Seasonal Variation in the water quality parameters of Fish Ponds at Fisheries Research and Training Institute (FR & TI), Lahore Pakistan.

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Abstract

Any characteristics of water which effects growth, reproduction, survival, production of aquaculture species are considered as water quality variable. In a good water quality environment the production, survival and reproduction of aquaculture species more than poor water quality environment. The water quality gives knowledge about the use and suitability in every field including fishing. Many researchers view that the quality of water largely depends on physicochemical parameters and biological characteristics. Variations in the quality of water bodies (especially far above or below acceptable levels) can be detrimental to fishes and humans, as well as, other ecosystems which depend heavily on them. Therefor this study was conducted to study the seasonal variation in the water quality parameters. Water samples from three fish ponds of Fisheries Research and Training Institute in triplicate were collected in November-December 2016 and April-May 2017 and tested for temperature, pH, total alkalinity, dissolved oxygen, hardness, turbidity, free CO_2, conductivity, TDS and salinity. Collected data statistically analyzed for mean, standard deviation, minimum, maximum, bar graph and correlation by using SPSS 22. All the parameters show variations with change in season which was mostly related to variation in temperature. Temperature has significant negative correlation with dissolved oxygen and significant positive correlation with all other tested parameters. Dissolved oxygen have negative correlation with all tested parameters. Remaining all other water quality parameters have positive correlation with each other. All physico chemical conditions were fully life supporting and helpful for the growth and nourishment of healthy fish.

Key Words: Water quality; FR & TI; Fish Ponds; Seasonal Variation; FQCL

1. Introduction

In this world water is vital gift for all living beings. From the total fresh water of the earth very minute quantity is available to man. Currently due to unplanned urbanization, use of chemicals, rapid industrialization cause

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varied and heavy pollution in aquatic organisms and deterioration of water quality of aquatic fauna including fish (Kiran 2010).

Water quality is the major concern of all experts now in the world. WHO emphasize water delivered to customer must be free from toxic substances and pathogenic organisms. The quality of water mainly depends upon the location of the source and environmental protection. Therefore the quality of water determined by the chemical and physical analysis (Abdo 2005).

Any characteristics of water which effects growth, reproduction, survival, production of aquaculture species are considered as water quality variable. In a good water quality environment the production, survival and reproduction of aquaculture species more than poor water quality environment (Iqbal et al. 2004). The water quality gives knowledge about the use and suitability in every field including fishing. Fast declining accessibility of useable water and unequal distribution of water on the surface of the planet square measure the key issues in terms of water amount and quality (Boyd and Tucker 2009).

Surface water reservoirs are the freshwater resources are used for irrigation and domestic purposes. These provides ecosystems for water life especially fish culture (Mustapha 2008). Water pollution now a day is conserved not in terms of public health but also in terms of its aesthetics, conservation, preservation of normal beauty and resources (Nagaraju, Rajashek, and Kumar 2018).

Many researchers view that the quality of water largely depends on physicochemical parameters and biological characteristics (Singh et al. 2018). These characteristics are therefore used to ascertain the conservation and utilization of the resource, as well as, the

general management for the purpose of fishing, irrigation and drinking or for other domestic and commercial use (Kodom et al. 2018).

Aside anthropogenic activities, which affect the quality of freshwater resources (including rivers and lakes), seasonal variations driven by precipitation (mainly rainfall), surface runoff, groundwater flow and abstraction, also have significant effect on the concentration and accumulation of pollutants and as a result, affecting the surface water quality (Garg et al. 2010).

Variations in the quality of water bodies (especially far above or below acceptable levels) can be detrimental to fishes and humans, as well as, other ecosystems which depend heavily on them (Yogendra and Puttaiah 2008). Water quality assessment and monitoring, therefore, provides significant information for managing water resources and further protecting the environment, since the resource is of serious importance to natural environment and human improvement (Kodom et al. 2018).

The Fisheries Research and Training Institute Lahore is the only leading research institution in Pakistan focusing on inland fisheries and aquaculture. This study was conducted to study the seasonal variation in the water quality parameters of Ponds at FR & TI, Lahore Pakistan.

2. Material and methods

Water samples from three fish ponds of Fisheries Research and Training Institute in triplicate were collected in November-December 2016 and April-May 2017. The parameters which are considered to be

important for water quality were selected for the study. These include temperature, pH, total alkalinity, dissolved oxygen, hardness, turbidity, free CO_2, conductivity, TDS and salinity. For the temperature, pH, electrical conductivity, TDS and salinity in situ measurements were taken. These were checked by liquid in glass thermometer (Model: Zeal, England), pH meter (Model: pH 100 YSI, USA) and conductivity meter (Model: CM 35+, Crison Spain) respectively.

Ponds water samples were collected in one (1) liter hygienic plastic bottle with screw caps, placed in ice container and transported to Fish Quality Control Labs Lahore (Chemistry Section), Fisheries Research and Training Institute Manawan for further tests. Turbidity, hardness, carbon dioxide and total alkalinity were checked by turbidity meter (Model: 2100AN HACH, USA) and Hanna water testing kit (HI 3812, HI 3818, HI 3811) respectively.

The collected data of water quality parameters statistically analyzed for mean, standard deviation, minimum, maximum, bar graph and correlation by using SPSS 22 (Statistical Pakage for Social Sciences).

3. Results and Discussion

Seasonal variation of water quality in fish ponds of Fisheries Research & Training Institute was checked for ten (10) physico chemical parameters. The study was carried out from November-December 2016 (winter) and April-May 2017 (summer). Range of variation with seasonal mean along with standard deviation of water quality parameters of Fisheries Research &Training Institute ponds are given in table 1. Monthly variation of water quality parameters showed

in figure 1 and correlation of coefficients of different water quality parameters are given in table 2.

Daily and seasonal temperature fluctuation are more obvious in fresh water territories. In FR & TI ponds water temperature increased in summer month and decrease in winter month. Same seasonal variation were also find by (Garg et al. 2010).

pH of water is very important as many biological actions happen within a fine range. Particular organisms could face a fatal situation due to variation in pH beyond range. According to Chhatawal (1998) the suitable range of pH requirement is 6.5 to 9.0 at day time. (Garg et al. 2010) reported that change in pH of water body is a sign of useful nature of the water body. The change in pH in fish pods of FR &TI in winter were in the range of 6.41-7.77 has mean value 7.48 and in summer were with range 7.65-8.90 having mean value of 8.14.

Alkalinity of natural fresh water is generally cause by bicarbonates and carbonates in hydroxides of Mg, Ca, K, Na, Fe and NH4 as these are the major components of alkalinity. The total alkalinity in our study find from 264mg/L to 356 mg/L winter to summer, which made the fishponds as nutrient rich and highly fruitful water body. Similar seasonal variation in alkalinity also found (Garg et al. 2010).

The dissolved oxygen (DO) changes from one water to the other water body. Dissolved oxygen greater than 5 mg/L support excellent growth of fauna and flora. (Das, 2000). In this study dissolved oxygen was found as to vary from 9.22 (winter season) with range 7.95-10.41 to 8.15 (summer season) with range 6.30-10. Maximum concentration was found during winter season. The DO is inversely

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proportional to temperature. These findings of this study match with the results of (Garg et al. 2010). The dissolved oxygen level in fish ponds of FR & TI are good for the fish for healthy growth.

On the values of hardness Sawyer (1960) classify the water in three categories, soft (0 - 75 mg/L), moderately hard (75 - 150 mg/L) and hard (151 -300 mg/L). FR &TI ponds water are moderately hard water with hardness ranging from 133mg/L (winter) to 191 mg/L (summer).

Light penetration and turbidity showed an inverse relationship. In this study maximum turbidity was found as 34.30 NTU in summer season April-May 2017 while minimum value was found as 0.59 NTU in winter season November-December 2016. Ali et al. (2000) also have the same findings.

Respiration and organic matter decay liberated free carbon dioxide. Free carbon dioxide content of fresh water mainly depends on temperature of water, respiration rate, depth and organic matter decomposition (Sakhare and Joshi, 2002). In this study the level of carbon dioxide in water was found 3.19 mg/L in winter and 11.72mg/L in summer. These results are similar as per findings of (Garg et al. 2010).
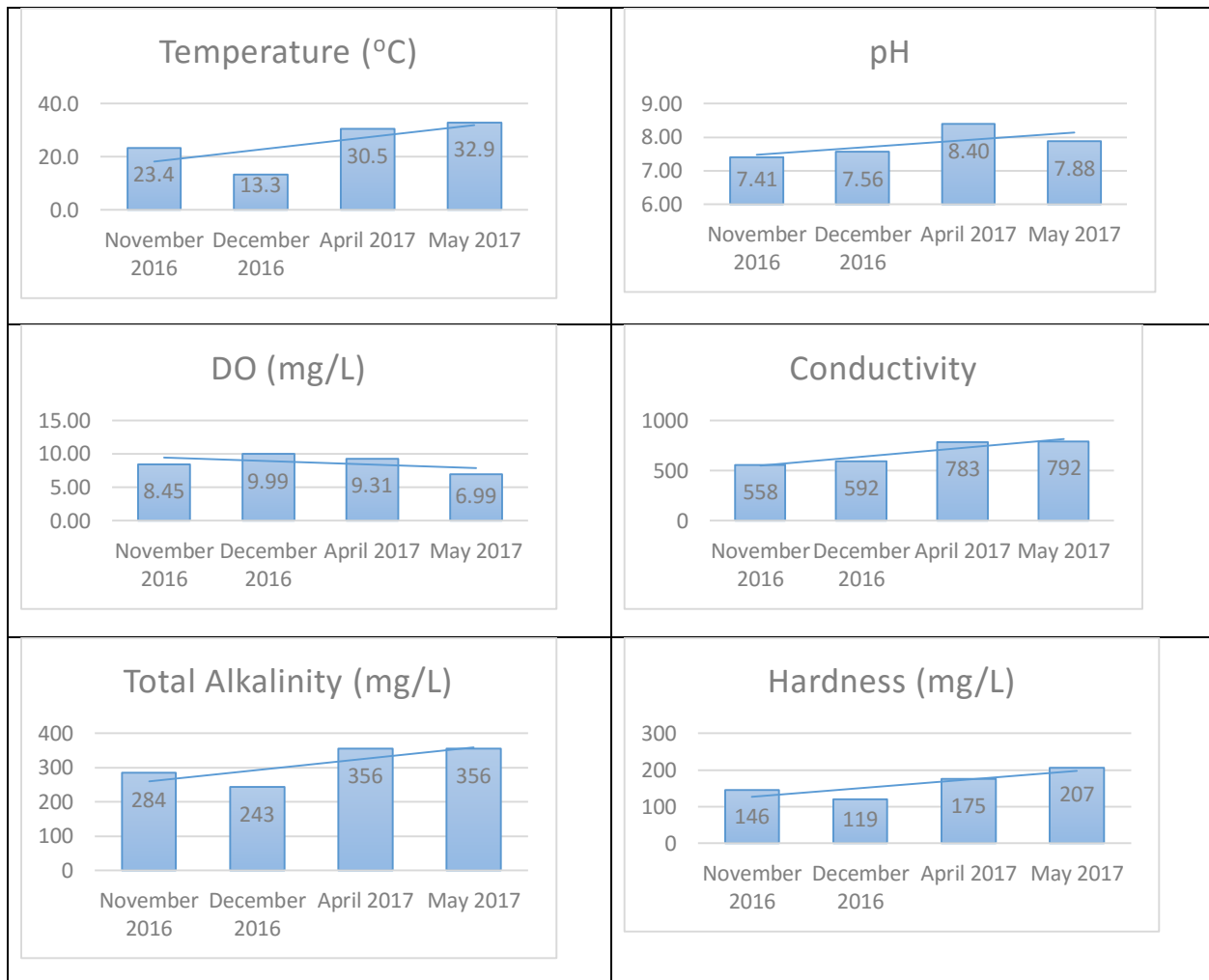
Ability of a solution to pass electric current is conductivity. Several factors including ionic mobility, temperature and ionic valencies influence the conductivity. Conductivity gives a rapid idea of knowledge of TDS concentration and salinity of water (Iqbal et al. 2004). The conductivity was found 575 uS/cm during winter season with range 543-604 and 788 uS/cm during summer season with range 769-811.

The total dissolved solids (TDS) on average was found 395mg/L in winter season and 417mg/L during summer season. The highest values 466 during summer season and these results are the according to the findings of (Garg et al. 2010). Kirubavathy et al. (2005) find that excess amount of TDS in water disturb the ecological balance and caused suffocation of aquatic funa. Similarly the values of salinity were higher (321 mg/L) as compared to that of winter (207 mg/L)

S/No.	Parameters	Winter Nov-Dec 2016				Summer April-May 2017			
		Range of Variation		Mean ± SD		Range of Variation		Mean ± SD	
		Min	Max			Min	Max		
1.	Temp (ºC)	9.90	25.30	18.38	5.76	29.5	34.0	31.7	1.4
2.	pH	6.41	7.77	7.48	0.23	7.65	8.90	8.14	0.35
3.	Total Alkalinity (mg/L)	229	298	264	23	297	450	356	41
4.	DO(mg/L)	7.95	10.41	9.22	0.86	6.30	10.00	8.15	1.27
5.	Hardness(mg/L)	108	156	133	15	117	252	191	30
6.	Turbidity (NTU)	0.59	2.87	1.51	0.76	10.50	34.30	23.03	7.24

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7.	Free CO2(mg/L)	2.30	4.60	3.19	0.57	8.00	16.00	11.72	2.31
8.	Conductivity (uS/cm)	543	601	575	19	769	811	788	13
9.	TDS(mg/L)	366	451	395	24	363	466	417	38
10.	Salinity(mg/L)	179	256	207	26	289	351	321	19

Table 1. Range of variation, mean and standard deviation of water quality parameters of FR & TI Ponds

Temperature (°C): November 2016: 23.4; December 2016: 13.3; April 2017: 30.5; May 2017: 32.9

pH: November 2016: 7.41; December 2016: 7.56; April 2017: 8.40; May 2017: 7.88

DO (mg/L): November 2016: 8.45; December 2016: 9.99; April 2017: 9.31; May 2017: 6.99

Conductivity: November 2016: 558; December 2016: 592; April 2017: 783; May 2017: 792

Total Alkalinity (mg/L): November 2016: 284; December 2016: 243; April 2017: 356; May 2017: 356

Hardness (mg/L): November 2016: 146; December 2016: 119; April 2017: 175; May 2017: 207
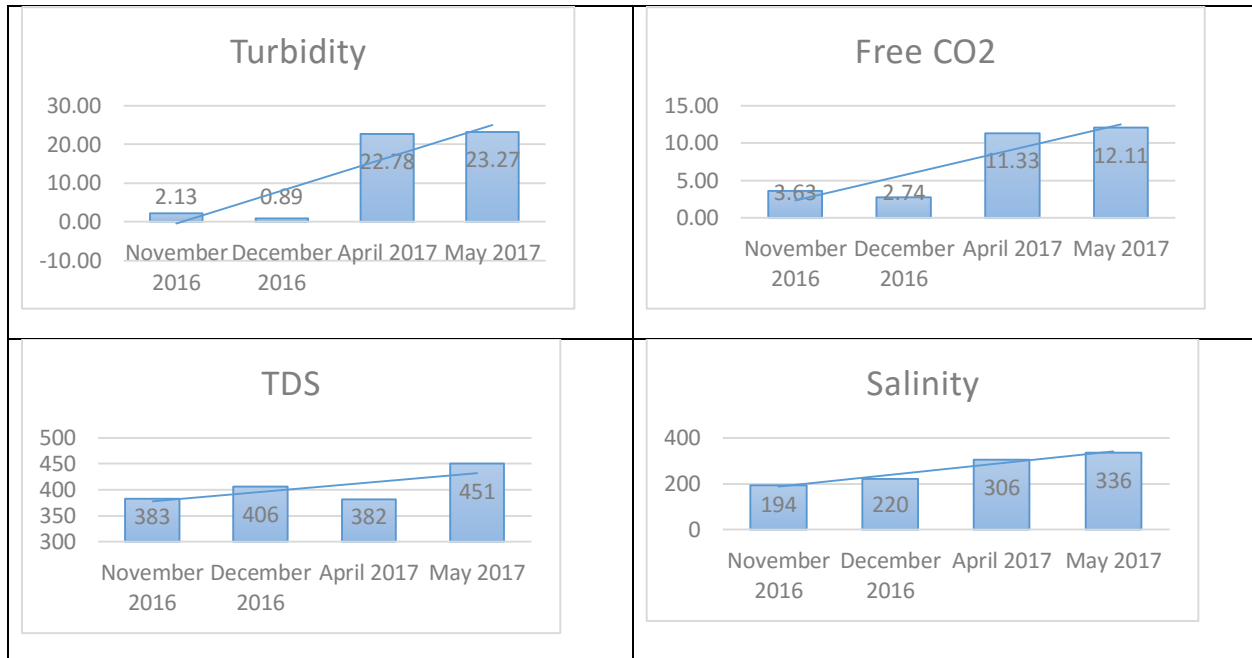
Figure 1: Showing Monthly variation in the water quality parameters of FR & TI Ponds

	Temperature	pH	DO	Conductivity	Total Alkalinity	Hardness	Turbidity	Free CO2	TDS	Salinity
Temperature	1									
pH	.566**	1								
	.000									
DO	-.688**	-.029	1							
	.000	.810								
Conductivity	.785**	.728**	-.398**	1						
	.000	.000	.001							
Total Alkalinity	.825**	.576**	-.452**	.779**	1					
	.000	.000	.000	.000						
Hardness	.827**	.425**	-.614**	.748**	.758**	1				
	.000	.000	.000	.000	.000					
Turbidity	.785**	.684**	-.438**	.884**	.786**	.672**	1			
	.000	.000	.000	.000	.000	.000				
Free CO2	.834**	.678**	-.471**	.919**	.808**	.818**	.934**	1		
	.000	.000	.000	.000	.000	.000	.000			
TDS	.277*	-.088	-.561**	.369**	.255*	.386**	.310**	.307**	1	
	.019	.461	.000	.001	.031	.001	.008	.009		
Salinity	.778**	.619**	-.458**	.936**	.749**	.752**	.831**	.858**	.574**	1
	.000	.000	.000	.000	.000	.000	.000	.000	.000	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 2: Correlation Coefficient (r) amongst water quality parameters of the FR & TI Ponds (Data is the mean value of the monthly collected samples)

In this study the seasonal variation in temperature showed a direct effect on water quality parameters. Temperature has significant negative correlation with dissolved oxygen and significant positive correlation with all other tested parameters. Dissolved oxygen have negative correlation with all tested parameters (Garg et al. 2010). Remaining all other water quality parameters have positive correlation with each other as given in table 2.

4. Conclusion

All the parameters show variations with change in season which was mostly related to variation in temperature. The overall quality of FR & TI ponds water was within normal range of all the tested parameters. All physico chemical conditions were fully life supporting and helpful for the growth and nourishment of healthy fish.

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