sometimes, the washed containers were also dried by heater waves or oven. Based on the research plan, a constant interval was followed for sampling and sample were also collected, if weather, local gathering and situation are convenient. Perhaps due to the enormous crowds, even sampling itself was a difficult process, so we strictly avoided taking samples in such circumstances.

Moreover, a periodical water sampling was collected by the following of proper description, standardized and elaborated protocols. During the time sampling, it was strictly monitored that the newly developed and described methods for this present investigation may meet with desired research results as there were a number of precautions such as collections of sample, transports, submissions and examination of samples were well taken cared. However, as normal, sample was carried out for further research analysis with a great attention for optimum outcomes.

3. Results and Discussion

Water quality varied seasonally which was explored in the present study. The physicochemical parameters of water samples in Pili water dam were assessed in all climatic seasons which are depicted in the different graphs (Figure 1). During the study period, the maximum temperature was recorded as 29.9 ± 1.2 °C (SD) in summer season while it was recorded as 23.0 ± 0.6 °C (SD) in monsoon and 19.5 ± 0.1 °C (SD) in winter season. Due to its physical characteristic, the temperature of the water fluctuates in a cycle that is dependent on time, month, and different

environmental conditions. The interpretation value of correlation coefficient value of all three seasons showed significant variations in the water temperature of the studied samples ($r = 0.7$; $p < 0.001$; $df = 91$) however there was no significant difference was noted in among the season ($p > 0.05$). According to the studies, yearly mean temperature of air varies throughout the year. There was a dramatic shift pattern of the optimal year mean temperature compared to the minimum mean temperature of the study site. On the basis of the average yearly mean temperature, the optimal mean temperature of water was determined. Even though water temperature is a variable that changes over time, it was shown that temperature fluctuations are a deciding factor in floral and faunal variety of the study site. Many factors and environmental variables are influenced water quality, therefore in order to achieve the best possible results, it was firstly concentrated on a single location, and later on, it was taken care of as a precautionary measure throughout the study period and observations.

The temperature of the water fluctuated somewhat with the seasons. However, additional variables such as festival gatherings, cultural gatherings, unexpected changes in the environment, and an abundance of pollutants and waste materials at regular intervals are playing a significant role in the temperature alteration as identified as a major concern in recent studies. In general, such changes have been observed throughout the year since it is a cyclical phenomenon in every year. In several studies, it was discovered that the intensity of sunlight exposure caused surface to warm, especially around mid of the day when water directly exposed by sunlight. During early morning, temperature was lower than other times of the day. According to the months, and light exposure, which varied with both night and day length help in the temperature alteration of the water temperature.

It was found that the concentration of nitrate was higher in summer seasons in comparison to winter and monsoon season. During summer period, it was recorded as 17.3 ± 1.7 mg/l (SD) in winter season 16.5 ± 2.1 mg/l (SD) in summer season and 12.7 ± 0.9 mg/l (SD) in monsoon season respectively. It is shows that the concentration of nitrate in the dam water was higher in winter season and lower in monsoon season. There was a significant difference was found in the nitrate concentrations variations in the samples of different seasons ($r = 0.8$; $p < 0.05$; $df = 91$).

The biological oxygen demand is a very explicit feature of water characteristics and play a crucial role in the floral and faunal diversity. It was noticed that biological oxygen demand varied with respect to environmental conditions as it was recorded as 61.4 ± 3.7 mg/l in monsoon whereas 58.4 ± 5.8 in summer season and 52.5 ± 4.9 mg/l in winter season respectively. The chemical oxygen demand was recorded as 74.5 ± 3.9 in monsoon while 69.5 ± 4.8 in summer and 67.8 ± 7.4 (SD) in winter season. There was a significant relationship found in the different climatic seasons ($r = 0.8$, $p < 0.05$). The depth of the water bodies is one of its distinguishing qualities. According to the river's depth, a range of unique characteristics may be noticed at different points throughout its length and width. There is a wide range of depths of water resources depending on location and time.

In the present study, the depth of water at a particular location was assessed and recorded. The lowest reported water depth was discovered in summer season while peak winter time i.e. January has had a low amount of water amount, which is likely owing to the lack or connectivity of water bodies or channels in the winter season. A typical observation in the study area during peak winter season was conducted and results of the study shows that there is less water available during this time period and that more water is being retained owing to agricultural crop irrigation during this time period. A typical observation in the study area during peak winter season shows that there is less water available during this time period and that more water is being retained owing to the agricultural crop irrigation especially during this time period.

During sampling, the recorded sample showed highest dissolved oxygen level as 6.1 ± 0.4 mg/l in the monsoon while in case of winter, it was recorded as 5.9 ± 1.1 mg/l and lower most was noted in the summer season as summer 5.3 ± 0.4 mg/l. It was found that there was a significant variation among the seasons in which sample were collected ($r = 0.6$; $p < 0.05$; $df = 91$). The abundance of water in July combined with the rainy season and inefficient management of rain water in the study region were observed as main factor. Maximum water depth was reported during the monsoon season, particularly in July month when rainy season was recorded on peak. The availability of water in all of sampling sites made sampling easier during this period. There were fewer gatherings basically local masses and fishermen because of the availability of water around the sampling areas, were also seen.

It was believed that the local peoples may be helpful for collection of general information and data sampling, especially when it comes for common information such as types of fishes available in the market, their market demand and capturing frequencies with respect to the demand, makes more interesting observation. The study area was noticed when it came to visiting the sample locations, yet a great number of local fishman are easily accessible to gather important information especially for the estimation and monitoring water characteristics.

pH concentration may effect on morphology, physiology and metabolic activities of aquatic organisms. As a result, pH concentration plays a significant role in aquatic animal life. Hence, it can be used as an indication of the water pollution and contaminations level assessment. Presence of pollutant gradients and waste materials in the water can be easily distinguished by using pH range values and there are several techniques are present and being used with the fundamental principle.

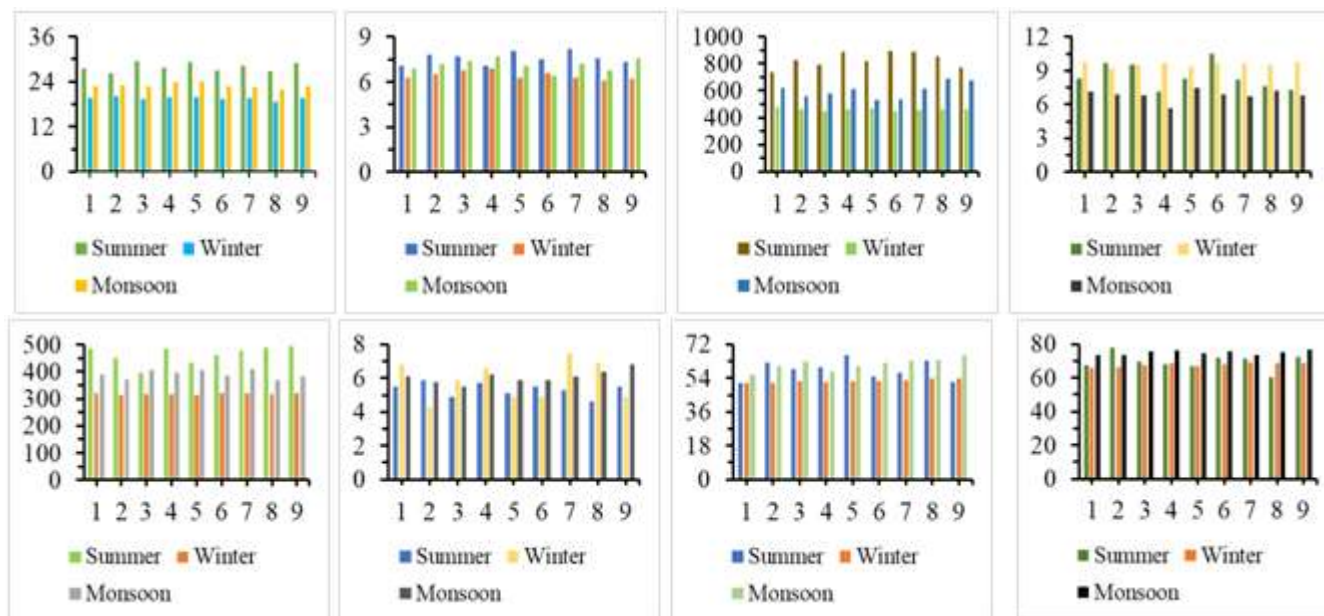
There was a variation in the pH values in different climatic seasons such as summer (7.6 ± 0.4 SD), winter (7.6 ± 0.1 SD) and monsoon (7.1 ± 0.4 SD). As a result, aquatic animals have developed adaptations to a specific trait that confer their presence or movement accordingly. Sometimes, due to the unfavourable conditions, even if a species didn't move, it reduces their genetic variabilities leads towards the species extinction. Because of this, the properties of water and the balance of its parameters are playing an important

role in aquatic species survivability. The results reveal that pH value varied seasonally however, some other gradients especially residential and industrial pollutants are merged with water and circulated in the dam sue to the presence of different channels. Among the physicochemical parameters of the water, pH is one of the most essential qualities when it is defining aquatic life. In term of the research findings, the measurements of pH and its values was varied over the study period. In general, it was also noticed that the floral and faunal diversity are also varied and benefitted from pH range variations, which was considered as an important characteristics of water quality determination factor. However, pH is regarded to be one of the most prominent and quality determining factors of water quality. Many of its alterations had have impacted on both floral and faunal diversity. Aquatic animal diversity has been decimated by a range of changes in present and recent years. The seasonal fluctuations in the pH value may potentially induced fish migration since water quality fluctuates with seasonal variations in the parameter concentrations.

Since acidic elements were found across the sampling sites thus, there was a unique alteration pattern in the water characteristics was observed and probably it may be a possible cause of alkalinity quality of the water. As a result of these factors are significantly influences to all the types of animals and plants which reproduces and grow around the water bodies also had a significant influence in determining of its physical and chemical characteristics. In many cases, it was noticed that the surrounding of the agricultural crops, the dumping of waste materials deteriorates the quality and productivity of the agricultural forms and moreover, it also influences the agricultural harvesting and crop production due to contaminated water use. Through the passage of

agricultural waste products, water flow was hampered and its physicochemical characteristics changed. Results of seasonally varying nutrients may influence the physicochemical properties of the dam water. However, the concentration of nutrients constituents was found to be considerably greater in the collected samples in rainy seasons than in all seasons and the concentration of nutrients was lower in just a few areas. The amount of concentration is shown to vary according on the season and the site locations.

There are a large number of variations was found in this study. The selected locations where various forms of effluents which were commonly noticed from agriculture, industry or trade, and such water - mixed effluents were present, and a sustainable relationship with the physicochemical parameters was established. The water was gathered in this dam through several routes and around the study locations, water was thus accessible in the additional agricultural and drinking areas. The intake of pollutant water may create a numerous serious health hazard. In recent days, due to the over use of fertilisers and residential as well as commercial fuels, the pollution of water increased exponentially and it is obvious that it may hampered the floral and faunal diversity of the aquatic bodies. Moreover, agricultural activities around the sampling sites may added in good proportion and improve the conservation activities to conserve fish diversity as well as physiochemical variables of the dam water. Temperature also plays an important role in the breakdown or conversion of various household and commercial effluents which are a considered as a manor causative factor for the degradation of water qualities and imbalances in the physicochemical parameters of the water.



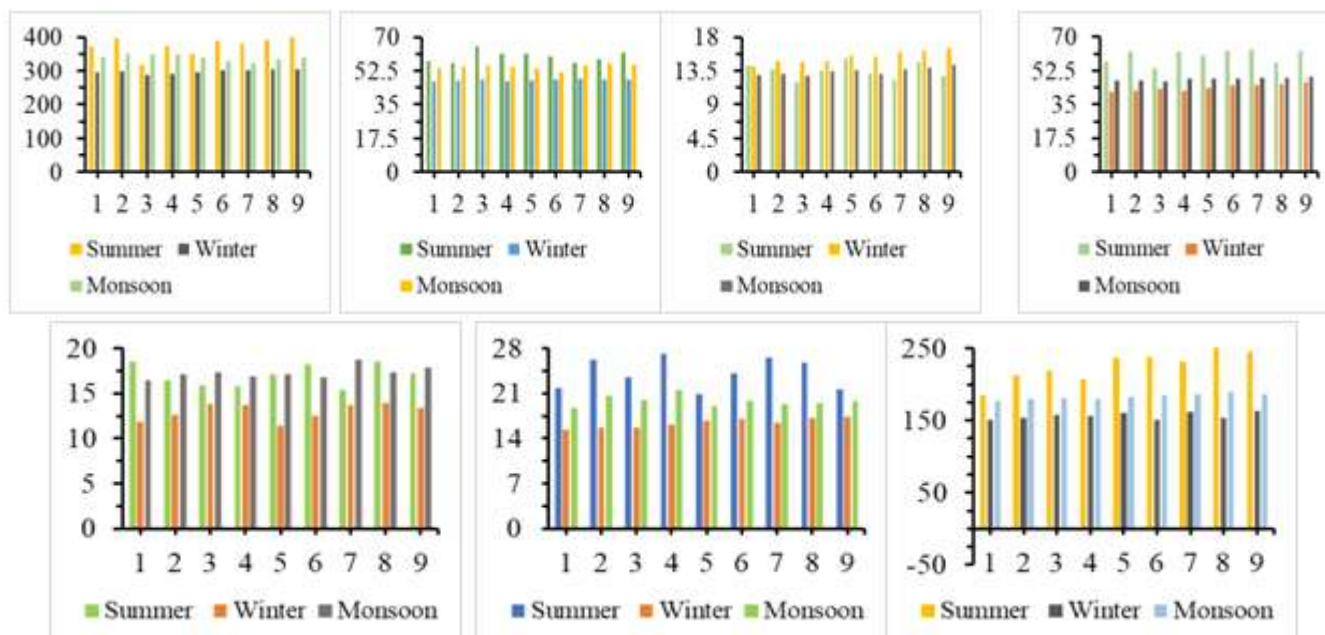


Figure 1: Seasonal variations in the physicochemical parameters (like Temperature, pH, Conductivity, Turbidity, TDS, Dissolved Oxygen, Biological Oxygen Demand, COD, Hardness, Calcium, Chloride, Iron, Nitrate, Sulphate and Alkalinity) of dam water.

References

- [1] Kumarasamy, P., James, R. A., Dahms, H. - U., Byeon, C. - W. & Ramesh, R. (2014) Multivariate water quality assessment from the Tamiraparani river basin, Southern India. *Environmental earth sciences*, **71**, 2441 - 2451.
- [2] Liang, B., Han, G., Liu, M., Yang, K., Li, X. & Liu, J. (2018) Distribution, sources, and water quality assessment of dissolved heavy metals in the Jiulongjiang River water, Southeast China. *International journal of environmental research and public health*, **15**, 2752.
- [3] Mannina, G. & Viviani, G. (2010) A parsimonious dynamic model for river water quality assessment. *Water Science and Technology*, **61**, 607 - 618.
- [4] Naddeo, V., Zarra, T. & Belgiorno, V. (2007) Optimization of sampling frequency for river water quality assessment according to Italian implementation of the EU Water Framework Directive. *Environmental science & policy*, **10**, 243 - 249.
- [5] Scannapieco, D., Naddeo, V., Zarra, T. & Belgiorno, V. (2012) River water quality assessment: a comparison of binary - and fuzzy logic - based approaches. *Ecological engineering*, **47**, 132 - 140.
- [6] Yadav, K. K., Gupta, N., Kumar, V., Sharma, S. & Arya, S. (2015) Water quality assessment of Pahuj River using water quality index at Unnao Balaji, MP, India. *Int J Sci Basic Appl Res*, **19**, 241 - 250.