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Physiochemical Characteristics of Water, Soil and Sediment of Zebi Dam and Changoz Dam of Karak District with Special Reference to Their Impact on Fish Growth

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Abstract: The present study was conducted to examine the physicochemical parameters of water, soil and sediment of Zebi Dam and Changoz Dam of Karak district and their impact on fish survival and growth. The parameters of water, soil and sediments includes temperature, pH, conductivity, total dissolve solids, color, odor and elasticity. The results of the present study revealed that eachselected physiochemical parameter was found to be in permissible range for fish growth and survival except the conductivity values of soil and sediment found to be low, but proved to be not lethal for growth of fishes. Thus, our present work revealed that the environmental conditions Zebi and Changhoz dams of Karak district have been found to be more suitable for fish growth and survival. Hence, our present study will provide useful assistance to the aqua culturists and fisheries managers to improve more the conditions of dams more for fish growth and survival. Furthermore, such information could also be valuable for determining the growth rate and productivity of fishes.

Key words: Physiochemical Characteristics of Waterm · Soil and Sediments · Zebi Dam · Changhoz Dam · Fish Growth

INTRODUCTION

Karak is a district of the Khyber Pakhtunkhwa province of Pakistan. It is situated to the south of Kohat District and on the north side of Bannu and Lakki Marwat districts. Many small dams had been built in Karak district to store the rain water and also use for domestic and agriculture purposes. Zebi Dam is located on North East of Karak city. while Changoz Dam was constructed in 2007 on Changhoz River at 6 Kilometers west of Karak city in Karak District of Khyber Pakhtunkhwa province of Pakistan [1].

Dams are the most important water sources and are also multi-usage components, because they could be used as sources of drinking water, energy production as well as for irrigation and fisheries purposes [2].

The quality of water and protected soil of an ecosystem canbe estimated by studying their large number of physiochemical characteristicsthatcould play a significant role to support allnecessities of aquatic biota [3]. Therefore, the study of physiochemical parameters of any ecosystem could also beused to analyze the production potential because several chemical and physical factors of water and soil caninfluenceon productivity, abundance and species compositionof all aquatic biota [4-5]. Though, there are many physicochemical features of water and soil that may directly or indirectly influence on the quality, production, distribution and growth of fishes and various other aquatic organisms, however, the parameters like temperature, pH and salinity found to be having great impact on the activities of organisms, especially fishes of any lentic and lotic environments [6].

The study of physiochemical characters of water and soil is important for understanding the metabolic events in an environment. Thewater and soil parameters can influence each other and also on the sediment parameters, as well as they govern the abundance and distribution of

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both flora and fauna. Therefore, it is obligatory to analyze the important water and soil parameters. Such studies from time to time will provide useful knowledge about all favorable or unfavorable changes that are occurring in an ecosystem and also their impact on all those organisms, which are living in that ecosystem [7]. Thus, our present study was designed to examine the physiochemical characters of water, soil and sediments of Zebi Dam and Changoz dam in order to evaluate their impact on the fish production in dams and to analyze the significance of these parameters in fishery managing policies, restoring it if polluted and anticipating the effects of man-made changes on the dam lake. Such study will also be valuable in future to guarantee the safety of the aquatic ecosystem, environment for good and healthy production of fish for consumption in the future[8].

MATERIALS AND METHODS

Study Area and Sampling: Water, soil and sediment samples for physicochemical analysis were collected once a time from the two different dams *i.e.* Zebi dam and Changoz dam of Karak district on 2nd April 2015. The water samples were collected from approximately 5-10 cm below the water surface of each dam with the help of acid sterilized plastic bottles. While soil and sediments were put separately in tight polyethylene bags and shifted to the laboratory. In the laboratory,these soil and sediment samples were oven dried at 60 degree centigrade and broken into smaller size particles with mortar and pestle and sieved through a 0.2mm sieve.

Physiochemical Characteristics: The physicochemical characteristics like temperature, pH,conductivity (EC), total dissolve solids (TDS), colour, Odor and elasticity ofwater, soil and sediments were determined. Parameters like colour and odor were detected at the sampling sites, while the remaining parameters were analyzed immediately after reaching in laboratory.

Temperature: Temperature is one of the most important ecological factors which control the physiological behavior and distribution of the aquatic system [9]. The temperature was measured with the help of thermometer followed APHA method [10].

Hydrogen Ion Concentration (pH): pH of all samples was determined by using JENWAY portable electronic pH meter model 3020 by method followed byTorimiro*et al*. [11].

Electric Conductivity (EC) and Total Dissolved Solids (TDS): The Electricalconductivityof water, soil and sediment samples was analyzed by Conductivity meter JENWAY model no.4520. Conductivity meter was calibrated by 0.1 KCl (potassium chloride) solutions and washed with distal water and dried. Than electrode was dipped in the samples and checked the conductivity. The same method was used to check the total dissolved solids(TDS) of all samples.

RESULTS AND DISCUSSIONS

Tables 1 and 2 showing the physiochemical parameters including temperature, pH, conductivity, total dissolve solids (TDS), colour, Odour and elasticity of water, soil and sedimentsfromZebi and Changoz dams of Karak district.

Color, Odor and Elasticity: The color of an object is defined by the wavelengths of visible light that the object reflects. Palecolor, light greenish or greenish color of waters is suitable for fish growth [12]. Dark brown color is mortal for fish culture, light green color good for fish culture, dark green color is not ideal for fish culture and clear water is unproductive for fish culture [13]. Thegreen, bluish green / brown greenish color of water is the indication ofpresence and abundance of phytoplankton populations. These planktons are responsible for the production of food and remove the depletion of oxygenation in water, which is also virtuousfor fish growth and survival [14]. Odor affects the aesthetics of recreational water and the taste of fish. Sewage, industrial and agriculture wastes when discharge in natural aquatic body can produce odor in water and soil by releasing toxic gases due to thedecomposition act ofmicrobes in bottom sediments. The color, odor and elasticity of water, soil and sediment samples were recorded in Tables 1 and 2, respectively.

Temperature: Temperature is one of important independent factor, which can influenceon the aquatic biota. The temperature is regarded as essential parameter for the metabolic activities of aquatic organisms and can also be consider as a biologically significant factor [15]. The rate of metabolism, growth and reproductive activities of fish is directly depends on water temperature as fish is a cold blooded animal. The optimum temperatureof water for survival and growth of fishes is between 26 to 32°C [16]. In the present study, the temperature recorded for water, soil and sediment samples of Zebi dam was close to 26°C, while in Changozdam was 27 °C (Tables 1 and 2).

Table 1: Showing physiochemical parameters of Zebi dam of Karak district.

Samples	Temperature °C	pH	Conductance µs /ml	Total dissolve solids (TDS) mg/50ml	Color	Odor	elasticity
water	26.3	7.35	98	50	Yellowish	Salty water	nil
soil	26.3	6.63	17	10	Red brown	pungent	elastic
sediments	26.0	6.87	18	22	Black brown	pungent	nil

Table 2: Showing physiochemical parameters of Changoz dam of Karak district.

Samples	Temperature °C	pH	Conductance µs /ml	Total dissolve solids (TDS) mg/50ml	Color	Odor	elasticity
water	27.2	7.5	79	100	White brown	odorless	nil
soil	27.3	7.74	62	40	reddish	odorless	elastic
sediments	27.3	7.74	68	50	reddish	odorless	nil

Thus, the result of present study revealed that the temperature measurements were found to be sufficient and most suitable for fish growth. Our result was in agreements with Anonymous [17]. High water temperature can enhance the growth of microorganisms and may increase taste, odor, colour and corrosion problems etc. [18].

Hydrogen Ion Concentration (pH): pH is the negative logarithm of hydrogen ion concentration. But pH values with range from 0 to 7 are acidic, whereas the values from 7 to 14 are alkaline. The pH also has great effect on the growth of fish.Very low values of pH can produce tuberculation and rust,while high pH values may produce incrustation, sediment, deposition and difficulties in chlorination for disinfections of water. The optimum pH range of water for fishes lies between 6.5-9.5 [19]. In the present study, the pH value of water sample of Zebi dam was 7.35 and Changhoz dam was 7.5, which reveals thatwater samples of both dam wereslightly alkaline in nature, hence good for growth and survival of fishes. Out present resultswere correlates with Pawar and Pulle [20]. Accordingly, pH of water is most important factor for the biotic communities of any aquatic body because most of the plant and animal species can survive in narrow range of pHfrom slightly acidic to slightly alkaline condition.

In the present study, the pH values of soils were measured to be 6.63 for Zebi dam and 7.74 for Changoz dam. The fish and other aquatic organisms mostly prefer soil pH ranged from 6.5 to 8.4 and if pH value below 5.0 or above 8.8 had been found to be damaging or even dangerous for aquatic life [21, 22]. Our present result was in agreement withThunjai [23].

The best pH recorded for the pond sediments lies between 6.5 and 7.5. in the present study, pH values calculated for sediments were measured to be 6.87 for Zebi dam and 7.74 for Changoz dam, which revealed that our results were lies in optimal ranged for fish growth and survival. The resultof our present study was correlates with sediment pH recorded by Marathe [24] who also found sediment pH toward alkaline. So pH values recorded for water, soil and sediment samples of Zebi and Changhoz dams were lies in desirable range for fish production, hence proved to be more suitable for fish growth and survival.

Electric Conductivity (EC): Electrical conductivity (EC) is a numerical expression ability of an aqueous solution to carry electric current. In aquatic environments, electrical conductivity is a very important element. Freshwater streams should have conductivity ranged from 15 to 500µs/ml because it can support diverse aquatic life.Fish are very sensitive to this value since conductivity is strictly related to the amount of osmotic pressure exerted on their cellular membranes. Conductivity outside this range could indicate that the water is not much suitable for certain species of fish or macro invertebrates [25]. However, Conductivity has not as much of effect on the fish growth as compare to other physiochemical parameters. In the present study, electrical conductivity calculated for water samples of Zebi dam was 98 µs /ml, while for Changhoz dam was 79 µs /ml, hence, revealed that the electrical conductivity of water in both dam was in suitable range for survival of fish.

In the present study, electrical conductivity recorded for the soilsamples collected from Zebi dam and Changhoz dam was 17µs /ml and 62 µs /ml, respectively. While, the electrical conductivity values noted for sediments were 18 µs /ml for Zebi dam and 68 µs /ml forChangozdam. Hence, it had been proved the values of electrical conductivity in both dams were found in desirable range, thereforefavorable for fish growth and survival.

Total Dissolved Solids (TDS): It is a simplest way to determine the total amount of dissolved salt in water sample. Normallytotal dissolve solids (TDS) of soil ranges from 5 to 1000 mg/L [26]. In the present study, the TDS values of water samples recorded in Tables 1 and 2 both the dams lies in the WHO and BIS permissible limit (500-1000mg/l) [27, 28], hence also suitable for drinking purpose.As the TDS value of the soil, water and sediment sampleswere lies in the range of low salinity zone, thence, the TDS values of both dams are suitable for fish survival as higher salinity sucks fluid out of the fish adding some strain to their system.

CONCLUSION

The growth and survival of fish is totally dependent on the physical and chemical quality of water and to some extent on soil and sediment of aquatic bottom. Water, soil and sediment qualities can be determined by the studies of some variables *i.e.*, temperature, pH, Electric conductivity, Total dissolve solids, elasticity, color andodor, etc. Most fish kills, disease outbreaks, poor growth, poor feed conversion efficiency and similar management problems are directly correlated to poor water quality. Therefore, from of the present study, it was concluded that all selected parameters of this study were found to be in permissible range for fish growth and survival, except the electrical conductivity values of soil and sediment of Zebi dam were low, but as the electrical conductivity has not much impact on fish growth, therefore, such values are not lethal for their growth. Hence, our present work will provide useful assistance to physicochemical analysis of water, soil and sediment and their impact on the fish growth and survival.

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