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INTERRELATIONSHIP BETWEEN PHYSICOCHEMICAL PARAMETERS OF CULTURE PONDS IN KAIKALUR AND MUDINEPALLI MANDALS IN KRISHNA DISTRICT OF ANDHRAPRADESH

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ABSTRACT

The paper deals with the physico-chemical parameters of water in fish ponds of kaikalur and mudinepalli mandals in Krishna districts of Andhra Pradesh for two crops in each Mandal. During the present study, statistical analysis was carried out to find out the relation between various water variable in each crop. In crop: 1 of Kaikaluru mandal, a negative correlation was observed between dissolved oxygen and water temperature (r= -0.303) and the correlation is significant at 5% level ($p<0.05$). In crop: 1 of Kaikaluru mandal, ammonia decreases with an increases of dissolved oxygen (r= -0.316) and the correlation is significant at 5% level ($P<0.05$).In crop: 2 of Kaikaluru mandal, pH increases with an increases of alkalinity (r= 0.361) and the correlation is significant at 5% level ($p<0.05$). In crop: 2 of Kaikaluru mandal, pH increases with an increases of dissolved oxygen (r= 0.309) and the correlation is significant at 5% level ($p<0.05$). In crop; 2 of Mudinepalli mandal a negative correlation was observed between water temperature and dissolved oxygen (r= 0.389) and the correlation is significant at 1% level ($p<0.01$).

Keywords: Temperature, Turbidity, Dissolved Oxygen, pH Hardness, Alkalinity, Ammonia Nitrite, Nitrate, Fish Culture

INTRODUCTION

Freshwater ecosystems have been used for the investigation of factors controlling the distribution and abundance of aquatic organisms. The physical and chemical

characteristics of water bodies affect the species composition, abundance, productivity and physiological conditions of aquatic organisms **[1]**. Assessment of water resource quality of any region is an important aspect for developmental activities of the region because rivers, lakes and man – made reservoirs and ponds used for water supply to domestic, industrial, agricultural and fish culture purpose **[2-6]**. Ponds are favourable habitats for a variety of flora, fauna and also used by the anthropogenic society, so its regular monitoring is necessary. Recently, lot of work has been done on changing ecological behaviour of ponds **[7-10]**.

Temperature, turbidity, dissolved oxygen, pH, and total alkalinity are significant parameters used to study the water quality **[11-12]**. The consideration of the physico-chemical factors in the study of limnology is basic in understanding the trophic dynamics of water body. Each factor does play its individual role, but at the same time the final effect is really the result of interaction of all the factors **[13-14]**.

MATERIALS AND METHODS

Samples were collected from two different areas i.e., Kaikalur mandal and Mudinepalli mandal in Krishna districts of A.P. Fish culture practices observed and discussed with the farmers. Physico-chemical parameters noted down. Temperatures observed with the help of mercury thermometer and Dissolve Oxygen observed with YSI model DO meter. Desktop pH meter measures pH values. Alkalinity and hardness measured by titrimetric method. Ammonia, Nitrite and nitrate measured with HACN test kits. Monthly physical and chemical analysis of water measured using tests Kits. The present study taken up in two mandals viz. Kaikaluru mandal (16º33'N & 81º12'E) and Mudinepalli mandal (16º24'N & 81º07'E) in Krishna districts of A.P, which are the two important mandals as far as fish culture, is concerned.

In the present study, statistical analyses were conducted with SPSS software program (SPSS, Richmond, USA) version 10 as described by **[15]**.

RESULTS AND DISCUSSION

In the present investigation, the following observations were noticed during two crops from both the study area.

The high alkalinity is a function of ion exchange that Ca ions replaced by Na ions and later contributed to alkalinity **[16]**. In the present study, farmers of both Kaikalur and Mudinepalli mandals are using organic manure and high protein rich feed regularly as a result the alkalinity of both the areas are

very high. This is similar with the findings of **[17].**

Pond total alkalinity was significantly greater where organic fertilization and feeds were applied **[17]**. Alkalinity increased with organic fertilization because bacterially generated CO_2 from manure decomposition dissolves calcium and magnesium carbonate in pond water into calcium and magnesium bicarbonate **[18]**.

In the present study, alkalinity and pH are positively correlated in crop: 2 of Kaikalur at five percent level of significance **(Table 6)**. This was coincided with the findings of **[19]**. **[20-22]** observed inverse relationship between alkalinity and pH.

In the present study, alkalinity and water temperature are positively correlated at one percent level of significance in crop: 1 and crop: 2 of Kaikalur **(Table 5 and 6)**, as observed by **[19]**.

[23] noted that pH higher than 7 but lower than 8.5 is ideal for biological productivity while pH lower than 4 is detrimental to aquatic life. The present findings are very nearer to the results given by **[23]**.

Accumulation of free carbon dioxide due to little photosynthetic activities of phytoplankton will lower the pH value of the water, while intense photosynthetic activities of phytoplankton will reduce the free carbon dioxide content resulting in increased pH values **[24, 25]**.

At alkaline pH values, photosynthetic activities would be high and should result in high oxygen content. Hydrogen ion concentration (pH) showed a positive correlation with dissolved oxygen. Increasing levels of dissolved oxygen in aquatic systems are usually associated with eutrophic and productive water bodies **[24]**.

In the present study pH showed positive correlation with dissolved oxygen in crop: 2 of Kaikaluru mandal (**Table 6).** This is similar with the findings of **[24]**.

The reduced level of transparency observed during the present study was mainly due to suspended solids and suspended organic matters, which were attributed by monsoon showers, addition of nutrients, human activities and other things **[26]**.

[27] recorded dissolved oxygen concentrations ranging from 6.3 – 8.3 mg/l. These results are similar to the results obtained in crop: 1 and crop: 2 of Kaikalur.

In the present study, the minimum dissolved oxygen level at Mudinepalli mandal is 5.5mg/l in crop: 1 **(Table 3)** and 5.7 mg/l **(Table 4)** in crop 2. These values agree with those of **[28]**.

During the study, water temperature and dissolved oxygen showed negative correlation

with five percent level of significance in crop: 1 of Kaikalur (**Table 5)** and one percent level of significance in crop: 2 of Mudinepalli mandal **(Table 8)**. **[29]** Confirmed that water temperature and dissolved oxygen are negatively correlated. Concentration of dissolved oxygen is inversely proportional to temperature at a given time **[30]**.

The present investigation resembles the above mentioned observations indicating that the higher temperature of water decrease the solubility of oxygen. The principal source of oxygen that is dissolved in water is by direct absorption at the air-water interface, which is greatly influenced by temperature **[31, 32]**. At low temperature more oxygen diffuses into water because the partial pressure is reduced, while at high temperature when the partial pressure is high oxygen diffuses out of the water. The solubility of oxygen in water is controlled by some major factors namely temperature, salinity, pressure and turbulence in the water caused by wind, current and waves. Surface agitation of water helps to increase the solubility of dissolved oxygen in water **[33]**.

In the present study, ammonia shows negative correlation with Sechhi disc at one percent level of significance in crop: 1 of Kaikalur (**Table 5)**. This is similar to the findings of **[34]**.

Ammonia can cause serious problems in pond management. Fish suffering from ammonia toxicity typically stop eating and become lethargic. Several causes can increase total ammonia nitrogen levels in ponds. If the fish are overfed, uneaten food sinks to the bottom, decays and releases ammonia, increasing the load on the nitrifying bacteria in the pond and filter. Too many fish in the pond or system can mean that the wastes produced exceed the capacity of the nitrifying bacteria. The pond system may not be operating properly and may contain abnormal amounts of captured solids, depleting dissolved oxygen levels and overburdening nitrifying bacterial colonies.

The relative increase in the ammonia during hot period may be attributed to the high evaporation rate, in addition to the denitrification process by the reduction of nitrite and nitrate into NH_3 **[35]**. have also remarked that the distribution of nitrifiers corresponds to oxygen level in the aquatic medium.

In the present study, ammonia show negative correlation with dissolved oxygen in crop: 1 of Kaikalur (**Table 5)** and crop: 2 of Mudinepalli mandal (**Table 8)** at five percent level of significance. This is similar with the findings of **[35]**. In the present study, pH shows positive correlation with ammonia in crop: 1 of Mudinepalli mandal at five percent

level of significance (**Table 7)**, which is similar with the results of **[36]**.

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Table 1: Combined Range, Mean and Standard Deviation of Physical and Chemical Parameters in Crop-1 of all the Ponds in Kaikalur mandal, Krishna District

Variable	Minimum	Maximum	Mean	Std Dev
Water Temp. (^{o}C)	27.5	33	29.87	1.36
Alkalinity (mg/l)	250	580	405.44	79.64
HARDNESS (mg/l)	320	650	483	73.63
pH	7.6	8.9	8.29	0.29
Secchi-disc (cm)	24	39	31.02	3.94
DO (mg/l)	3.9	8.1	5.43	0.86
AMMONIA (mg/l)	0.3	1.5	0.76	0.27
NITRITE (mg/l)	0.1	0.5	0.21	0.1

Table 2: Combined Range, Mean and Standard Deviation of Physical and Chemical Parameters in Crop-2 of all the Ponds in Kaikaluru mandal, Krishna District

Variable	Minimum	Maximum	Mean	Std Dev
Water Temp. (^{o}C)	27.4	34.2	30.61	1.73
Alkalinity (mg/l)	250	520	361.33	68.17
HARDNESS (mg/l)	280	640	435.11	89.93
pH	7.6	9.1	8.3	0.31
Secchi-disc (cm)	24	41	30.95	3.82
DO (mg/l)	4	8	5.54	0.89
AMMONIA (mg/l)	0.3	1.8	0.73	0.29
NITRITE (mg/l)	0.05	0.8	0.23	0.14

Table 3: Combined Range, Mean and Standard Deviation of Physical and Chemical Parameters in Crop-1 of all the Ponds in Mudinepalli mandal, Krishna District

Variable	Minimum	Maximum	Mean	Std Dev
Water Temp. (^{o}C)	28	30.2	29.29	0.5
Alkalinity (mg/l)	200	440	324.88	64.64
HARDNESS (mg/l)	420	650	533	66.13
pH	7.45	8.5	8.12	0.2
Secchi-disc (cm)	18	35	26.77	4.05
DO (mg/l)	5.5	9.5	7.93	0.85
AMMONIA (mg/l)	0.05	0.6	0.24	0.16
NITRITE (mg/l)	0.01	0.7	0.19	0.16

Table 4: Combined Range, Mean and Standard Deviation of Physical and Chemical Parameters in Crop-2 of all the Ponds in Mudinepalli mandal, Krishna District

Variable	Minimum	Maximum	Mean	Std Dev
Water Temp. (^{o}C)	27	29.7	28.39	0.51
Alkalinity (mg/l)	140	430	292.11	90.87
HARDNESS (mg/l)	195	700	468.55	153.12
pH	7.2	8.9	8.18	0.35
Secchi-disc (cm)	15	35	25.06	4.28
DO (mg/l)	5.7	9.8	7.74	0.99
AMMONIA (mg/l)	0.1	0.9	0.35	0.21
NITRITE (mg/l)	0.08	0.5	0.2	0.1

Table 5: Pearson Rank Correlation Coefficients and Level of Significance Between Various Physicochemical Parameters in Crop –1 of Kaikaluru mandal N=45

		W.T	ALK	HD	pH	SD	DO	AMMONIA	NITRITE
W.T	r								
	P								
ALK	r	.580(**)							
	P	.000							
HD	r	.579(**)	.719(**)						
	P	.000	.000						
pH	r	-.047	-.108	-.098					
	P	.759	.482	.523					
SD	r	-.212	-.214	-.206	.096				
	P	.161	.158	.174	.531				
DO	r	-.303(*)	-.109	.020	.119	.144			
	P	.043	.476	.898	.436	.345			
AMMONIA	r	.008	.311(*)	.191	.061	-.323(*)	-.361(*)		
	P	.960	.037	.210	.690	.031	.015		
NITRITE	r	-.099	-.053	.181	-.003	-.248	-.086	.283	
	P	.516	.731	.235	.986	.100	.573	.060	

NOTE: **: Correlation is Significant at the 0.01 level (2-tailed); *: Correlation is Significant at the 0.05 level (2-tailed)

Table 6: Pearson Rank Correlation Coefficients and Level of Significance Between Various Physicochemical Parameters in Crop –2 of Kaikaluru mandal. N=45

		W.T	ALK	HD	pH	SD	DO	AMMONIA	NITRITE
W.T	r								
	p								
ALK	r	.511(**)							
	p	.000							
HD	r	.714(**)	.444(**)						
	p	.000	.002						
pH	r	.359(*)	.361(*)	.343(*)					
	p	.016	.015	.021					
SD	r	.138	-.099	.150	-.036				
	p	.367	.517	.325	.815				
DO	r	.240	.068	.542(**)	.309(*)	.388(**)			
	p	.112	.659	.000	.039	.009			
AMMONIA	r	-.198	-.254	-.083	.133	-.178	-.035		
	p	.192	.092	.587	.385	.243	.820		
NITRITE	r	-.021	.129	.058	.025	.034	.120	-.062	
	p	.890	.397	.705	.872	.823	.432	.687	

NOTE: **: Correlation is Significant at the 0.01 level (2-tailed); *: Correlation is Significant at the 0.05 level (2-tailed)

Table 7: Pearson Rank Correlation Coefficients and Level of Significance Between Various Physicochemical Parameters in Crop –1 of Mudinepalli mandal. N=45

		W.T	ALK	HD	pH	SD	DO	AMMONIA	NITRITE
W.T	r								
	p								
ALK	r	-.106							
	p	.487							
HD	r	-.386(**)	.688(**)						
	p	.009	.000						
pH	r	.101	.052	-.012					
	p	.509	.732	.937					
SD	r	-.268	.080	.107	-.059				
	p	.075	.602	.483	.699				
DO	r	.045	.190	-.032	-.239	-.003			
	p	.771	.212	.836	.113	.987			
AMMONIA	r	.042	-.339(*)	-.349(*)	.334(*)	.073	-.047		
	p	.785	.023	.019	.025	.632	.761		
NITRITE	r	-.040	.043	.181	.023	-.231	-.328(*)	.018	
	p	.795	.778	.234	.882	.127	.028	.909	

NOTE: **: Correlation is Significant at the 0.01 level (2-tailed); *: Correlation is Significant at the 0.05 Level (2-Tailed)

Table 8: Pearson Rank Correlation Coefficients and Level of Significance Between Various Physicochemical Parameters in Crop –2 of Mudinepalli

		W.T	ALK	HD	pH	SD	DO	AMMONIA	NITRITE
W.T	r								
	p								
ALK	r	.205							
	p	.177							
HD	r	.213	.969(**)						
	p	.160	.000						
pH	r	-.312(*)	.070	.053					
	p	.037	.647	.731					
SD	r	-.438(**)	.286	.264	.130				
	p	.003	.057	.080	.393				
DO	r	-.389(**)	-.402(**)	-.400(**)	.016	.140			
	p	.008	.006	.006	.919	.361			
AMMONIA	r	.200	.789(**)	.716(**)	.131	.087	-.365(*)		
	p	.187	.000	.000	.390	.568	.014		
NITRITE	r	.032	.128	.087	.300(*)	.060	-.158	.098	
	p	.832	.403	.571	.046	.695	.300	.520	

NOTE: *: Correlation is Significant at the 0.05 Level (2-Tailed); **: Correlation is Significant at the 0.01 Level (2-Tailed)