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Physicochemical Analysis of Water and Soil of Barganat dam in North Waziristan Agency of FATA, Pakistan, With Special Reference To Their Influence on Fish Growth

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Abstract: A study was conducted to examine the physicochemical parameters of water and soil of Barganat Dam in North Waziristan Agency of Federally Administered Tribal Areas (FATA), Pakistan for observing their impact on fish growth and survival. The results of the present study revealed that each selected physicochemical parameter was found to be in the permissible range for fish growth and survival, except temperature that waslaid above the tolerable range.Hence, the present study will provides useful assistance to physicochemical analysis of water and soil of Barganat dam and their impact on the fish growth and survival. Furthermore, such information will also be valuablein future for the fish culturists to further improve the ecological setup necessary for growing fish.

Key words: Physicochemical characteristics of water and soil · Barganat dam · North Waziristan Agency of FATA · Fish growth

INTRODUCTION

Barganat Dam is a small dam, which is situated in North Waziristan Agency of Federally Administered Tribal Areas (FATA), Pakistan, as shown in Figure 1, respectively. The purpose of the dam is irrigation, flood control and fish cultivation.

The most diverse ecology in the world is aquatic ecology where water is the most important resource for all aquatic life and is essential for the growth and survival of organisms.Water is also needed for household, irrigation, industrial, agricultural and fishery production. Therefore, for each necessity, physicochemical analysis of water is quite necessary because impure water or polluted water resources couldn'tbe used for any purpose. Thence, its analytical study suggests the appropriate condition for fishery, agriculture and other purposes.

Fish populations are extremely reliant upon the variations of physicochemical characteristics of their aquatic environment which supports their biological functions [1]. Physicochemical properties of water play an important role in the maintenance of healthy aquatic ecosystem [2]. Fish are driven by their physicochemical environment to areas that are physiologically optimal [3].

Several studies have been conducted on the physicochemical analysis of water with respect to their effect on fish survival few are as follows.Marshall and Elliot [4] observed important relation between fish species and the effect of water temperature, salinity, dissolved oxygen on their survival. Blaber and Blaber [5] noted the correlation of productive feeding areas of fish withturbidity of water. Other studies have determined that when pH level of water approaches 9.06 to 10.0

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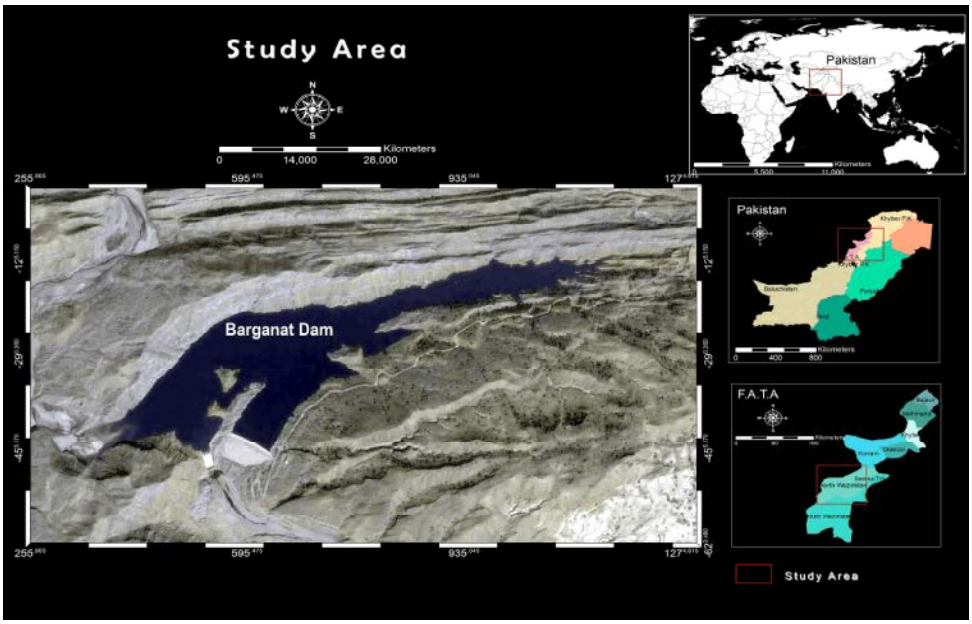

Fig. 1: Map showing Barganat dam located in North Waziristan Agency, Federally Administered Tribal Areas, Pakistan

than fish will move away from alkaline waters. Therefore, present study was conducted for assessing the quality of water and soil of Barganat dam for fish growth and survival by using some selected physicochemical properties. The present study will provide useful information for monitoring the changes in the water and soil quality as a result of the dam's natural dynamics over time.

MATERIALS AND METHODS

Study Area: The present study was performed on Barganat Dam, situated in North Waziristan Agency of Federally Administered Tribal Areas (FATA), Pakistan.

Sampling: Sampling was done one time on 5thJune 2015. Four samples of water and soil were collected randomly from four different locations at Barganatdam. Water samples were collected in acid cleaned plastics containers, while soils were collected nearer the bottom of dam and then placed in tight polyethylene bags for further analysis by using the methodology followed Rehman *et al.* [6] as follows;

Temperature Measurement: In laboratory, Thermometer was used for measuring the temperature. The Thermometer was dipped directly in all the samples and temperature values were recorded when mercury becomes constant at a point.

pH Value: To determination the pH of water and soil samples, pH meter JENWAY model no.3505 was used by preparing buffer solution of pH 4.0 and 8.0, respectively. The pH electrode is placed inside the beakers where the samples are collected and the constant values are recorded.

Determination of Electric Conductivity (EC): For the determination of EC of water and soil samples,Conductivity meter JENWAY model no.4520 was utilized. 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.

Determination of Total Dissolve Solids (TDS): TDS Meter is used to determine TDS of samples, the electrode of TDS Meter was washed with the help of distilled water, than electrode was dipped in the samples and checked the TDS and noted down the readings.

RESULTS AND DISSCUSSION

The results of physiochemical parameters including color, odor, elasticity,temperature, pH, conductivity and Total Dissolve Solids (TDS) of water and soil samples of Barganat Damare recorded in Table 1, respectively.

Color: Greenish, bluish green or brown greenish color of water in any aquatic environment indicates the presence ofplanktonsin it. All these colors of water had

Table 1: Physicochemical properties of water and soil samples of Barganatdam

Samples	color	odor	elasticity	Temperature (°C)	pH	Conductance (µs/ml)	TDS (mg/100ml)
Water	Colorless	odorless	Non-elastic	38	7.98	39	200
Soil	Red yellow	odorless	Non-elastic	39.5	8.14	43	300

been found to been excellent for fish growth and survival [7]. The Color pattern of soil might be the results from both chemical and biological processes.Yellow or red soil indicates the occurrence of iron oxides, while dark brown or black color reveals that the soil contain high organic matter content. The presence of specific minerals can also affect the soil color. Furthermore, manganese oxide causes a black color, glauconite makes the soil green, while calcite can make soil appearance white [8].But in present study, the water was colorless, while soil was red yellowish in color that indicates the presence of iron oxide in soil as shown inTable 1, respectively.

Odor and Elasticity: An odor in water is due to various sources such as, sewage, decomposing vegetation and microbial activity. Odor affects the aesthetics of recreational water and the taste of fish [9]. In present study the water and soil were odorless and non-elastic in nature.

Temperature: Temperature is the most important physical factor affecting the metabolic rate of fish and is also an important water quality attributes in aquaculture. The optimum temperature required for survival and growth of fishes is between 26 to 32°C [10], therefore, any changes in temperature can produce critical impact for fish growth and survival. Temperature controls the reaction rate of chemicals, solubility of gases in water and the toxicity of ammonia and of chemotherapeutics to fish [11]. In the present study, the temperature of water was 38°C, while soil temperature was 39.5°C. Thus from theobtained results of present study, it was concluded that temperature of dam was not within the maximal rate for growth of fishes, thence, not suitable for life of fish fauna.

Hydrogen Ion Concentration (pH): pH is one of the most important water quality parameters. Extremes of pH can affect the tastiness of water but the acidic effect on distribution systems is a more critical problem.The effect of pH on fish is also an important parameter and values which increasingly go away from the normally found values will have a more noticeable effect on fish, leading ultimately to death [11]. The optimum range of pH of water for fishes was lies between 6.5 to 9.5 [12]. In the present study, the pH of water measured in the dam was 7.98, while soil pH was 8.14, which are considered suitable for fisheries.

Electrical Conductivity (EC): Electrical conductivity is the ability of an aqueous solution to carry electric current. Fish are very sensitive to conductivity,since conductivity is strictly related to the amount of osmotic pressure exerted on their cellular membranes.Conductivity of freshwater mostly lies between 50 to 1500 µs/ml [13]. In present study, the conductance of water and soil sample were 39 µs/ml and 43 µs/ml, which revealed that both of these values are also desirable for fish survival, because if the fish is tolerable than any increase or decrease in conductivity value will not affect fish severely.

Total Dissolved Solids: Total Dissolved Solid (TDS) is quantity of inorganic salts, organic matter and other dissolved ingredients in water.TDS indicates the broad nature of salinity of water. TDS canaffect the quality of water, which later has critical influence on aquatic biota and every kind of organism has a typical salinity range that it can tolerate. Normally, TDS ranged from 5 to 1000 mg/L is considering as suitable range for fish growth [14]. In present study, the TDS of water obtained from Barganat dam was 200mg/l and TDS of soil measured was 300mg/l, thence were seen in the desirable range and suitable for fish growth and survival.

CONCLUSION

From theobtained resultsof the present study it was concluded that the physicochemical parameters like pH, conductivity, TDSof both water and soil obtained from the Barganat Dam of North Waziristan Agency were found within suitable range forfish growth and survival, except temperature of this dam thatwas found to be above the tolerable range of fishes. Therefore, thepresent studywill provides useful assistance about the physicochemical analysis of water and soil of Barganatdam and their impact on the fish fauna. Furthermore, such information will also be valuable for the fish culturistsin future toimprove the ecological setup necessary for the growth of various fish species found in this dam.

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