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Evaluationof Some Physiochemical Properties of Water, Soil and Sediments of the Dams of Kohat District, Khyber Pakhtunkhwa Province of Pakistan, with Special Reference to Their Impact on Fish Growth and Survival

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Abstract: A study was performed on some physiochemical properties of water, soil and sediments in Tanda and Gandiali dams of Kohat District, Khyber Pakhtunkhwa province of Pakistan during March 2015. From the present study, it was concluded that all selected parameters (temperature, pH, total dissolvedsolids, color, taste and odor) of water, soil, sediments of both dams were found to be in suitable range required for fish growth, survival and stocking. However, the water conductivity was less than desirable limit, which might be due to the geographical conditions with lack of cations.Both dams contain a good quality of soil for growth and survival of fish species.Thus, our present work will provideusefulinformation to the aqua-culturists for improving the ecological setup required for the Fish growth. Furthermore, such information can also be useful for management associations for proper management and substantial usage of the resources.

Key words: Tanda Dam · Gandiali Dam · Kohat District · Physiochemical Properties of Water · Soil and Sediments

INTRODUCTION

Kohat is the capital of Kohat District, located in Khyber Pakhtunkhwa province of Pakistan. The district is bordered by a chain of mountains, has an area of 2973 m^2, consists mostly of bare and complex mountain regions located in east of the Indus. Kohat city is facilitated with two dams, i.e., Tanda and Gandiali dams, which are good for fishing spot, hunting enthusiasts in Asia pacific because these dams contain great diversity of many fish species [1].

Water having good quality is essential for living organisms. Dams are the most important water resource now days. But unfortunately due to disposal of sewage, industrial wastes and human activities dams are being polluted. The dams are targets of the negative influence of urbanization. Most water bodies have become polluted due to addition of raw liquid and solid waste materials [2]. The physical and chemical properties of water play a significant role in distribution, abundance and composition of aquatic organisms [3]. The growth of aquatic life including both fauna and flora in surface waters is effected by different environmental situations that control the species as well as the physiological performance of the organisms. The flora and fauna existing in specific aquatic bodies are because of combined effects of several physical and chemical factors [4]. Knowledge of hydrological environments of any water body is not only valuable in analyzing its productivity, but will also permit an improved understanding of the life cycle and population of the fish community [5]. In the growing aquaculture industry, it is believed that good water quality is preferred to retain viable aquaculture production [6]. Poor water quality can result in minor

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production and less profit. Production is decreased when the water contain contaminants that can effect reproduction, growth, development, or even results in death to the cultured species [7]. The quality of surface water has declined in different countries in the previous few periods. As an effect of the emergent population, agriculture, increasing industry and urbanization, the local water bodies are threatened with the increasing water demand, as facing with general anthropogenic contributions of sediments and nutrients, particularly the lakes and reservoirs [8]. To handle this problem, it is necessary to make planning, management and water quality assessment [9]. Ecological balance of an aquaculture system is also dependent on its soil properties. The soil properties have a vigorus role in survival and growth of marine organisms. The soil serves as a biological filter through absorbing fish excretions, organic residues of feed and algal metabolites and also controls the salinity, solidity and pH of aquaculture systems [10].

The present study was conducted forevaluating the water, soil and sediment qualities of Tanda and Gandiali dams of Kohat districtthat are mostly used for livestock watering, fish production, growth and stocking. Our study will also form a baseline for monitoring water quality and will observe the effect of selected parameters on the dam's natural dynamics and fish growth.

MATERIALS AND METHODS

Study Area: The study was performed on Tanda Dam and Gandiali dam, both of which are located in Kohat District, in the Khyber-Pakhtunkhwa province of Pakistan (Figures 1 and 2).

Sample Collection: The samples were collected randomly from the six places at Gandiali dam and Tanda dam of Kohat district.For water collection, acid cleaned plastic bottles were utilized. Soils samples were collected nearer the bottom of Gandialiand Tanda dams, while sediments were collected near the bank of each dam and then put separately in tight polyethylene bags and shifted to the laboratory of the chemistry department of Kohat university of Science and technology (KUST) for physiochemical analysis followed the method of Naila *et al.* [11].

Sample Treatment: From each dam, soil sampleswere taken randomly at three different locationsand were mixed separately to get a composite sample of 2kg following the method of Naila *et al.* [11]. Soil sample was oven dried at 110°C.Using nitric acid; 2gram sample was acid digested. Then with the help of mortar and pestle sample was broken down into small pieces and sieve through 2.0mm sieve was kept on hot plate. After taking out from hot plate sample was filtered in 100 ml graduated cylinder up to 35 ml so that in the end 35 ml sample was prepared. Water samples of both dams were directly subjected for analysis. Total dissolved solids and Conductivity of water and soil samples were measure using Conductivity meter JENWAY model No.4520 and pH of water and soil samples was measured using pH meter JENWAY model No.3505.

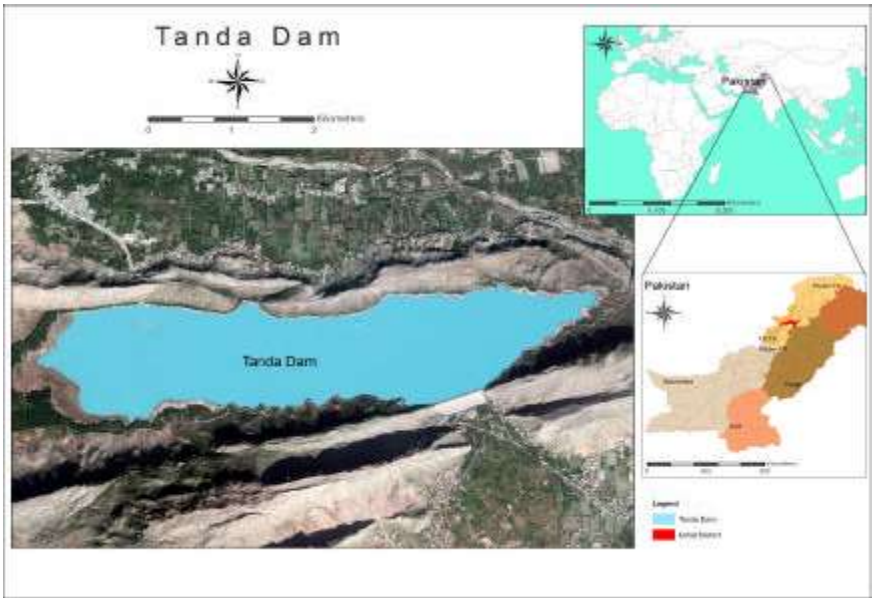

Fig. 1: Map showingTanda dam ofKohat District.

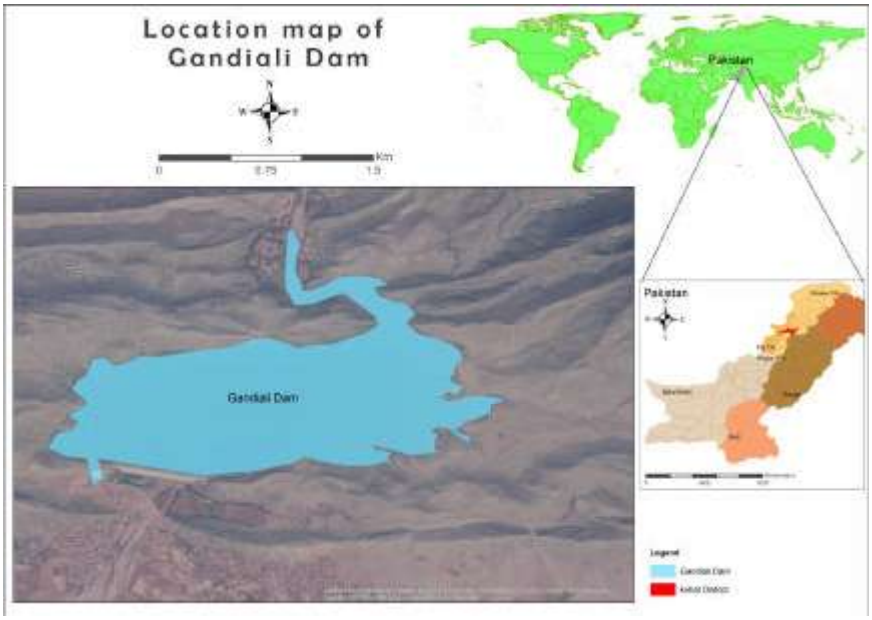

Fig. 2: Map showing Gandialidam of Kohat district

Physiochemical Characteristics: Physiochemical parameters of water including temperature, color, taste, odor, conductivityand pH were measured with the help of analytical procedures followed by Afshan *et al.* [12], while the properties of soil and sediments were also measured comprising temperature, color, elasticity and total dissolved solids with the help of method followed by Naila *et al.* [11], in order to focus theimpact of some physical and chemical properties of aquatic environment that play a significance role in distribution, diversity, species richness and growth of various aquatic organisms including fish fauna.

RESULTS AND DISSCUSSION

The physiochemical parameters including temperature, pH, conductivity, total dissolve solids (TDS), color, odor, elasticity, taste of water, soil and sedimentsof Gandiali and Tandadamsof Kohat district were recorded in Tables 1 and 2, respectively.

Temperature: Temperature is the most significant environmental factor affecting the survival and growth of fishes[13].Fish are Exothermic, gain heat from their external environment, so when the temperature of external environment fluctuates than the alterations in fish body temperature also occur accordingly [14]. All fish species has an ideal temperature range in which they grow quickly. Even though, fish can function in a wide range of temperatures, but every fish species have an optimum range, as well as upper and lower lethal temperatures which is responsible for various activities [15].

In the present investigation, the mean temperature value of Gandiali water was 34°C (Table 1) and Tanda dam was 32.5 °C (Table 2). The obtained results were correlates with the findings of Decline [16].From the results of the present study, it was concluded that the water temperature of both the dams were suitable and in tolerable limits for fish survival. The mean temperature recorded for soil and sediments ofGandiali dam was 33.5°C and 31.6°C (Table1)while that of Tanda dam was 30 °C and 32.5 °C respectively (Table 2).

Table 1: Physiochemical properties of water, soil and sediments from Gandiali Dam of Kohat district

	pH	Conductance (µs/ml)	Temperature (°C)	TDS (mg/50ml)				
Samples	Mean±S.D	Mean±S.D	Mean±S.D	Mean±S.D	Taste	color	odor	elasticity
Water	6.86±0.01	51.0±0.57	34.0±2.08	60.0±	Tasteless	Pale	odorless	Non-elastic
Soil	6.9±0.05	18.0±1.15	33.5±0.76	86.0±	Sour test	Reddish brown	odorless	Elastic
Sediments	6.9±0.05	15.0±1.52	31.6±1.74	70.0±	Sour test	Black brown	pungent	Non-elastic

Table 2: Physiochemical properties of water, soil and sediments from Tanda Dam of Kohat district

	pH	Conductance (µs/ml)	Temperature (°C)	TDS (mg/50ml)				
Samples	Mean±S.D	Mean±S.D	Mean±S.D	Mean±S.D	Taste	color	odor	elasticity
Water	7.35±0.01	46.0±1.53	32.5±1.32	50.0±2.51	Salty water	Pale	pungent	Non-elastic
Soil	6.63±0.14	31.0±2.51	30.0±1.15	30.0±0.57	Sour test	brown	pungent	Elastic
Sediments	6.87±0.32	31.0±1.52	32.5±2.10	29.0±1.52	Sour test	Black brown	pungent	Non-elastic

pH: pH is an important factor responsible for changing the water quality. Extreme pH negatively distress fish reproduction and growth [17]. ThepH range 7.0 to 8.5 is perfect for biological productivity and fishes can become stressed with a pH ranging between 4.0 to 6.5 and 9.0 to 11.0 and death is almost by the pH of greater than 11.0 or less than 4.0.The results of the present study show the suitable pH range of water in Tanda and Gandiali for fish growth and survival.The mean pH of soil and sediments of Gandiali dam was found to be 6.9 (Table 1) while Tanda dam soil was measured as 6.63 and soil sediments have pH 6.87 (Table 2). As, the optimum required pH of soil for fish production is between 6.5 to 7.3, therefore, from the above observations it was concluded that both the dams soil are highly productive and suitable for fish growth.

Conductivity: Conductivity shows the presence of the total ionic content in water [18-19]. Conductivity of freshwater fluctuates between 50-1500 µs/ml[20].Theconductance of Gandiali dam water, soil and soil sediments were measured as 51,18and 15 measured in units of µs/ml, respectively (Table 1). While conductance of Tanda dam water was 46 µs/ml (Table 2), the mean value is somewhat lower than those of the results calculated by Wisdom *et al.* [21] in range of 74-138 µs/ml, the conductance of soil and sediments of Tanda dam was 31 µs/ml and 31 µs/ml, respectively (Table 2).

Total Dissolved Solid(TDS): Total Dissolved Solid (TDS) is quantity of organic matter, inorganic salts and other dissolved ingredients in water. Total dissolved solids cause toxicity of individual ions, increases in salinity and changes in the ionic composition of the water. Increase in salinity is because of changes in biotic groups, exclude less-tolerant species, cause acute or chronic effects at specific life stages of organisms and also limit the biodiversity [22].In the present study, total dissolved solid (TDS)of Gandiali dam water was 60mg/50ml, while in soil and sediments were86mg/50ml and 70mg/50ml, respectively (Table 1), while TDS of Tanda dam water, soil and soil sediments were measured as 50mg/50ml, 30mg/50ml,and 29mg/50ml, respectively (Table 2).

Color: The color of water is an important factor as it shows the presence of plankton in water and hence provides good feeding opportunities. The water color of both Tanda and Gandiali damswas pale (yellowish) color that had been found to be most suitable for fish growth. Thus, our findings were correlates with as the same stated by National Agricultural Extension and Research [23].

Color of soil represents the carbon concentration and minerals concentration of soil. The Color of Gandiali dam soil and sediments was Reddish brown and Black brown (Table 1) While that of the Tanda dam have Brown colored soil and sediments were Black brown in color. The brown Color shows the capacity of soil to hold nutrients (Table 2). Both the Soil samples of dams were elastic in nature (Tables 1 and 2).

Taste and Odor: Taste and odor in water may be obtained from a variety of sources and conditions.Sewage and industrial chemical waste discharges or natural sources such as decomposing vegetation and microbial activity can cause odor. Odor affects the taste of fish[24].In the present investigation, the taste of Gandali dam water was tasteless, while soil and sediments had sour test. The taste of Tanda dam water was salty, while soil and sediments showed sour test. The odor of Gandali dam water and soil were odorless, while Tanda dam water and soil had pungent odor. The sediments odor of both dams' was pungent in nature as shown in Tables 1 and 2 respectively.

CONCLUSION

Tanda and Gandiali dam of Kohat district are of great importance as both dams are widely used for Agriculture purposes, livestock watering, as well as for Fishing.Tanda dam water is also used by people fordrinking and household usage.Physical and chemical analysis of water shows a good range of properties for both dams, suitable for fish growth, soil was also found to be of good quality. There should be proper management and Government should take action in the management of these fresh water sources, if proper management strategies do not developed than aquaculture cannot successfullyflourish.

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