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PHYSICO-CHEMICAL PROPERTIES OF SOME SELECTED FRESH WATER FISH PONDS IN RELATION TO FISH PRODUCTION IN WARANGAL AREA

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ABSTRACT: The study of Physico-chemical parameters in three local freshwater fish ponds in Warangal district have been studied for a period of one year from June, 2013 to May,2014. It is obvious that here in this state the fish culture is being done from june to September. Water samples were collected from the ponds and analyzed using standard laboratory methods and procedures. The physico-chemical parameters of the water such as pH, NH3-N,DO,BOD,TAL,TUR,TDS, THS and EC are not uniform in all the three ponds. These parameters vary from month to month in an year. However no much fluctuation has been observed in the parameters such as pH, NH3-N, DO and BOD in all the three lakes, it is observed. The results showed variation in various parameters at the different sampling stations. The Temperature was ranging from 26.80±2.90oC to 27.00±2.00oC, pH was from 6.83±1.59 to 7.10±1.66 and the Ammonia-nitrogen (NH3-N) content was 0.95±0.05 to 1.12±0.09mg/l. the dissolved oxygen content was from 6.8±1.02 to 7.40±1.56mg/l, Biological oxygen demand ranged from 1.89±0.074 to 3.14+0.015mg/l and Total alkalinity (TAL) was 38.5±1.58 to 39.40±2.80mg/l. Total dissolved solids(TDS) varied from 36.0±1.66 to 39.41±2.87 mg/l. while Total hardness (THS) was 19.95±1.89 to 23.80±1.62 mg/l and Turbidity was 24.00±1.00 to 28.0±2.44ppm. Electrical conductivity was from 115.06±6.54 to 118.9±3.87µmhos/cm. The NH3-N content was higher than the accepted values for fish culture while those of other parameters favored good fish production. The observations of the present study suggests that the fish culture in these three freshwater ponds in Warangal district are good to takeup fish culture practices. However if we adopt some water quality management practices and pond management techniques, it might give good positive results for fish culture, it is concluded.
Key words: Freshwater fish ponds, Physico-chemical parameters, Fish production.

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INTRODUCTION

Water is one of the most important components on earth and it covers three- fourth of the earth's surface. Large area of water available on earth is saline water and only a small quantity found as freshwater. Freshwater has become a scarce commodity due to over exploitation, population growth and also pollution [12, 13, 22, and 27]. Industrial effluents, domestic sewage and municipal wastes are being continuously added to the fresh water reservoirs affecting the water and changing its physico-chemical quality and making it unfit for fish production[8]. And also agriculture. The maintenance of healthy aquatic system is dependent on the physico chemical properties and biological diversity [30]. The interactions of both the physical and chemical properties of water play a significant role in composition, distribution, abundance, movements and diversity of aquatic organisms [19]. Water is the home of fishes and its quality is most over looked. The qualitative aspect of pond and its management is ignored until it affects fish production. Water quality is generally considered as means of the certain component of water which are present and facilitate for the optimum growth of aquatic organisms [9]. The Water quality is group of physical, chemical and biological factors which influence the use of water for the purpose of fish culture.

These factors include dissolved oxygen, pH, hardness, turbidity, alkalinity, ammonia and temperature. Other parameters such as biological oxygen demand (BOD) and chemical oxygen demand(COD) indicate the pollution level of a given water body [9]. The Productivity depends on the Physico-chemical characteristics of the water body [14]. In recent years, the Inland water bodies in the Warangal district have been subjected to alteration of ecological condition. This is partly due to the human activities, population growth, use of petroleum and its by products, over exploitation and exploration and indiscriminate use of pesticides in agriculture practices which resulted in the pollution of the aquatic environment. More over uncontrolled discharge of domestic waste water into the ponds has resulted in Eutrophication of ponds[21]. The entry of the pollutants in the fresh water affects on enhancement of oxygen demand and nutrient load in the water. promoting toxic algal blooms and leading to destabilized aquatic ecosystem[18]. Water of such poor quality may be acidic, rich in nutrients and organic matter , high in suspended solids or polluted with industrial or agricultural chemicals. Such a deterioration in water quality can result in fish being under stress and vulnerable to diseases [16]. Fish ponds in freshwater areas of Warangal district play a vital role in fisheries to supply the much needed animal protein to the people inhabiting especially rural areas. There is dearth of information on production of fish from fish ponds in Warangal district especially in the fresh water zones. It is therefore important to know about Water quality parameters and their management which have influence on growth and survival of quatic organisms especially fish objective of the present investigation was to provide data on water chemistry and biological characteristics of the fresh water fish ponds of selected in Warangal district.

MATERIALS AND METHODS

Study area and Sampling stations.

Three important freshwater fish ponds in Warangal district were selected which have been identified to use for fish cultivation. They are Thimmapur, Upparapalle and Yellanda ponds for the assessment of water quality to take up fish culture in these ponds in this District. To assess the water quality, water samples have been analysed for a period of one year from June, 2013 to May,2014.

Fig-1: Map of Telangana State

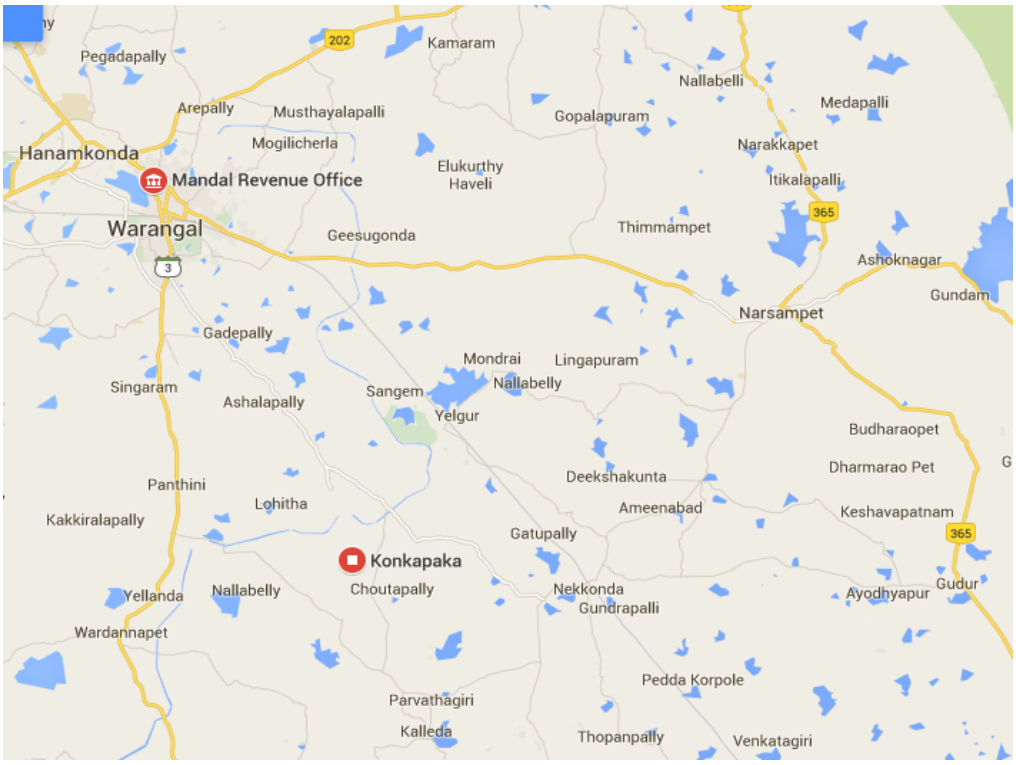

Fig-2: Map of Warangal District shows Mandals

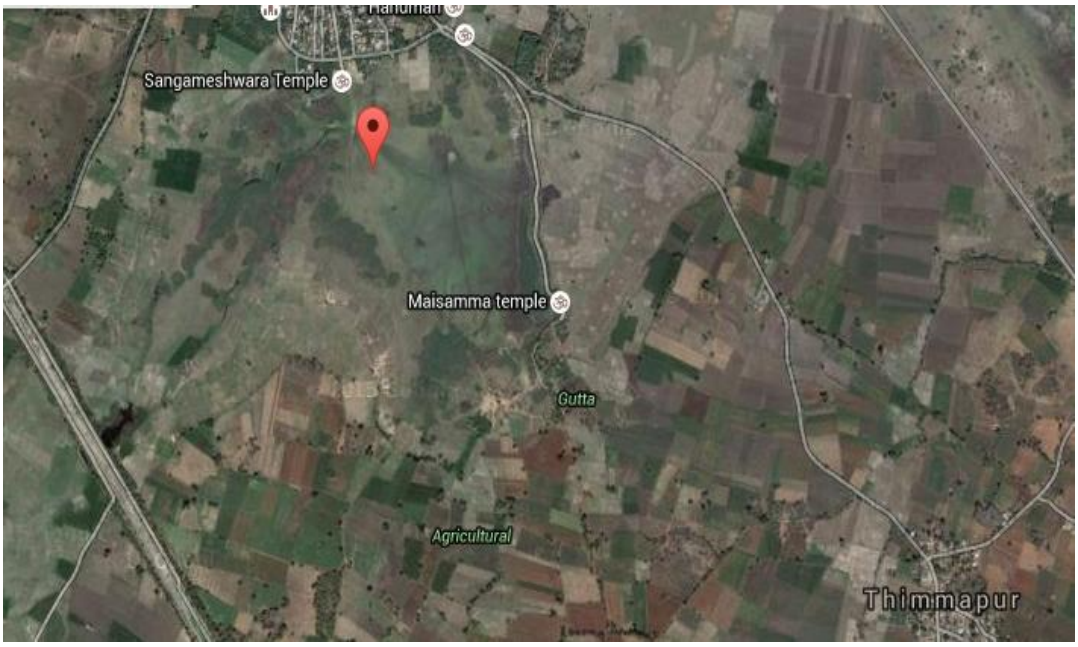

Fig-3: Satillite Image of Thimmapur Pond

Fig-4: Satillite Image of Upparapalle Pond

Fig-5: Satillite Image of Yellanda Pond

Sample Collection and Analysis

In order to collect the water samples from the three ponds there are three sampling sites in each pond were fixed and a composite sample was prepared inorder to minimise the error in the water quality if any. The water samples were always collected during early hours of the day. Prior to sample collection, all the sampling bottles were thoroughly washed, sun-dried and rinsed with the same water to be collected in the ponds. The sampling bottles were labeled with dates and collection sites. Until analysis, the collected water samples were kept in a cool container maintaining temperature below 25oC. Water temperature was measured at the pond sites using a mercury-in-glass thermometer graduated in degree Celsius (0-100^{o}C). The pH, ammonia, total alkalinity and total hardness were determined with Hach's Model FF-2 Aquaculture test kit. Dissolved Oxygen (DO) and BOD were determined by Wrinkler's method [29]. The Turbidity was determined using a Hach ratio Turbidimeter is described by APHA [1]. The electrical conductivity was measured with a conductivity meter (Lovibond US meter, type CM-21). The Total Dissolved Solids (TDS) was measured by filtering the water sample to remove the particulate matter, the filtrate evaporated to dryness and the residue weighed. The TDS was calculated according to Boy [2].Sodium and potassium ions were estimated by flame photometric method. Chlorinity was estimated by titration with silver nitrate ($AgNO_3$) in presence of chromate ions. Salinity was estimated from chlorinity as Salinity = Chlorinity x 1.805 + 0.03.

Data Analysis: The data obtained were subjected to Analysis of Variance using the Statistical Analysis SystemUser's Guide (SAS, 1999). Duncan's Multiple Range Test (Duncan, 1955) was performed to compare the means of the stations at P = ≤ 0.05 level of significance.

RESULTS AND DISCUSSION

The analytical data of the water samples are presented in Table 1. Different Physico - chemical parameters were analyzed in three ponds. The analysis show that the highest mean temperature of 27.00±2.00^{o}C was observed at Upperapalle pond, while the lowest temperature of 26.8±2.90^{0}C was observed in Thimmapur pond. The highest mean pH of 7.1±1.66 was observed in Thimmapur pond, while the lowest value of 6.83±1.59 was recorded in Yellanda pond. High value Ammonia-nitrogen level of 1.12±0.09 mg/l was observed in Yellanda pond, while the lowest mean of 0.95±0.05mg/l was recorded in Upperpalle pond. Highest DO content of 7.4±1.56 was recorded in Yellanda pond, while lowest of 6.8±1.02mg/l was observed in Thimmapur pond.

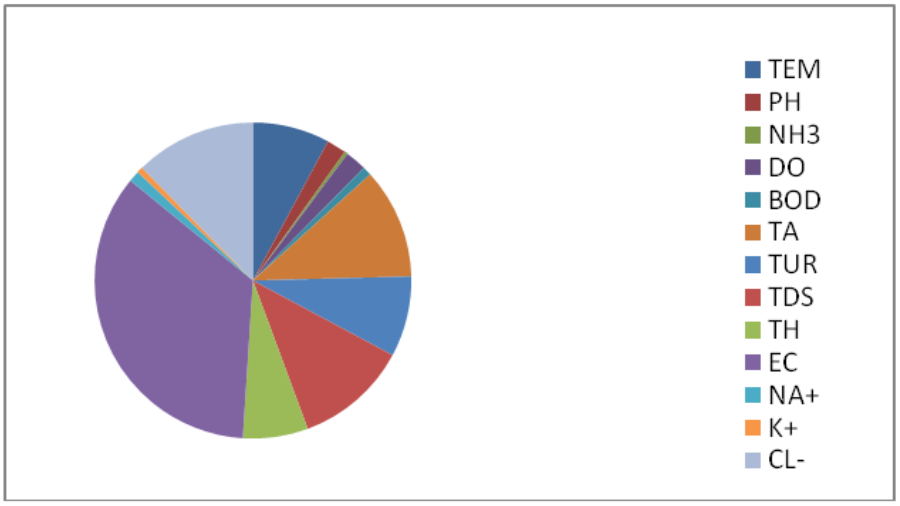

Fig-7: Parameters of Upperapalle pond

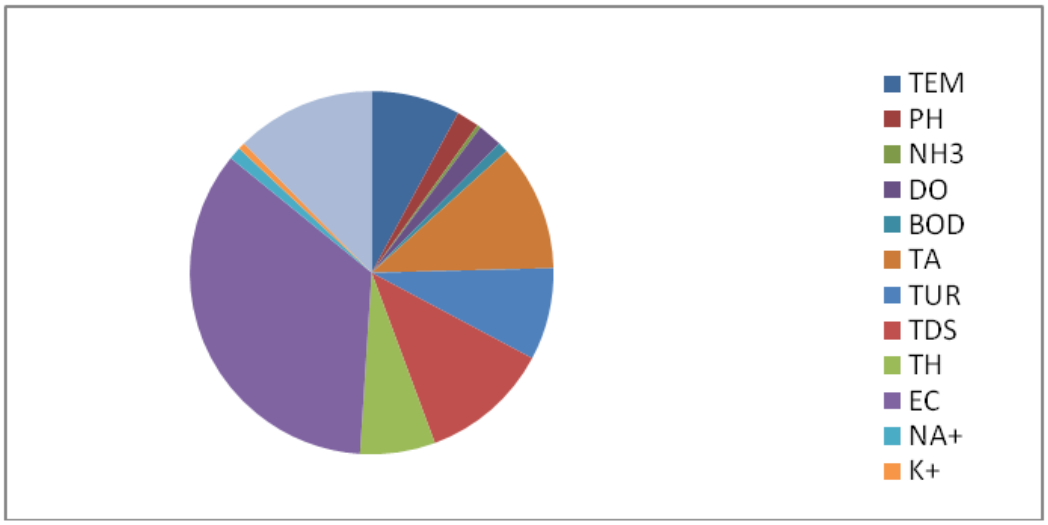

Fig-8: Parameters of Yellanda pond

Table-1: Shows Comparative account of the Physico-Chemical parameters of the THREE Ponds with FEPA and WHO limits

PARAMETERS	THIMMAPUR POND	UPPARAPALLE POND	YELLANDA POND	FEPA	WHO	DESIRABLE RANGE (Boyd .1990)
Temperature (0C)	26.8 ±2.90	27.00±2.00	26.90±1.86	27.0	<35	20-30
pH	7.1±1.66	6.90±1.08	6.83±1.59	6-9	6.5-8.5	6.5-9
Ammonia (NH3), (mg/I)	1.002±0.004	0.95±0.05	1.12±0.09			0.0125mg/l
DO (mg/I) .	6.8±1.02	7.0±0.93	7.4±1.56	8-10	8-10	5.0 mg/l to saturation
BOD (mg/l)	1.89±0.074	2.5±0.09	3.14±0.015	10	10	0.29mg/l
Total alkalinity (mg/I)	39.40±2.80	39.0±4.50	38.5±1.58		1.0	50-400mg/l
Turbidity (ppm)	24.00±1.00	27.80±1.89	28.00±2.44	1.0	500	10-1000 ppm
TDS(mg/l)	37.24±4.16	36.00±1.66	39.41±2.87	500		500mg/l (Sarkar, 2002)
Total hardness (mg/l)	23.80±1.62	19.95±1.89	22.78±1.37		200	50-400mg/l
EC(µmhos/cm)	115.06±6.54	116.0±4.98	118.9±3.872	200		20-1500 µmhos/cm (Abowe,2010)
Na+(Ppm)	3.8 ± 0.03	4.0 ±0.01	3.84 ± 0.01		200	___
K+ (Ppm)	1.73 ±0.001	1.86 ±0.021	2.1± 0.042			___
Chlorinity(ppm)	36.00 ±1.67	38.48 ± 2.45	42.24±3.21		250	___

The highest mean total alkalinity of 39.40±2.80 mg/l was observed in Thimmapur pond, while the lowest mean total alkalinity of 38.5±1.58 mg/l was observed in Yellanda pond. During our study it is observed that the water of these three ponds have been using for mostly cultivation and fish culture. These physico -chemical parameters of water however have tremendous influence on fish culture if not agriculture practices. Because these factors certainly, have influence on fish and other aquatic organism. Water temperature, an important parameter which influences the onset of fish spawn, growth of aquatic vegetation growth and the biological demand of the pond water. As water temperature increases, it holds less oxygen. The plants and animals also use more oxygen due to increase of respiration rate. These factors result in less availability of oxygen for fish in water. The water temperature observed in all the three ponds in this study is considered as normal temperature for aquatic life especially in the Indian region. Which is considered as the characteristic feature of medium humid climate [19]. The temperature observed in this study consider with the earlier report of Boyd [3] which is good for fish production. Water pH affects metabolic and physiological processes of fish and also exerts considerable influence on toxicity of ammonia [16]. Except the Yellanda pond, the pH of Thimmapur and Upperapalle pond water are desirable lower limit (Table 1). It is a common feature that the pond water in all areas in india appeared slightly acidic and may need lime application although their effect may be minimal on acidity [10, 15,]. This observation was thoroughly applicable here as no lime has been used in these three ponds to regulate the pH values of 6.5 to 6.6 are good for fish production, hence the pond water at Thimmapur and Upperapalle were appeared more conducive for fish culture. The acceptable range would be 6.5 to 9.0. Fish can become stressed in water with a PH ranging from 4.0-6.5 and 9.0-11.0. Fish growth is limited water of pH <6.5, reproduction ceases and fry can die at pH<5.0 [3]. Ammonia is introduced into the pond through dead phytoplankton, left over feed, dead and decaying organic matter. Fishes are very sensitive to un-ionized ammonia and needs an optimum range of 0.02-0.05mg/l (ICAR, 2006). Robinette (1976) reported that 0.12mg/l NH_3 caused reduction of growth and gill damage in Channel Catfish.

It is observed values in the present study that all the three pond waters were higher than desired range and this may affect the growth of fish. The higher ammonia content formed in the water may be attributed to the decomposition of various components in the pond water adding to then enhancement of ammonia content. Oxygen is a basic component for the body activities of the fish. It induced into the pond mainly through photosynthesis by aquatic green plants and dissolved oxygen from the air. Dissolved oxygen content of the water is measured as the amount of gaseous oxygen dissolved in an aqueous solution that plays a vital role in the biology of fish culture. [6, 9]. The mean DO values obtained in three ponds range from 6.8 ± 1.02 to 7.4±1.56 mg/l and which can sustain aquatic life. These values also agree with the minimum DO of 5.0 mg/l as reported for tropical fishes by Saloom and Duncan [25].Biological oxygen demand varied slightly among the three ponds are observed in the study areas. The BOD values are higher than the desirable levels as reported by Boyd [4]. in Table 1. The higher BOD values and their magnitudes may depend upon temperature, density of plankton, concentration of organic matter and the other related factors. Biological oxygen demand indicates as a potential parameter for reducing the Dissolving Oxygen content in water and this could result in organisms being stressed, suffocated and eventual leads to the death [1]. However, no fish was observed or seen under these stated conditions in this study. Alkalinity is a measure of the total concentration of bases in pond water and It is water's ability to resist changes in pH. A total alkalinity of at least 20ppm is necessary for good pond productivity. As a matter of fact the Water with high alkalinity and similar hardness Levels has a neutral or slightiy basic PH and does not fluctuate widely. The values obtained in this study are appreciable and fall within desirable range [2]. Turbidity levels in natural waters seldom exceed 20,000mg/l [17]. Turbidity restricts light penetration, limits photosynthesis and production of undesirable macrophysics in ponds [2]. The turbidity values obtained in all the three ponds are within the desirable range, are above the lower limit. Turbidity relates to the amount of materials present in the water and this could be as a result of input of wastes by the fish farmers into these ponds especially in Uppaerpalle and Yellanda pond. Water from the various ponds vary in solids concentrations depending on the degree of mineralization, amount of suspended clay and abundance of plankton [3]. Excessive organic manuring and feed wastage have been reported to increase TDS [20]. and often lead to poor water quality [16]. This could have also been responsible for the variation of TDS values (range 27.9±4.70 to 145.4±91.01mg/l). Water hardness is a measure of the alkaline earth metals such as Calcium and Magnesium concentration in water samples [9]. Apart from values for ponds in Thimmapur that are close to the desirable lower limit of 50mg/l [3]. Calcium and Magnesium are essential to fish for metabolic reactions in bone and scale formation. Additionally, hardness and total alkalinity can affect PH through interaction with the carbon di oxide cycle. Hard water has a higher concentration of alkaline earth metals, Thus the water in the three ponds under study were not hard but softer. The content of the electrical conductivity was at average levels of 115.06±6.54 to 118.9±3.872 µmhos/cm. These values show the extent to which the ponds contain dissolved solids and which enter the pond water through pollutants. This Could be detrimental to the survival of aquatic life in these ponds. Boyd [3] stated that specific Conductance for fresh water often range from <25 to >500µmhos/cm, but in some polluted waters it may reach 10,000 hs/cm. hence values obtained in this study fall within the acceptable limits. In comparison, the observed values of the parameters fall within FEPA and WHO [3, 30]. standards for good water for pond fish culture. Chloride anion is generally present in natural waters. Chloride concentration is higher in organic wastes and its higher concentration in natural water is definite indication of pollution from domestic sewage. The ecological significance of chloride lies in its potential to regulate salinity of water. Most of the water soluble salts in a pond environment generally remain in Cl^- form and hence the amount of Cl^- ions in pond water indicates very closely the amount of soluble salts present. The optimum concentration of chloride ion in fresh water aquaculture are not through studies, however it is reported that1-100ppm concentrations are usually considered to be favorable(5). However, the standard limit set by WHO is 250 ppm. All the three ponds have recorded less than the WHO standard. Sodium and Potassium is one of the major cations in water and soil. Fish ponds are usually considered to be fairly well supplied with potassium [8]. High clay and organic matter content of productive fish pond soils [28], associated with alkaline pH values usually tend to maintain moderate to good amount of potassium (K) in pond soil and water [5]. However, with increasing use of N and P fertilizers, potassium isgradually becoming the limiting nutrient, and estimation of potassium ion in pond water is becoming important [5]. The potassium ion concentration did not show significant concentration with any other parameter. Generally, sodium (Na) is not included in regular analysis of pond water. However, in brackishwater ponds Na occurs in very high concentration and determination of this element may be felt necessary. In the present study, the sodium ion content was low ranging from 3.8 ppm (Thimmapur) to 4.0 ppm (Upperapalle).

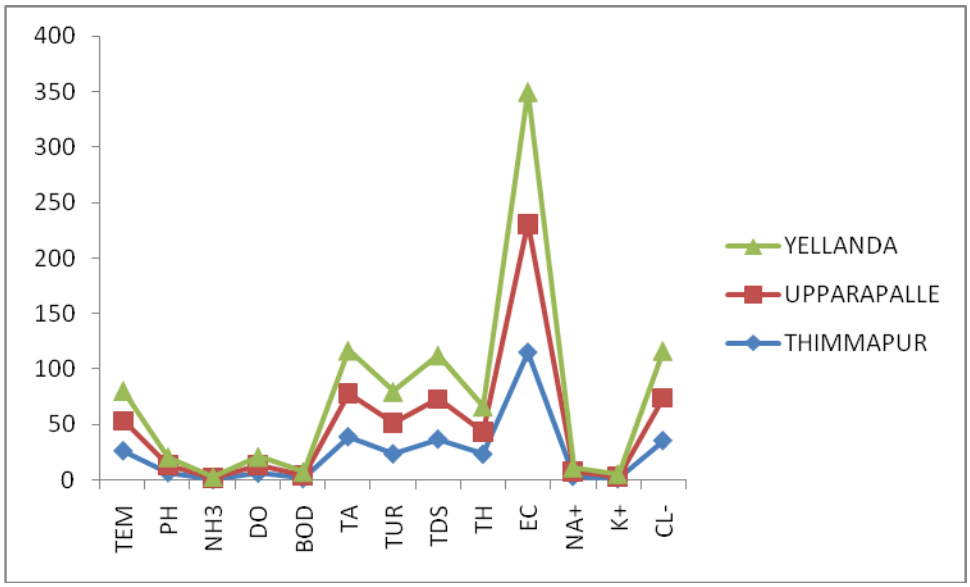

Fig-9: Comparison of Physico–Chemical Parameters of Three ponds

CONCLUSION

This study observed that fish farmers in the investigated areas used slightly acidic water for fish production while ammonia, BOD and electrical conductivity levels were fairly high. The high content of BOD will deplete the DO amount which will eventually be harmful to aquatic life. Lime application will correct pH to a more acceptable level for fertilizer use. There is also the desirable need to analyze the pond water at regular intervals. Farmers should be educated on better managerial practices bordering on feeding practices, pond management, good water exchange practice to reduce organic load and waste accumulation. This will ensure that some of the parameters in this study will not exceed levels that could be harmful to fish in the environment. Such a measure will guarantee the safety of the aquatic ecosystem, humans and environment for good and healthy production of fish for consumption. Further detailed analysis in different seasons involving other related Parameters as well, will throw more light on the status of these ponds.

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