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Significance of Different Parameters on Fish Biological Processes

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ABSTRACT

Water quality and fish diversity have an indispensable relationship, In general, water temperature is the key for most of the water quality parameters. As per my experimental record, the minimum temperature of water(WT) was 21.87°C recorded in the spring whereas the maximum was 28.6°C in the summer. The average value of pH during the study period was ranged from 6.82 in autumn and 8.52 in summer. The minimum value of Dissolved Oxygen(DO) was observed during summer(6.06 mgl $^{-1}$) whereas the maximum value was observed in the winter (7.55 mgl $^{-1}$). There is no difference statistically in Total Alkalinity(TAL) in spring (126.2800 mgl $^{-1}$) and rainy (125.1100 mgl $^{-1}$) season whereas low TAL did not differ statistically in autumn (116.2000 mgl $^{-1}$) and winter (116.2000 mgl $^{-1}$). Seasonal analysis showed ammonia-nitrogen(AMN) was varied between 0.10 (Autumn) to 0.16 mgl $^{-1}$ (Summer). Total Soluble Salt (TSS) varied from 192.12 to 260.57 mgl $^{-1}$. Higher values were observed in the summer (260.57 mgl $^{-1}$) whereas lower was in the autumn season (192.12 mgl $^{-1}$). Season wise Total Hardness(TH) higher value was noted in the winter (139.53 mgl $^{-1}$) whereas lower values were in the rain (122.73 mgl $^{-1}$). During my study period, the water temperature has a positive and significant correlation with total soluble salt, ammonium nitrogen, total alkalinity but negatively correlated with dissolved oxygen and total hardness. The pH is positively correlated with total alkalinity (r =0.503 at p ≤ 0.01) but negatively correlated with dissolved oxygen (r = 0.723 at p ≤ 0.01).

INTRODUCTION:

Fish perform all their bodily functions in water. Because fish are dependent upon water to breathe, feed, grow, excrete wastes, maintain a salt balance, and reproduce, understanding the physical and chemical qualities of water is critical to successful aquaculture (Morehead. *et.al*.,2003). Fish and other aquatic animals and plant life require the water they live in to be a certain pH level to be healthy. If the pH level is too low or too high, it can make fish sick, even kill them. A low pH means that the water is acidic; a high pH means that the water is alkaline. pH is a measure of the relative amount of free hydrogen and hydroxyl ions in the water. Water that has more free hydrogen ions is acidic, whereas water that has more free hydroxyl ions is basic. Since pH can be affected by chemicals in the water, pH is an important indicator of water that is changing chemically (Nwosu. et.al.,2000 and Ndubuisi. et.al.,2015).

A dissolved oxygen level that is too high or too low can harm aquatic life and affect water quality. Fish and crustaceans obtain oxygen for respiration through their gills, while plant life and phytoplankton require dissolved oxygen for respiration when there is no light for photosynthesis Adequate dissolved oxygen is necessary for good water quality. As dissolved oxygen levels in water drop below 5.0 mg/l, aquatic life is put under stress. The lower the concentration, the greater the stress. Oxygen levels that remain below 1-2 mg/l for a few hours can result in large fish kills. (Mouzon et.al.,2014).

Ammonia accumulates easily in aquatic systems because it is a natural byproduct of fish metabolism. All animals excrete some waste in the process of metabolizing food into the energy, nutrients, and proteins they use for survival and growth. In fish, the principal metabolic waste product is ammonia. Urea and uric acid are the most common nitrogenous waste products in terrestrial animals; freshwater fish excrete ammonia and marine fish excrete both urea and trimethylamine oxide. (Randall et.al.,2002)

Many fish can only thrive in certain levels of water hardness, and if the levels are outside acceptable parameters, it can cause stress and death. Water that comes from lakes and rainwater is often devoid of minerals, making it soft. It is important to understand how water hardness affects pH in your aquarium. Hardness generally represents the concentration of calcium (Ca^{2+}) and magnesium (Mg^{2+}) ions, because these are the most common polyvalent cations. Other ions,

such as iron (Fe^{2+}) and manganese (Mn^{2+}), may also contribute to the hardness of water, but are generally present in much lower concentrations. (Parra. et.al.,2007 and Kumawat et.al.,2018)

Objectives: Water parameters have been analyzed on a seasonal basis to assess the pond water.

- ✓ It is essential for all living aquatic animals (Kiran 2010).
- ✓ Fish production depends upon the water quality management in fish ponds ecosystems.
- ✓ The different factors like temperature(WT), pH, dissolved oxygen(DO), total alkalinity(TAL), ammonia nitrogen(AMN), total soluble solids(TSS), and total hardness(TH) can impact to pond ecosystem for better growth of fishes.

MATERIALS AND METHODS:

Chemical factors

Chemical factors like pH, dissolved oxygen, alkalinity, hardness, phosphates, and nitrates influence the productivity of the pond.

Collection of water samples:

Water samples were collected from the sub-surface, about 20-25cm below the level of pond water. In a particular season, near about 12 times sample is collected randomly from different place for my study. The sample was stored in a clean glass-stopper bottle of one liter capacity and was used for analysis (Banerjea 1967).

Water temperature (WT):

The water temperature was recorded by **mercury centigrade thermometer**. As fish is a cold-blooded animal, its body temperature changes according to that of the environment affecting its metabolism and physiology and ultimately affecting the production. Higher temperature increases the rate of biochemical activity of the micro biota, plant respiratory rate, and so increase in oxygen demand.

pH :

Water is slightly alkaline in condition, with the optimal range of 6.5-8. Less than 5 and more than 10 pH is lethal to fish and prawns. The pH of water was measured on the spot with a **portable digital pH meter** of ELICO MAKE IN THE LABORATORY (Michael 1984).

Dissolved Oxygen (DO) : The sample was collected from pond (20 ml) afte then followed by modified **Winkler Volumetric Method ,** Jhingran 1991.

Total alkalinity (TAL) : Total alkalinity was measured **methyl orange indicator method**. (Welch 1962, Michael 1984)).

$$\text{Total alkalinity } (Mgl^{-1}) = \frac{(\text{Voloume of acid used})\ (\text{Normality of acid})\ (50{,}000)}{\text{Volume of sample (ml)}}$$

Ammonia-Nitrogen (AMN) :

A modified **phenate method (Wetzel 1983)** was used to measure this parameter. Ammonia is the by-product from protein metabolism excreted by fish and bacterial decomposition of organic matter such as wasted food, faeces, dead planktons, sewage etc. The unionized form of ammonia (NH_3) is extremely toxic while the ionized form (NH_4^+) is not and both the forms are grouped together as "total ammonia".

Total soluble solids(TSS) : Total dissolved solids were determined by (**Kudesia ,1980).**

$$\text{Total solids } (mgl^{-1}) = \frac{\text{Increase in weight of beaker} \times 100{,}000}{\text{Volume of sample(ml)}}$$

Total hardness(TH)

A 50 ml of water sample was taken in an Erlenmeyer's flask and pH was maintained (12-13) by adding buffer solution. The reaction was stirred and 0.1 ml of Ferrochrome Black T (EBT) indicator was added to it and titrated against Ethylene Diamine Tetra Acetic Acid (EDTA) (0.01 N) to reached end point by changing to blue coloration. Total hardness was calculated by the following method. **(Kudesia 1980, NEERI 1988)**.

$$\text{Total hardness } (mgl^{-1}) = \frac{(\text{Volume of EDTA, used}) \times 1000}{\text{Volume of sample (ml)}}$$

Data Analysis:

Data were subjected to statistical analysis using the statistical package for social science **(SPSS) version 16.** Mean value of each season were analysis by Duncan's multiple range test with $p \leq 0.01$. Means were presented as mean ± standard deviation and standard error. Analysis of variance (ANOVA) and descriptive statistics were used to compare the different parameter of the water sample. Co-relation and co-efficient (r) study of different parameter was indicating is highly signified ($p \leq 0.01$ level 2-tailed) and slightly significant is $p \leq 0.05$ level 2- tailed, which compare the inter-relationship among the different water parameter.

RESULTS AND DISCUSSION:

RESULTS:

Table No. 1: Seasonal variation of various water parameters of pond (**mean ± SE**)

Parameter	Unit	Spring (Feb-Mar)	Summer (Apr-Jun)	Rain (Jul.-Sept)	Autumn (Oct.)	Winter (Nov.-Jan)
Water temp. (WT)	0°C	21.87±0.31	28.6 ± 0.37	26.83 ± 0.22	25.03± 0.001	22.46 ± 0.37
Hydrogen ion conc. pH		7.14±0.011	8.52 ± 0.53	7.3 ± 0.43	6.82 ± 0.32	6.86 ± 0.06
Dissolved oxygen (DO)	mgl^{-1}	6.37 ± 0.06	6.06 ± 0.07	6.94 ± 0.08	7.34 ± 0.09	7.55 ± 0.06
Total alkalinity (TAL)	mgl^{-1}	126.28±1.3	135.55 ± 1.5	125.11 ± 1.33	116.2 ± 0.45	117.83 ± 0.29
Ammonia nitrogen (AMN)	mgl^{-1}	0.14 ± 1.71	0.16 ± 0.94	0.13 ± 1.19	0.10 ± 1.43	0.13 ± 1.71
Total soluble solid (TSS)	mgl^{-1}	244.65 ± 1.16	260.57±0.78	239.33 ± 5.62	192.12 ± 0.92	205.27 ± 2.55
Total hardness (TH)	mgl^{-1}	136.87 ± 1.12	126.27±2.57	122.73 ± 0.84	123.06 ± 2.33	139.53 ± 1.06

SE : Standard error of mean

A fish pond is an ecological environment in which many animals and plant organisms coexist and interact. They influence fish productivity. The level of different water quality parameters of fish pond in different seasons during my study period was presented in the table 1 and fig. 1.

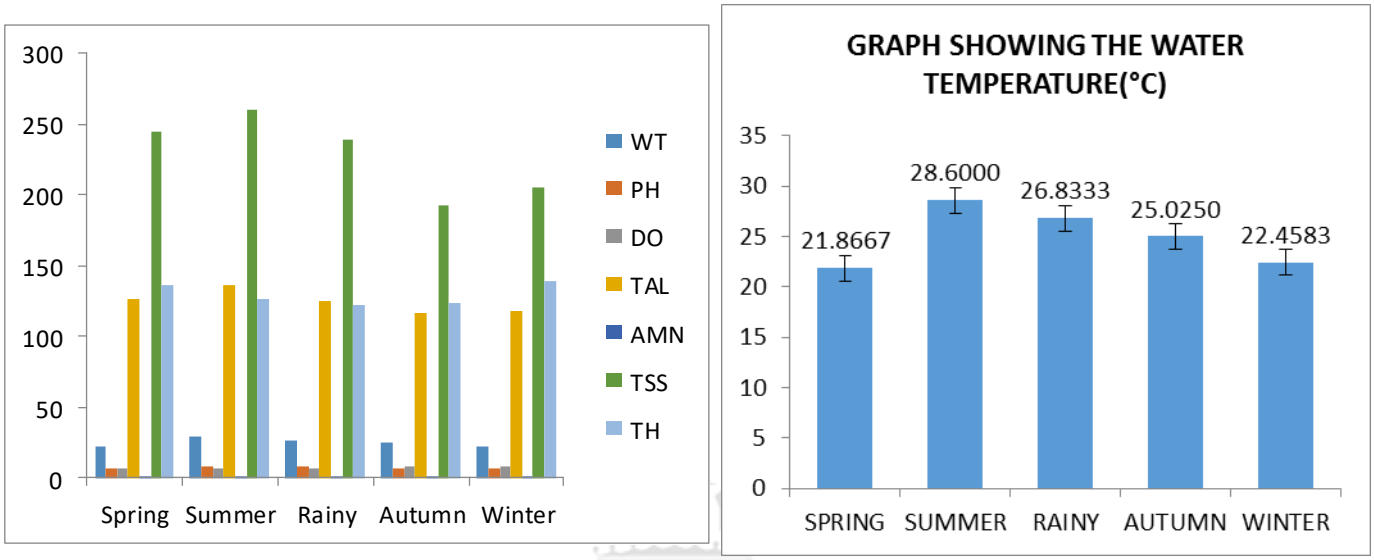


Figure No. 1 & 2: Seasonal variation mean of various water parameters and water temperature (WT) of a pond.

Temperature (WT):

To know about the difference amongst the mean, the DMRT (Duncan's multiple range tests) test has been employed. The DMRT test for water temperature is placed in the table 2. The different temperature of a year has been analysis and found that the same mean temperature shown in spring and winter season after then water temperature decreases gradually. Fish being a cold blooded animal, temperature of the water body affect the body temperature, growth, feed consumption and other body function. The mean temperature showed the range from 21.87°C to 28.6°C during the study period. The minimum temperature was 21.87°C recorded in the spring whereas maximum was 28.6°C in the summer. As per the table 1, 2 and fig 1, 2.

Table No. 2: Descriptive and DMRT Statistics of Different Water Parameters

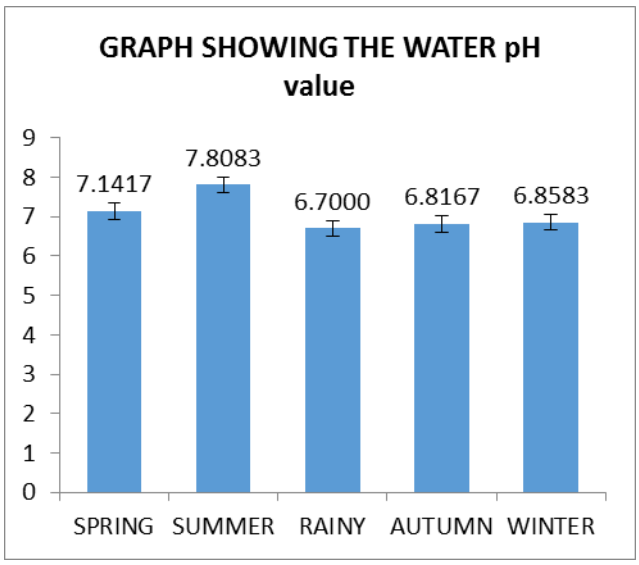
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
temp	1-SPRING	12	21.8667[d]	1.6773	0.4842	20.8010	22.9324	19.9000	24.5000
	2-SUMMER	12	28.6000[a]	2.1312	0.6152	27.2459	29.9541	24.9000	32.3000
	3-RAINY	12	26.8333[b]	1.6560	0.4781	25.7811	27.8855	23.7000	29.8000
	4-AUTUMN	12	25.0250[c]	0.8270	0.2387	24.4996	25.5504	23.7000	26.4000
	5-WINTER	12	22.4583[d]	1.3774	0.3976	21.5832	23.3335	20.8000	24.9000
	Total	60	24.9567	2.9987	0.3871	24.1820	25.7313	19.9000	32.3000
pH	1-SPRING	12	7.1417[b]	0.5036	0.1454	6.8217	7.4616	6.3000	7.9000
	2-SUMMER	12	7.8083[a]	0.5632	0.1626	7.4505	8.1662	6.9000	8.9000
	3-RAINY	12	6.7000[c]	0.4369	0.1261	6.4224	6.9776	6.0000	7.2000
	4-AUTUMN	12	6.8167[bc]	0.4407	0.1272	6.5366	7.0967	6.0000	7.3000
	5-WINTER	12	6.8583[bc]	0.4522	0.1305	6.5710	7.1456	6.1000	7.5000
	Total	60	7.0650	0.6150	0.0794	6.9061	7.2239	6.0000	8.9000
DO	1-SPRING	12	6.3750[c]	0.5030	0.1452	6.0554	6.6946	5.8000	7.3000
	2-SUMMER	12	6.0583[c]	0.6201	0.1790	5.6644	6.4523	5.2000	6.8000
	3-RAINY	12	6.9417[b]	0.3450	0.0996	6.7225	7.1609	6.3000	7.4000
	4-AUTUMN	12	7.3417[a]	0.2746	0.0793	7.1672	7.5161	7.0000	7.9000
	5-WINTER	12	7.5500[a]	0.2195	0.0634	7.4105	7.6895	7.2000	7.8000
	Total	60	6.8533	0.6985	0.0902	6.6729	7.0338	5.2000	7.9000
TAL	1-SPRING	12	126.2800[b]	4.9508	1.4292	123.1377	129.4289	118.6000	131.4000
	2-SUMMER	12	135.5500[a]	6.0137	1.7360	131.7291	139.3709	126.5000	141.2000
	3-RAINY	12	125.1100[b]	6.2292	1.7982	121.1505	129.0662	117.6000	136.6000
	4-AUTUMN	12	116.2000[c]	2.2369	0.6457	114.7788	117.6212	112.6000	119.5000
	5-WINTER	12	117.8300[c]	2.7579	0.7961	116.0810	119.5856	113.4000	121.9000
	Total	60	124.2000	8.3313	1.0756	122.0428	126.3472	112.6000	141.2000
AMN	1-SPRING	12	0.1392[b]	0.0173	0.0050	0.1282	0.1502	0.1100	0.1700
	2-SUMMER	12	0.1608[a]	0.0124	0.0036	0.1530	0.1687	0.1400	0.1800

	3-RAINY	12	0.1267[c]	0.0107	0.0031	0.1198	0.1335	0.1100	0.1400
	4-AUTUMN	12	0.1042[d]	0.0117	0.0034	0.0968	0.1116	0.0800	0.1200
	5-WINTER	12	0.1267[c]	0.0144	0.0041	0.1175	0.1358	0.1100	0.1600
	Total	60	0.1315	0.0228	0.0029	0.1256	0.1374	0.0800	0.1800
TSS	1-SPRING	12	247.9800[b]	13.5259	3.9046	239.3894	256.5773	235.7000	285.3000
	2-SUMMER	12	260.6100[a]	2.8350	0.8184	258.8071	262.4096	254.2000	263.7000
	3-RAINY	12	239.3300[b]	22.9962	6.6384	224.7139	253.9361	201.9000	263.1000
	4-AUTUMN	12	192.1200[d]	3.2738	0.9451	190.0366	194.1968	188.2000	198.4000
	5-WINTER	12	205.2700[c]	10.5272	3.0389	198.5863	211.9637	192.3000	225.6000
	Total	60	229.0600	29.0897	3.7555	221.5470	236.5763	188.2000	285.3000
TH	1-SPRING	12	136.9100[a]	4.9542	1.4302	133.7606	140.0561	131.2000	146.3000
	2-SUMMER	12	126.2700[b]	4.7923	1.3834	123.2218	129.3115	119.7000	133.4000
	3-RAINY	12	122.7300[b]	2.1269	0.6140	121.3736	124.0764	119.7000	125.4000
	4-AUTUMN	12	123.0600[b]	6.7872	1.9593	118.7459	127.3707	116.2000	137.2000
	5-WINTER	12	139.5300[a]	4.7467	1.3703	136.5174	142.5493	128.5000	147.3000
	Total	60	129.7000	8.6017	1.1105	127.4763	131.9204	116.2000	147.3000

Same superscript within the rows does not differ statistically.

Table No. 3: ANOVA of different water parameters.

ANOVA						
		Sum of Squares	D f	Mean Square	F	Sig.
temp	Between Groups	391.082	4	97.771	38.557	.000
	Within Groups	139.465	55	2.536		
	Total	530.547	59			
pH	Between Groups	9.552	4	2.388	10.290	.000
	Within Groups	12.764	55	.232		
	Total	22.317	59			
DO	Between Groups	19.109	4	4.777	27.144	.000
	Within Groups	9.680	55	.176		
	Total	28.789	59			
TAL	Between Groups	2862.266	4	715.567	31.920	.000
	Within Groups	1232.962	55	22.417		
	Total	4095.229	59			
AMN	Between Groups	.021	4	.005	28.242	.000
	Within Groups	.010	55	.000		
	Total	.031	59			
TSS	Between Groups	40671.554	4	10167.889	60.426	.000
	Within Groups	9254.868	55	168.270		
	Total	49926.422	59			
TH	Between Groups	3038.456	4	759.614	31.485	.000
	Within Groups	1326.954	55	24.126		
	Total	4365.410	59			



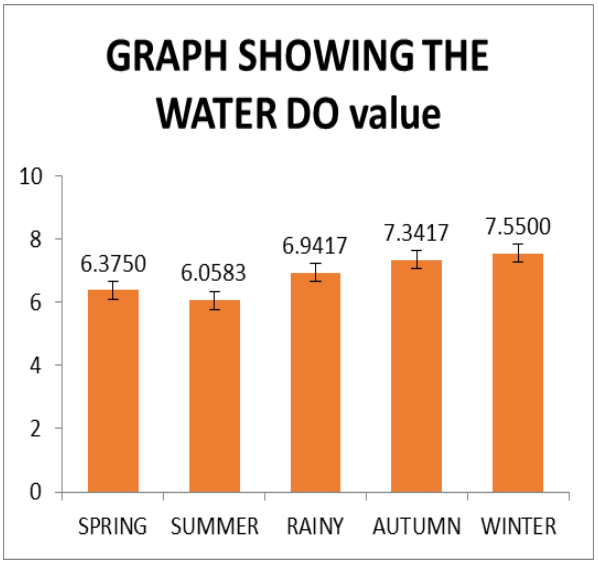


Figure No. 3 & 4: Seasonal variation of pH and dissolved oxygen (DO) value among the different seasons .

Hydrogen ion concentration (pH):

It is measure to hydrogen ion concentration. The average value of pH during study period was ranged from 6.82 and 8.52. Water body is alkaline in nature. Season wise higher value was noted in the summer (8.52)whereas, lower value in the autumn (6.82). The DMRT test for water temperature is placed in the table 2, which indicate that maximum pH shown in summer, after then spring (7.14) and rainy (6.7). The same pH were shown in autumn(6.8167) and winter (6.8583). It was presented in the table 1, 2 and fig 1, 3.

Dissolved Oxygen (DO):

Oxygen depletion in water leads to poor feeding of fish, starvation, reduced growth and more fish mortality, either directly or indirectly (Bhavnagar and Gag, 2000). Dissolved oxygen is an important indicator of the water quality. It is the ability of water to retain oxygen . The seasonal variation in average dissolved oxygen was noted as 6.06 - 7.55 mgl -1. The minimum value was observed during summer (6.06 mgl -1) whereas the maximum value was observed in the winter (7.55 mgl -1). The DMRT test report (table 2) indicate that as per decreasing order of dissolved oxygen were same as winter (7.5500 mgl -1) and autumn (7.3417 mgl -1),

then rainy (6.9417 mgl -1) and finally same as spring (6.3750 mgl -1) and summer (6.0583 mgl -1). It was presented in the table 1, 2 and fig 1, 4.

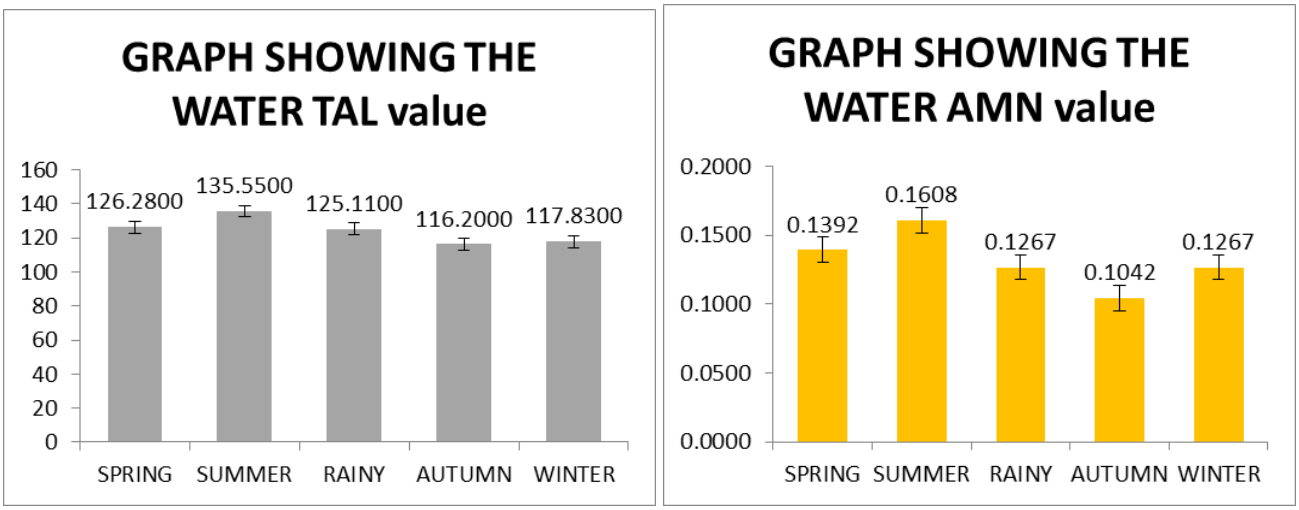


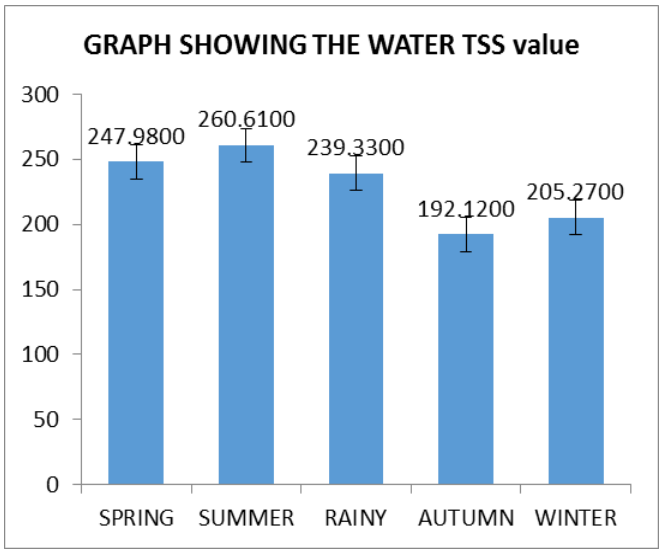
Figure No. 5 & 6: Seasonal variation of total alkalinity(TAL) and (AMN) value among the different seasons .

Total alkalinity (TAL):

Alkalinity of the water sample mainly due to carbonate and bicarbonate ions present mostly in the form of calcium carbonate ($CaCO_3$) . The average alkalinity varied from 116.2 to 135.55 mgl $^{-1.}$ The minimum alkalinity was in the autumn (116.2 mgl $^{-1)}$ where as maximum was in the summer (135.55 mgl $^{-1}$). It was presented in the table 1 and fig 1 and 5. Table 2 indicates that there is no differ statistically in spring (126.2800 mgl $^{-1}$) and rainy (125.1100 mgl $^{-1}$) season whereas same low TAL was not differ statistically autumn (116.2000 mgl $^{-1}$) and winter (116.2000 mgl $^{-1}$). It was presented in the table 1, 2 and fig 1, 5.

Ammonia - Nitrogen (AMN):

It measures the unionized (NH_3) and ionized (NH_4^+) form of ammonia present in the water body . Seasonal analysis showed ammonia- nitrogen was varied between 0.10 to 0.16 mgl $^{-1}$. Seasonally higher mean value was in the summer (0.16 mgl $^{-1}$) and lower value in the autumn (0.10 mgl $^{-1}$) . It was presented in the table 1 and fig 1 and 6. DMRT statistics of different water parameter of AMN was not differ statistically during the season rainy (0.1267 mgl $^{-1}$) and winter (0.1267 mgl $^{-1}$). It was presented in the table 1, 2 and fig 1, 6.



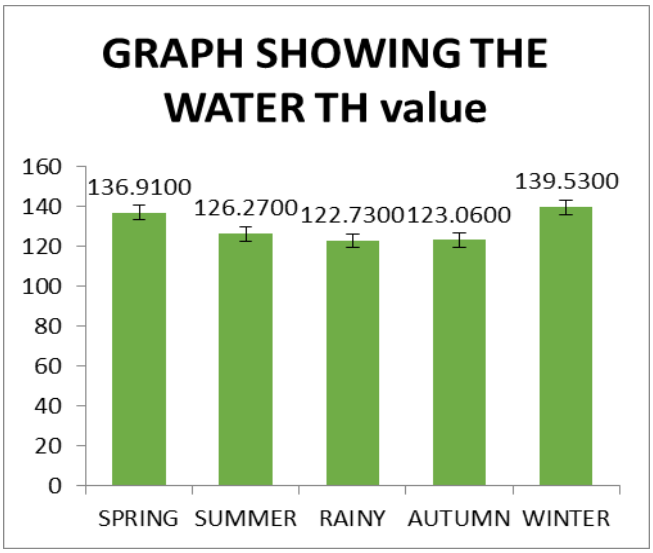


Figure No. 7 & 8: Seasonal variation of total soluable solid(TSS) and TH value among the different seasons .

Total Soluble Solid (TSS):

It refers to matters that dissolved in the water. Dissolved solids includes carbonate , sulfate , phosphate , nitrate Ca^{2+} , Mg^{2+} , Na^{+}, organic ion etc . These ions help in aquatic life. Total soluble salt varied from 192.12 to 260.57 mgl $^{-1.}$ Higher values was observed in the summer (260.57 mgl $^{-1}$) where as lower was in the autumn season (192.12 mgl $^{-1}$) . It was presented in the table 1 and fig 1 and 7. As per DMRT indication spring (247.9800 mgl $^{-1}$) and rainy (239.3300 mgl $^{-1}$) season of the mean TSS value was does not differ statistically. It was presented in the table 1, 2 and fig 1, 7.

Total Hardness (TH):

The hardness of water sample is mainly due to salt of calcium and magnesium . It is also due to carbonate and bicarbonate ions. The total hardness was varied from 122.73 to 139.53 mgl $^{-1}$ in different seasons. Season wise higher value was noted in the winter (139.53 mgl $^{-1}$),whereas lower values were in the rain (122.73 mgl $^{-1}$). It was presented in the table 1 and fig1 and 8. From table 2 of DMRT statistical mean data, higher value indicates both in spring (136.9100 mgl $^{-1}$) and summer (126.2700) whereas the next similar value of summer, rainy (122.7300), autumn (123.06) does not differ . It was presented in the table 1, 2 and fig 1, 8.

DISCUSSION:

Bhavnagar and Singh (2010) studied the pond fish culture to water quality in Haryana. Bhatnagar *et al.* (2004) suggested the range of temperature i.e. 28-32^{0}C good for tropical major carps; <12^{0}C – lethal but good for cold water species. According to Santosh and Singh (2007), Catfishes and other air breathing fishes can survive in low oxygen concentrations of 4 mg L^{-1}. Ekubo and Abowei (2011) recommended that fish can die if exposed to less than 0.3 mg L^{-1} of DO for a long period, minimum concentration of 1.0 mg L^{-1} DO is essential to sustain fish for long period and 5.0 mg L^{-1} are adequate in fishponds.

According to Santosh and Singh (2007), the suitable pH range for fish culture is between 6.7 and 9.5 and ideal pH level is between 7.5 and 8.5 and above and below this is stressful to the fishes. Ideally, an aquaculture pond should have a pH between 6.5 and 9 (Bhatnagar *et al*., 2004).

Table No. 4: Correlation Coefficient (r) matrix among water parameters

	Temp	pH	DO	TAL	AMN	TSS	TH
temp	1						
pH	.252	1					
DO	-.341**	-.441**	1				
TAL	.406**	.503**	-.723**	1			
AMN	.237	.512**	-.543**	.772**	1		
TSS	.330*	.372**	-.752**	.882**	.749**	1	
TH	-.579**	-.062	.142	-.288*	.072	-.083	1

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

During this study period, water temperature has a positive and significant correlation with total soluble salt, ammonium nitrogen, total alkalinity but negatively correlated with dissolved oxygen and total hardness . The pH is positively correlated with total alkalinity ($r = 0.503$ at $p \leq 0.01$) but negatively correlated dissolved oxygen ($r = 0.723$ at $p \leq 0.01$).

The dissolved oxygen is the important factor for growth and survival of fishes. Dissolved oxygen(DO) concentration in the pond water remains in the range of 6.06 to 7.55 mgl $^{-1}$. It shows seasonal variations due to photosynthesis and respiratory activity. Dissolved oxygen shows negative and significant variation with water temperature ($r=0.341$ at $p \leq 0.01$) . This finding is also verified by Mahoob and Sheri (2002) and Tahir (2008).

Correlation analysis of hydrogen ion (pH) of the water parameter is presented in the table 4. As observed from table 4, pH bears a highly positive correlation with total alkalinity ($r=0.503$ at $p \leq 0.01$), Ammonia nitrogen content ($r=0.512$ at $p \leq 0.01$) and TSS ($r=0.372$ at $p \leq 0.01$). Hydrogen ion concentration (pH) activity is the index of environmental condition of pond water. It shows seasonal variation within the range 6.82 to 8.52. The pond water remains alkaline through out the study period. The pH is positively correlated with ammonia nitrogen (AMN) is ($r=0.512$ at $p \leq 0.01$) and negatively correlated with dissolve oxygen($r = 0.543$ $p \leq 0.01$). According to Terziyski et al. (2007) water temperature and transparency are higher in dry season where as dissolved oxygen is more in winter.

Higher amount of total alkalinity is observed in summer and total hardness found to be maximum in the winter season. Water parameters like moderate pH and low temperature show maximum dissolved oxygen in the winter season. Presence of carbonate and bicarbonate makes pond water slightly alkaline , which proves to be suitable for aquatic animals (Swelium et al.,2005 , Terziyski et al,2007).

Dissolved oxygen with increase in temperature also increase weight gain in cat fish (Buentello et al.,2000) . Jha et al ,(2007) observed seasonal fluctuation in water temperature and its relationship with growth of *Cyprinus carpio*. He noted that a lower temperature retard growth rate of the fish whereas, optimal temperature in spring increase is growth. Growth rate is profound in the temperature range between 22^0 - 30^0 C than 16^0 – 20^0 C (Wang et al, 2006 b).

The water temperature, dissolved oxygen and pH should be in acceptable range for fish production (Yadav 2006). The dissolved oxygen in the range of 6.06 – 7.55 mgl $^{-1}$ is the optimum oxygen level for the favorable fish growth rate (Baur and Schlou 2006). Fish biomass, length-weight relationship are found to be higher at pH 8-8.5 which is optimum

for fish growth of silver fat fish (Lopes et. at.,2001, Majhi et al. 2006). As observed from the table 4 ammonium nitrogen is highly correlated with total solute soluble ($r=0.749$ at $p \leq 0.01$) and observed no correlation with total hardness.

Dissolved oxygen is vital for aquatic life. The decomposing organic matter, dissolved gases, industrial waste, mineral waste and agricultural runoff results to get lower DO levels (Srivastava et al., 2011; Addo et al., 2013). Concentration levels of DO below 5.0 mg/L adversely affect aquatic life (Sinha and Biswas, 2011). Thus, DO values in the present study ranges from 6.06 ± 0.07 to 7.75 ± 0.06 mg/L, with an overall mean concentration of 6.8533 mg/L, which is suitable for life of the aquatic ecosystem as per table 2. Others also reported similar values of DO for river water bodies (Karikari et al., 2013; Jayalakshmi et al., 2017;). According to Stone and Thomforde (2004) the desirable Range is 50-150 mg L-1 as CaCO3 and acceptable Range is above 10 mg L-1 as CaCO3. According to Bhatnagar et al. (2004) hardness values less than 20ppm causes stress, 75-150 ppm is optimum for fish culture and >300 ppm is lethal to fish life as it increases pH, resulting in non-availability of nutrients.

Changes in the physico chemical parameters of water sample reflects seasonal variation in the water quality. Seasonal changes in water parameters in different season depend on water input and the rate of evaporation (Zaghloul 2011). Water parameters during summer have been affected by evaporation of water in the rainy season, the water parameters are affected due to an increase amount of water through rain. Such type of seasonal impact also observed and discussed by Abd-Ellah (2009).

CONCLUSION

This investigation may be helpful in determining health status of these three fishes . The estimation of proteins and lipids will certain detect early signs of clinical pathology with respect to their habitat. It must be indicates the comparative values of two parameters of protein and fats of three different fishes. Health status, medicinal values, controlling disease capacity of human beings may be easily known by Doctors. Correlation and pattern of biochemical changes in tissues like liver, pancreases, gills and muscles are found in accordance with the intrinsic and extrinsic factors.

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REFERENCES

1. Abdullah, A. M., R. Hashim and P. M. Aliyu(2009): Evaluating the use of Lactobacillus acidophilus as a biocontrol agent against common pathogenic bacteria and the effects on the haematology parameters and histopathology in African catfish *Clarias gariepinus* juveniles. Aquacult. Res. 42(2): 196-209.
2. Addo-Bediako, A., Marr, S.M., Jooste, A., Luus-Powell, W.J., (2014). Are metals in the muscle tisuue of Mozambique tilapia a threat to human health ? A case study of two impoundments in the Olifants River, Limpopo, South Africa. International Journal of Limnology 50: 201 – 210.
3. Bauer.C, Schlou.G, (2006). Reaction of common carp (*Cyprinus carpio*), to oxygen deficiency in winter as an example for the suitability of radio telemetry for monitoring the reaction of fish to stress factors in pond aquaculture. Aquacult. Res. 37: 248 – 254.
4. Bhakta, J.N ., Bandopadhay ,P.K., Jana,B.B. (2006). Effect of different doses of mixed fertilizer on some biogeochemical cycling bacterial population in carp culture pond. Tur. J. Fish. Aqua. Sci. 6: 165 – 171.
5. Bhatnagar, A. and Singh, G., (2010). Culture fisheries in village ponds: a multi-location study in Haryana, India. Agriculture and Biology Journal of North America, 1(5), pp 961-968.
6. Bhatnagar, A., Jana, S.N., Garg, S.K. Patra, B.C., Singh, G. and Barman, U.K., (2004). Water quality management in aquaculture, In: Course Manual of summer school on development os sustainable aquaculture technology in fresh and saline waters, CCS Haryana Agriculture, Hisar (India), pp 203-210.
7. Buentello, J.A ., Gatlin, D.M ., Neill ,W.H. (2000). Effects of water temperature and dissolved oxygen on daily feed consumption, feed utilization and growth of channel catfish (*Ictalurus punctatus*). Aquaculture 182: 339 – 352.
8. Ekubo, A. A. and Abowei, J.F.N., (2011). Review of some water quality management principles in culture fisheries, Research Journal of Applied Sciences, Engineering and Technology, 3(2), pp 1342-1357.
9. Jayalakshmi ,S., Pugazhendy, K., Tamizhazhagan, V., Sakthidasan, V., Jayanthi, C., Sasikala ,P., (2017). Therapeutic efficacy of Alovera against the effect of cypermethrin toxicity in the freshwater *Cyprinus carpio*. International Journal of Zoology and Applied Bioscience. 2(6):386-391.
10. Jha, P.S., Barat, K., Sarkar, K., (2007). Comparative effect of live food and manure treatment on water quality and production ornamental carp, *Cyprinus carpio* during winter, summer, monsoon and post – monsoon grow out experiment on concrete tanks. J. Appl. Ichthyol. 23: 87 – 92.
11. Karikari, A. Y., Akpabey, F. & Abban, E. K. (2013). Assessment of water quality and primary productivity characteristics of Volta Lake in Ghana. Academia Journal of Environmental Sciences 1 (5), 88 - 103.
12. Kumawat .R, Ojha M.L, Saini V.P, Sharma S.K(2018). Effect of water hardness on survival and growth of Labeo rohita (Hamilton) fry. Journal of Entomology and Zoology Studies. 6:2337-2341.
13. Lopes, J.M., Silva, L.V.F., Baldisserotto, B. (2001). Survival and growth of silver catfish larvae exposed to different water pH. Aquacult. Int. 9: 73 – 80.

14. Majhi, S.K., Das, A., Mandal, B.K., (2006). Growth performance and production of organically cultured grasscarp *Ctenopharyngodon idella* under midhill conditions of Meghalaya North East India. Tur. J. Fish. Aqua. Sci. 6: 105 – 108.
15. Mahboob, S., Sheri, A.N., (2002). Influence of fertilizers and artificial feed on the Seasonal variation in physic-chemical factors in fish ponds. Pakistan J. Zool. 34(1): 51 – 56.
16. Morehead D.T, Hart P.R(2003). Effect of temperature on hatching success and size of striped trumpeter (Latris lineata) larvae. Aquaculture.; 220:595-606.
17. Mouzon, N.R., Null, S.E.,(2014). Assessing the effects of water. rights purchases on dissolved oxygen, stream temperatures, and fish habitat. Poster presentation, AGU Fall Meeting, December, 2014.
18. Ndubuisi, C.U, Chimezie J.A, Chinedu C.U, Chikwem C.I, Alexander .U(2015). Effect of pH on the growth performance and survival rate of Clarias gariepinus fry. International Journal of Research in Biosciences. 4:14-20.
19. Nwosu, B.F, Holzlöhner .S(2000). Influence of temperature on egg hatching, growth and survival of larvae of Heterobranchus longifilis Val. 1840 (Teleostei: Clariidae). Journal of Applied Ichthyology. 16:20- 23.
20. Parra, JEG, Baldisserotto.B(2007). Effect of water pH and hardness on survival and growth of freshwater teleosts. Fish osmoregulation, 2007, 43-48.
21. Randall D. J. and Tsui T. K. N. (2002). Ammonia Toxicity in Fish. Mar Pollut Bull. 45(1–12):17–23.
22. Sahu, P.K., Jena, J.K., Das, P.C., Mondal, S., Das, R., (2007). Production performance of *Labeo calbasu* (Hamilton) in polyculture with three Indian major carps *Catla catla* (Hamilton), *Labeo rohita* (Hamilton) and *Cirrhinus mrigala* (Hamilton) with provisions of fertilizers, feed and periphytic substrate asvariedinputs . Aquaculture, 262 : 333 – 339.
23. Santosh, B. and Singh, N.P., (2007). Guidelines for water quality management for fish culture in Tripura, ICAR Research Complex for NEH Region, Tripura Center, Publication No. 29.
24. Sapkale, P.H, Singh R.K, Desai A.S(2013). Effect of different water temperatures and pH on the growth, specific growth rate and feed conversion efficiency of spawn to fry of common carp, Cyprinus carpio. International Journal of Environment and Waste Management.; 12:112-120.
25. Sinha, S. N. and Biswas, M. (2011). Analysis of physico-chemical characteristics to study the water quality of a lake in Kalyani, West Bengal. Asian J. Exp. Biol. Sci. 2: 18-22.
26. Srivastava, S.K., Sarkar, U.K., Patiyal, R.S., (2012). Fishing methods in streams of the Kumaon Himalayan region of India. Asian Fisheries Sci. 15: 347 – 356.
27. Stone.N.J.,(1996): Fish consumption ,fish oil ,lipids and coronary heart disease.*Circulation*,vol-94 .page 2337—2340 .
28. Swelium, M.A., Abdella, M.M., El-Din, S.A.S., (2005). Effect of dietary protein energy level and fish initial sizes on growth rate, development and production of *Nile tilapia*, *Oreochromis niloticus* L Aquacult. Res. 36: 1414 – 1421.
29. Tahir, M.Z.I., (2008). Studies on partial replacement of fish meal with oil seed meals in the diet of major carps insemi intensive culture system. Ph. D. Thesis. Dept Zool. Univ. Agri. Faisalabad Pakistan, 174 – 178.
30. Terziyski, D.G., Grozev, R., Kalchev,Stoeva A., (2007). Effect of organic fertilizer Plankton primary productivity in fish pond. Aquacult. Int. 15: 181 – 190 .
31. Yadav, B.N., (2006). Fish and Fisheries, Daya Publishing House, New Delhi : 123p.
32. Zaghloul, K.H.,Omar,W.A., Abdel-Khalek, A.A., Hegab,S.A., (2011). Ecological monitoring of Mediterranean *Solea aegyptiaca* transplanted into lake Qaroun, Egypt : Australian Journal of Basis and Applied Sciences, 5(7): 851 – 862.