



Temperature and pH values: Impact and assessment of river water

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Abstract

Water quality monitoring and conservation are critical since water is one of the most fundamental aspects of species survival. Rivers play an important role in the absorption and conveyance of waste debris from urban and industrial areas. Industrial and household discarded products comprising a variety of hazardous substances may have noticeable effects on aquatic organisms. Seasonal changes in physicochemical characteristics, particularly the influence of water quality, are typical for influence and assessment. As temperature and pH values have an important role in biological activities. The reproduction and survival rate of fishes may be affected by changes in surface water temperature and pH values therefore it might have a significant impact on the faunal diversity of the Ram Ganga River.

Keywords: river water, fish diversity, physicochemical parameters, conservation

Introduction

A river system is a process that connects both the main channel and tributaries and carries a considerable load of dissolved and particulate matter from both natural and manmade sources in a one-way flow (Bukaveckas *et al.*, 2011) [2]. The lithology of the basin, atmospheric inputs, climatic circumstances, and anthropogenic inputs all have an impact on the quality of a river at any one location (Laizé and Hannah, 2010) [10]. Rivers, on the other hand, play a critical role in the absorption and transportation of urban and industrial waste water as well as agricultural runoff (Peng *et al.*, 2011) [11]. Surface runoff is a seasonal phenomenon that is heavily influenced by the climate within the basin, but municipal and industrial wastewater discharge is a continual polluting source (Rajaram and Das, 2008) [12]. Several studies have discovered that the water quality of the country's rivers varies by region. Industrial and domestic waste products containing a variety of harmful chemicals that can endanger water bodies and the living environment in a variety of ways, as well as impose a considerable burden on water and land populations, may have apparent effects. Anthropogenic stress is important in ecological services and energy (Afroz *et al.*, 2014) [1]. However, such study efforts are critical for learning more about seasonal changes in the physicochemical components of water and adjacent places (Vega *et al.*, 1998) [13].

Seasonal changes in precipitation, surface runoff, interflow, groundwater flow, and pumped in and outflows all have a significant impact on river discharge and on pollution concentrations in river water. As a result, a fundamental understanding of hydro-morphological, chemical, and biological properties is required for efficient, long-term river management. However, due to difficult-to-interpret geographical and temporal changes in water quality, a monitoring programme is required to provide a representative and valid estimate of the quality of surface waters (Afroz *et al.*, 2014) [1]. Seasonal fluctuations of the physicochemical parameters, including polluted water impact, cause additional strain and obstruction in aquatic animals are commonly reported. Changes in the surface of water temperature may affect the breeding and even survival rate of fish fauna (Donelson *et al.*, 2010; Firkus *et al.*, 2018) [5, 7]. Floods and droughts will also modify water quality by direct effects of dilution or concentration of dissolved substances (Delpla *et al.*, 2009) [4]. For low river flow rates, the main effect on water quality is as for a temperature increase and pH concentration of water therefore almost all physicochemical equilibriums and biological processes are influenced by the variation in temperature and pH value.

Materials and Methods

Samples were collected and observations were conducted on a regular basis at the Ram Ganga River during February 2021 to May 2022. The information was gathered with the help of local fishermen who rely on this river for livelihood. A supply of plastic containers and sterile bottles were gathered for sampling. Each container was purged with deionized water before sampling and sometimes weak nitric acid was also used if deionized water was not available. A regular interval for sampling was followed according to the study strategy, and samples were collected if the weather, local gathering, and scenario were permitted during the field visit. Because sampling was difficult owing to the large crowds, sample collection was strongly avoided.

Furthermore, water samples were collected regularly using techniques that were properly described, standardized, and expanded. Several precautions, including sample collection, transportation, submissions, and sample analysis, were carefully observed during sampling period to ensure that the newly designed and specified methodologies for this research would provide the anticipated research results. However, as is customary, a sample was taken for additional study examination with utmost care to provide the best possible results.

Results and Discussion

The present study shows seasonal variation in the physicochemical parameters of Ram Ganga River. Water quality is influenced by the number of factors and environmental variables and a few are very important which determine the quality of water such as pH and temperature. The temperature of water surface are being considered one of the important factor which derives and decide the reproductive fitness and survival of aquatic species. Water temperature was measured throughout sample excursions. The average temperature of surface water was recorded as 27.69 ± 2.57 °C in summer season while 13.41 ± 1.58 °C in winter season and 20.31 ± 4.16 °C in monsoon season (Figure 1). It was found that the variations of surface water temperature alter seasonally as reported in the previously carried studies. In a few studies, the yearly mean temperature of air was also studied which were closer to water bodies and they mentioned that it varied from season to season.

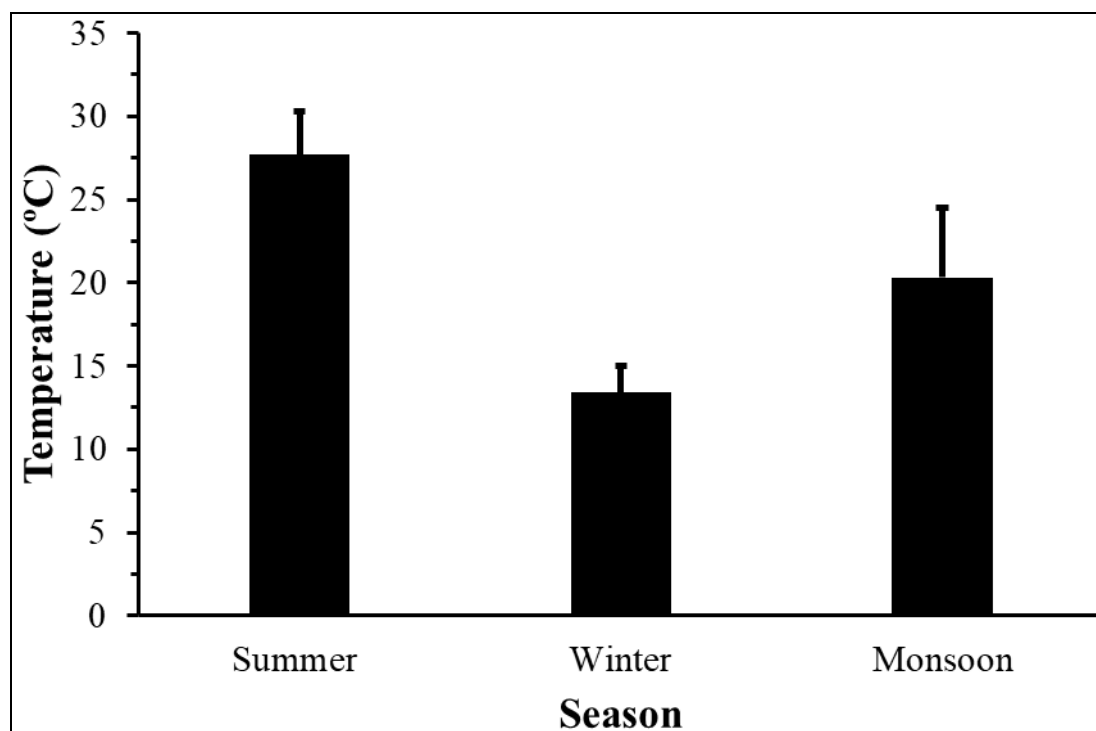


Fig 1: Frequency of Mean temperature of Ram Ganga River, Moradabad, Uttar Pradesh.

Water temperature has an impact on most biological processes, influencing nutrient recycling, metabolic responses, development, and mortality of fish and other aquatic species. The hydrochemistry of water varies as the temperature of the water rises. As a result of these changes, nutrient cycling from sediments alters. Temperatures near the surface of the water may have a considerable influence on fish. Temperature swings are unpredictable, which has an impact on aquatic ecosystems, particularly fish diversity. The highest water temperature was observed in the summer season when water bodies were directly exposed to sunlight, and the lowest water temperature was observed in the winter season, when water bodies were received and or exposed to the least sunlight and its intensity was also lower, resulting in surface water temperatures that were cooler than the summer season. Water temperatures were mild throughout the monsoon season, indicating a modest degree of heat intensity exploration. The average yearly mean temperature was used to compute the annual mean water temperature. Although water temperature varies throughout time, temperature fluctuations have been proven to be a deciding factor in the research site's aquatic floral and faunal variety. The average temperature was obtained to be appropriate for aquatic organisms, especially fishes where they can reproduce and grow. According to recent studies, the quantity of sunlight exposure caused a warm surface, especially around midday when the water is directly exposed to the sun throughout the summer season, particularly on hot days. In the morning, the temperature was lower than at other times of the day. The water temperature fluctuates with the months and light exposure, which varies with the timing of sunset and sun emergence, i.e. night and day length (Fujioka and Yoneyama, 2002). The temperature of the water fluctuated in a cycle that was dependent on time, month, and potentially other external factors due to physical properties. Festivals, cultural gatherings, unforeseen environmental changes, and an abundance of pollutants and waste materials at regular intervals are all contributing to the temperature shift that has been identified as a major concern in recent years (Holt, 2000) ^[9].

Depending on the river's depth, different characteristics may be seen across the length and width of the Ram Ganga River. The water depth varies depending on the season and locale. The summer season had the lowest maximum depth, possibly due to a lack of water in this season, whereas the monsoon season had the highest maximum depth, possibly due to abundant water availability caused by rainy water as well as improper water harvesting management, resulting in maximum water depth. Typical observations in the research region during the peak winter season were noted as findings of the study revealed that there is less water available during this period and that water is being used for irrigation of agricultural and commercial crops. The highest water depth was observed during the monsoon season, particularly in July, when the monsoon season was at its peak. The availability of water at all of the sampling locations made sampling easy during this period. There were fewer visitors, largely locals and fishermen, due to the availability of water near the sample locations. Local people were seen to be beneficial for acquiring general information and data sampling, especially when it comes to common knowledge such as physicochemical evaluation, which leads to more interesting findings. pH value of the analyzed sample was obtained from the analysis of samples. As pH is fluctuated throughout the year and also season to season. The mean value of the studied sample's pH was found as 7.47 ± 0.55 in the summer, 6.44 ± 0.26 in the winter, and 7.14 ± 0.38 in the monsoon (Figure 2). The shifting pattern of pH was substantially associated with seasons hence it may have a significant influence on the physicochemical parameters of Ram Ganga River. The quality and balance between its physicochemical parameters might play a vital role in the survival of aquatic animals and as an indicator, this all may lead to exploring more causes and consequences of threatened factors and thus aquatic species extension. The obtained value of pH of different climatic seasons categorically differs from each other however it may also be varied due to the presence of household and industrial pollutants and these are mixed with water, and passes through various pathways in the aquatic system and species thus hampered biochemical process of aquatic species and also reduces their survivorship.

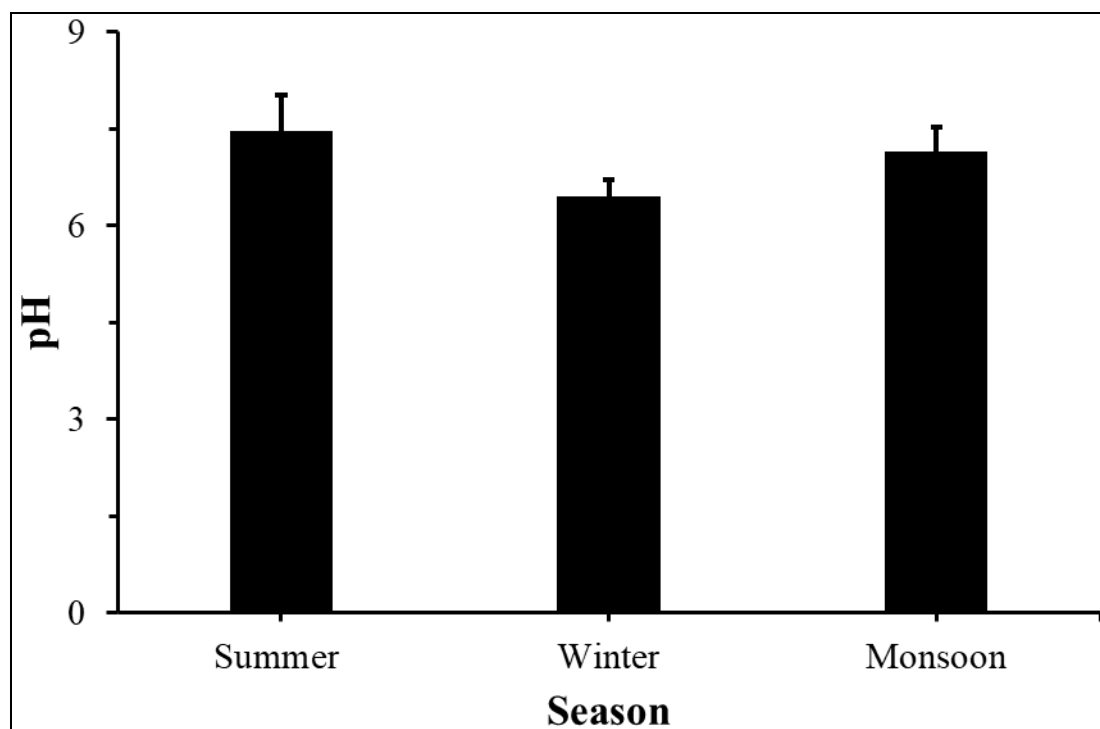


Fig 2: Seasonal variation of pH value of Ram Ganga River, Moradabad, Uttar Pradesh.

The morphology, physiology, and metabolic processes of aquatic species may be affected by pH level. As it is previously addressed that pH levels have a considerable influence on aquatic animal life. It may be used to estimate the amount of water pollution and contamination of a particular area. The presence of pollutant gradients and waste materials in water may be easily recognized by using pH meter and which has a prescribed range of pH value. Other than the pH meter use, there are various types of equipment and procedures which are presently on trend to estimate pH value of the sample. In the terms of defining aquatic life, pH is one of the most important physicochemical properties of water. As it was observed that the readings of pH value fluctuated throughout the study period.

As a key element of the water quality determinant, variations in pH value have been well addressed in the previous studies as there are several adverse influences were noticed on aquatic floral and faunal diversity. A variety of factors were also included as causative agents which destroyed aquatic diversity (Downing *et al.*, 2010). Because of the changes in the water quality, seasonal variations in pH value and surface water temperature might be a potential cause of local fish migration. As aquatic species have evolved adaptations to specific characteristics which allow them to communicate and reproduce in the aquatic environment. Even if a species does not relocate and seasonal movement during scarcity and or in unfavourable conditions, may alter

their genetic map as a result, such species may face a great population reduction and even it may lead leads towards the population extinction (Cheung *et al.*, 2009) ^[3].

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