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Some studies of water quality parameters in private Fish farms, Muzafargarh, Pakistan

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Abstract
This study was carried out to investigate present status of various physio-chemical parameters of private fish farms located in village Jalalabad of district Muzaffargarh, Pakistan. Water sampling was carried out on fortnightly basis for winter and summer season. Main physico-chemical parameters like air and water temperature ranged from 24 °C-38 °C and 22 °C–33 °C. While pH ranged from 6.8-8.5.Total dissolved oxygen was found to be 5.93-11.03mg/l. Light penetration varied from 5″- 21.07″. The Carbonates and bicarbonates fluctuated within a limit of 22.2-47.2mg/l and 71.04-158.36mg/L. Free carbon dioxide remained very low throughout the experiment. Total dissolved solids varied from 1333-1533mg/L, while alkalinity was found to be 100.64-193.88mg/. Hardness, Calcium and Chloride ranged between 1391.67-1716.67mg/L, 353.33–560mg/L and 7.36-23.68mg/L respectively. The findings of the current study revealed that physico-chemical parameters of water were within permissible range except TD Sand Hardness. It is concluded that water can be useful for fish culture. Correlation coefficient showed positive and negative relationship.

Keywords: physico-chemical parameters, fortnight changes, Muzaffargarh

Introduction
Water quality is summation of all physical, chemical, biological and aesthetic characteristic of water that influences its beneficial use [1]. A primary task in aquaculture is to maintain water quality conditions within tolerable levels for the species being cultured, but this is not always achieved. Fish is a valuable protein food and good source of income for people. Water acts as medium for fish to perform their life existing activities [2]. So, for the survival and proper growth of aquatic organisms, appropriate quality of water is very necessary [3]. Some important physical and chemical parameters influencing the aquatic environment are temperature, pH, salinity, and dissolved oxygen. Others are total suspended and dissolved solids, total alkalinity and acidity and heavy metal contaminants. These parameters are the limiting factors for the survival of aquatic organisms (flora and fauna). Poor water qualities may be caused by low water flow, municipal effluents and industrial discharges [4]. Even if lethal concentrations of certain metabolites are avoided, fish health can be affected by stress that may be imposed, if fish are required to tolerate less than optimum water quality conditions [5]. The productivity depends on the physic-chemical characteristics of the pond water. The maximum production is obtained when the physical and chemical factors are at the optimum level [6]. Interest in water analysis is due to the enormous importance of water to all categories of living things. It is necessary for the healthy development of man, animals and plants [7]. In recent years, aquaculture is being projected as a possible solution to the food problems faced by the masses. It gives higher productivity/unit as compared to agriculture and animal husbandry. Water quality studies are important and have been taken up because these play a key role in aquaculture [8]. Present study was conducted to monitor seasonal variation in physicochemical parameters of water in commercial fish farm and this type of study was never conducted in the study area.

Materials and Methods

Present study conducted a private fish farm in Baste Jalalabad, on Ali Pur Road 10 km away from Muzaffargarh city. The pond under study is 2.5 km away from main road. This farm was established in 2006. It comprises 15 ponds, each measuring 1 to 2 acres area and 6 to 7 feet depth. The depth of water remained in the range of 3.5 to 5.5 feet during the entire study period. Physical and chemical parameters were determined by the method as described [1]. The source of water for pond is diesel tube well. Artificial feed and fertilizers were added to fish pond and changes were observed. The pond was stocked by three types of fishes i.e. *Labeorohita*, *Catlacatla* and *Cirrhinus mrigala*. The study was carried for the period of eight months i.e., from January to August, in 2008. The pond was marked as A, B and C from south to north in order to have a clear differential picture on account of their differences in physic-chemical parameters. The water samples were taken from the surface and subsurface of fish pond in plastic bottles of 1 liter capacity on fortnight basis. The analysis was carried out 2-3 hours after sampling in laboratory condition. Different physic-chemical parameters of water quality were determined in laboratory condition. Some parameters like air temperature, water temperature, pH and light penetration, were determined immediately. The bottles were labeled with date, time and name of sample with the help of water proof marker. Physic-chemical parameters were determined by methods in [1].

Results

The mean values (±SD) ranges of different Physico-chemical parameters for private fish farm baste Jalalabad, Muzaffargarh are given in table-III and variation in the data during the entire study period was observed and described in this section. The overall range in air temperature was observed 24 to 38 °C while water temperature fluctuated in the range of 22 to 33 °C. The air and water temperature showed variation with season. Air temperature gradually increased since January and reached its peak value in June. Then there was a gradual decline in subsequent months (Fig. 1 & 2, Tab I). The overall range of light penetration was observed between 5″ to 21.7″ during April and January respectively. Light penetration showed 6 alternative variations with the seasonal variation during the entire study period (Fig. 3 Table 1). Dissolved oxygen varied from 5.93 to 11.03mgl/l in June and January respectively. It showed 6 alterative variations with seasonal variation during the entire study period (Fig 4 Table 1). pH value fluctuated between 6.8 to 8.5 in March and May respectively. pH showed 5 alterative variations with the seasonal variation during the entire study period (Fig. 5 Table 1). Free carbon dioxide remained absent throughout the entire period. There was no rainfall from January to August during the entire study period but there were 5 to 85% clouds during February and March. Clouds were absent in subsequent months. Total dissolved solids fluctuated in the range of 1333.33 to 1533.33mg/l during January and March respectively. The total dissolved solids showed variations during the entire study period (Fig. 6, Table II). Carbonates ranged between 22.2 to 47.28mg/l during June and May respectively. Carbonates showed 9 alternative variations with the seasonal variation during the entire study period (Fig. 7, Table II). Bicarbonates ranged between 71.04 to 158.36mg/l in March and April respectively. Bicarbonates showed 8 alternative variations with the seasonal variation during the entire study period. Bicarbonates showed high values from February to June and then showed a decline (Fig. 8, Table II). The overall range of total alkalinity fluctuated between 100.64 to 193.88mg/l in March and April respectively. The alkalinity in the water was raised from January to June and after that it reversed (Fig. 9, Table II). Chloride fluctuates between 7.36 to 23.68mg/l in the months of May and February respectively. Chlorides showed fluctuations in all the months of observations (Fig. 10, Table II). Calcium ranged between 353.33 to 560 mg/l during March and April respectively. Calcium reached at peak in April and then showed a gradual decline (Fig. 11, Table II). The hardness fluctuated between 1391.69 to 1716.67mg/l in March and June respectively. It showed 9 alternative variations with the seasonal variation during the entire study period (Fig. 12, Table II).

Discussion

This study comprises of one pond having a depth (7ft). Temperature is one of the most important environmental variables for all aquatic organisms [9]. Air and water temperature showed positive relationship. The temperature of water at various depths was found to be influenced in general by the seasonal variables. Similar results has been showed in studies conducted by Aslam *et al* [10] one of the most obvious and familiar property of water is its transparency. Light exerts a profound influence upon the whole series of biological phenomenon in nature [11]. Light penetration was low with some fluctuations during the entire study period. This type of results were obtained in a study conducted by Rath (1993) [12]. Turbidity directly affects the life existing in water. It reduces the depth to light can penetrate and hence reduces the growth of plants. If water is more turbid having a large amount of total solids then it act as a limiting factor for the organism [13]. The favorable range of P^H was 6.5 to 9. This is most suitable for fish production [1]. The pH value of pond water showed alkaline in nature during entire study period was suitable for fish production as described by others [10]. Dissolved oxygen is inversely proportional to temperature [1]. Dissolved oxygen was maximum at low temperature and minimum at high temperature during entire study period. The highest value of dissolved oxygen was recorded11.03mg/l in January and lowest one was 5.93mg/l in June. These results were in consistence with the studies conducted by others [11]. Carbonates showed higher values in summer and low value in subsequent months. Carbonate alkalinity showed positive relationship with pH and these are in line with the studies reported by Islam [14]. Bicarbonates were maximum in April and minimum in March during entire study period and this was same as reported in another study [15]. Hardness is due to soluble Ca++ and Mg++ salts present in water medium, which is expressed in $CaCO_3$ equivalent. Hardness was maximum in June and minimum in March during study period. Hardness level in this study was found conducive for fish growth [14]. Total dissolved solids showed highest value in March while lowest values were recorded in January. There were variations in total dissolved solids during period. Clay particles are kept in suspension because of the negative electrical charges associated with them [11]. Throughout the study period, all the physic-chemical parameters like temperature, dissolved oxygen, light penetration, Chlorides and all other parameters remained in favorable ranges for the production of fish. As water quality plays a key role in increasing productivity of any water body therefore, its periodic monitoring is highly predictable.

Table I: Table showing seasonal variations in Physico-chemical parameters of fish pond at Private Fish Farm, Baste Jalalabad, Muzaffargarh.

Date	Month	Air Temperature (°C)	Water Temperature (°C)	Light Penetration (Inch)	Dissolved Oxygen (mg/I)	pH	Clouds %
30-01-08	January	28	22	21.7	11.03	7.6	0
18-02-08	February	24	22	12.2	8.4	7.8	85
04-03-08	March	29	24	6.8	9.9	7.0	0
16-03-08	March	28	25	6.6	9.76	7.0	5
31-03-08	March	25	22	5.03	8.2	6.8	30
18-04-08	April	38	31	5.0	7.53	8.0	0
30-04-08	April	38	30	7.9	7.13	8.0	0
14-05-08	May	33	28	6.3	7.4	8.5	0
01-06-08	June	30	28	5.23	6.43	7.5	0
17-06-08	June	31	27	5.33	5.93	7.4	0
02-07-08	July	35	29	5.7	6.3	7.4	0
18-07-08	July	38	33	5.23	7.26	7.4	0
04-08-08	August	37	30	5.33	7.73	7.6	0
Minimum		24	22	5.0	5.93	6.8	0
Maximum		38	33	21.7	11.03	8.5	85
Average		31.85	27	7.56	7.9.	7.54	9.23

Table II: Table showing seasonal variations in chemical parameters of fish pond at Private Fish Farm, Baste Jalalabad, Muzaffargarh.

Date	Month	Total Dissolved Solids (mg/I)	Carbonate (mg/I)	Bicarbonate (mg/I)	Total carbonate (mg/I)	Chloride (mg/I)	Calcium (mg/I)	Hardness (mg/I)
30-01-08	January	1333.33	31.08	102.12	133.2	16.96	363.33	1515
18.02-08	February	1348.33	23.68	78.44	102.12	23.68	396.67	1516.67
04-03-08	March	1421.67	31.08	79.91	11.66	15.04	353.33	1401.67
16-03-08	March	1533.33	29.6	71.04	100.64	17.28	391.67	1391.67
31-03-08	March	1441.67	23.68	98.42	122.1	14.4	411.67	1675
18-04-08	April	1516.67	28.12	125.06	153.18	11.84	486.67	1615
30-04-08	April	1430	35.52	158.36	193.88	7.36	560	1668.33
14-05-08	May	1388.33	47.28	139.2	186.8	7.36	528.33	1421.67
01-06-08	June	1463.33	22.2	124.25	146.45	14.4	523.33	1618.33
17-06-08	June	1498.33	35.52	130.31	165.95	15.04	506.67	1716.67
02-07-08	July	1471.67	32.56	117.66	150.22	15.36	501.67	1606.67
18-07-08	July	1505	39.96	105.05	145.04	14.4	515	1455
04-08-08	August	1506.67	35.52	109.52	147.09	15.68	458.33	1690
Minimum		1333.33	22.2	71.04	100.64	7.36	353.33	1391.67
Maximum		1533.33	47.28	158.36	193.88	23.68	560	1716.67
Average		1450.64	31.8	110.72	143.38	14.52	461.28	1560.89

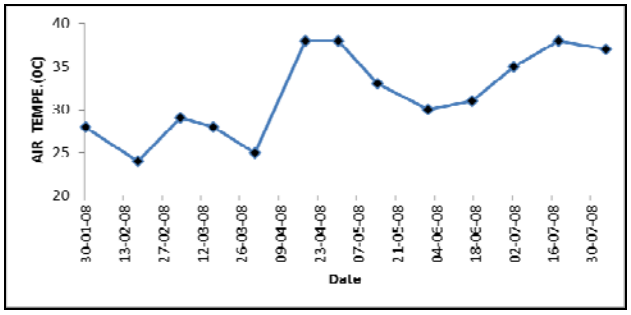


Fig 1: Seasonal Variations In The Parameters Of A Fish Farm

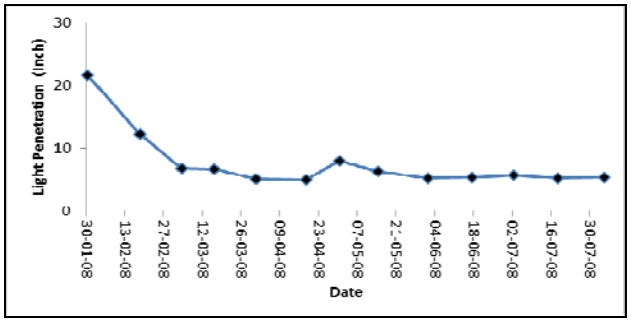
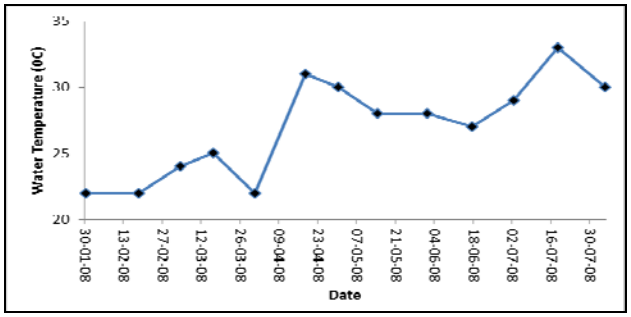


Fig 3



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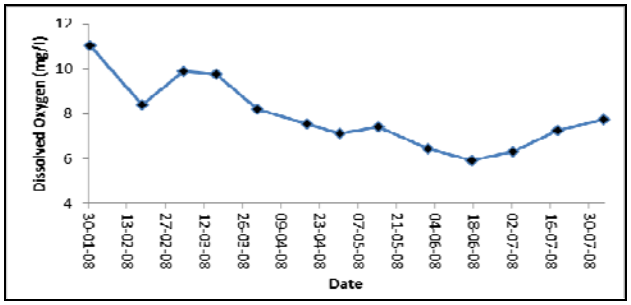

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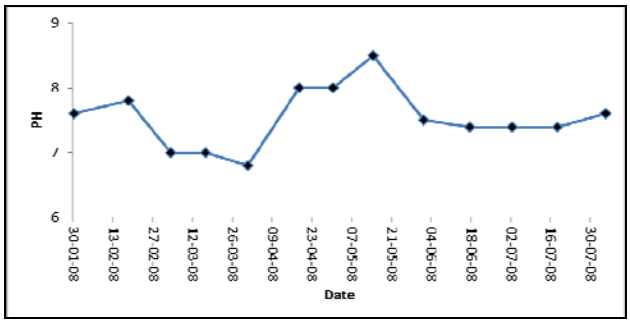


Fig 5

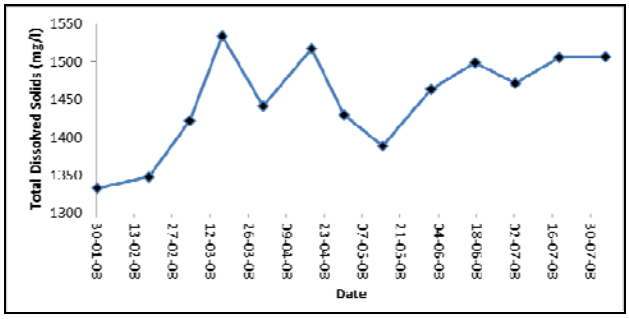
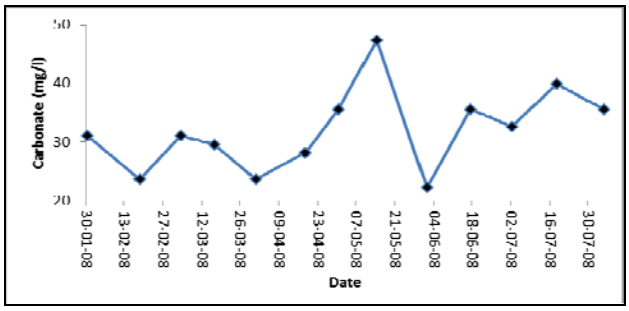


Fig 6



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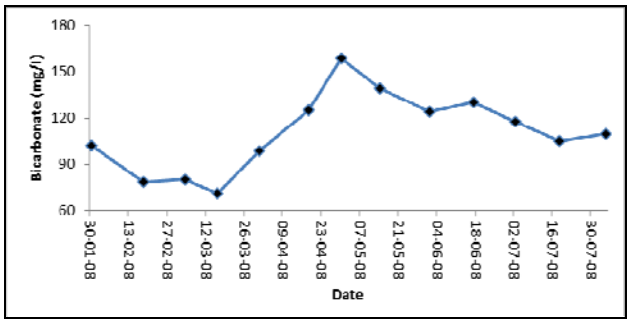

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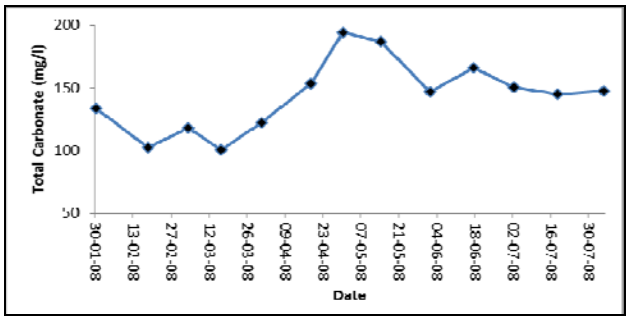

Fig 9

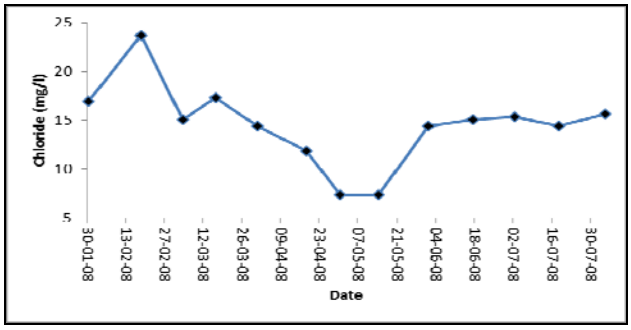

Fig 10

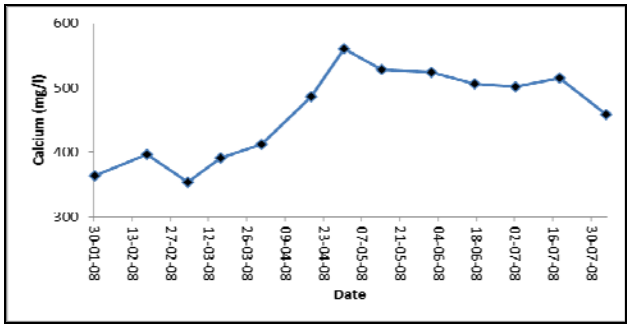

Fig 11

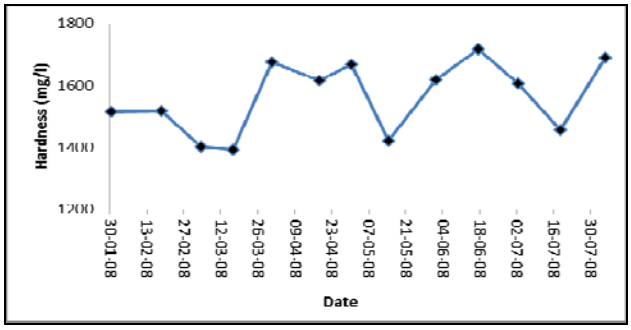

Fig 12

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