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Environmental Perspectives of the Hydrographical Features of Three Different Ponds in Kokkallur Region of Balussery Panchayat, Kozhikode District

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Abstract: **The world's pond ecosystems are being threatened by many factors. These include a variety of anthropogenic activities, which entail urgent need of research and education programs to create awareness in the society for their protection and conservation. In the present work, hydrographical features of three different ponds in Kokkallur region of Balussery panchayath of Kozhikode district was monitored. The study was conducted on three ponds in Kokkallur village namely, Chenery pond, Parakulam pond, Muryankulangara pond. The objectives of the study were to investigate the seasonal variations of hydrographical features such as temperature, pH, transparency, salinity, carbon dioxide, dissolved oxygen, Biological Oxygen Demand and primary productivity of the selected ponds. Water samples were collected during the year 2019-2020 from the study area and the hydrographical features were analysed with respect to the seasons following standard methods. The study indicated that there is a pronounced variation of most of the water quality parameters with variations in season. The alteration of these water quality parameters may provide an early warning signal about the degradation of these pristine ecosystems. The pond water quality is degraded mainly due to discharge of wastes from residential area, sewage outlets, soil wastes, detergents and automobile oil wastes. The findings of the present study also provide a better understanding of this damaged ecosystem and remind the need for the rejuvenation of these natural paradise for enhancing the fishery potential and maintaining the ecological sustenance of this fresh water ecosystem. The main objective of this study is to disseminate information on importance of ponds for their effective conservation and management strategies, especially in India's current scenario. The available studies show that the ponds in India are under threat due to increase in pollution rates and encroachment.**

***Keywords*: Hydrographical features, salinity, DO,BOD,COD**

OBJECTIVES OF THE STUDY

- The purpose of the work is to remind the need for the rejuvenation of pond ecosystems for enhancing the fishery potential and maintaining the ecological sustenance of this fresh water ecosystem.
- The main objective of this study is to disseminate information on importance of ponds for their effective conservation and management strategies, especially in India's current scenario.
- The study indicated that there is a pronounced variation of most of the water quality parameters with variations in season. The alteration of these water quality parameters may provide an early warning signal about the degradation of these pristine ecosystems.
- The study highlights the point that anthropogenic pressure is responsible for the degradation of pond ecosystems and found that the pond water is unsuitable for drinking and other domestic purposes.
- Water quality is the most important factor affecting fish health and performance in aqua culture production system, through providing good water quality, ponds can be used for fish culture and also for irrigation.

- The main objective of the study was to investigate the seasonal variations of hydrographical features such as temperature, pH, transparency, hardness, salinity, ammonia, carbon dioxide, Dissolved oxygen, Biological Oxygen Demand , Primary productivity and Chemical Oxygen Demand of three different ponds in Kokkallur region.
- The study deals with the assessment of fluctuations in the physico-chemical characteristics of three ponds in Kokkallur region that would form a reminder to conserve these precious ecosystems.

I. INTRODUCTION

Life on the earth is not possible without water, because it is the most essential constituent of the environment. Out of many fresh water sources, ponds are useful in many ways and it is one of the methods of artificial infiltration of underground water. Unlike the river ecosystem, the pond ecosystem is categorized under the lentic ecosystem for the reason that the water remains stagnant in ponds for a relatively longer period of time. Ponds are the important habitats and they provide water for domestic, industrial and agricultural uses as well as providing food.

Ponds are important hotspots of biodiversity. Collectively they support more species, and more scarce species, than any other fresh water habitat (Cereghino *et al.,* 2008). They are more abundant than any other fresh water habitats, they often contribute more to regional biodiversity than river or other fresh water habitat. Ponds are easily disrupted by human activity. The pond water is polluted mainly due to discharge of wastes from residential area, sewage outlets, solid wastes, detergents and automobile oil waste (Bhuiyan and Gupta, 2007). Physico-chemical parameter analysis of any aquatic ecosystem is necessary because their hydro chemistry affects its biota to a great extent. Water quality influences the existence of aquatic organisms (Jyotsna ,2014).

The hydrographical features of pond water have a direct impact on prevailing organisms as well as human being using such water. The study of different water quality parameters helps in understanding the metabolic events of the aquatic system. Certain parameters such as temperature, p^H, transparency, salinity, carbon dioxide, Dissolved oxygen, Biological Oxygen Demand and primary productivity are necessary for the proper understanding of flora and fauna and their abundance and distribution with time. The changes in these parameters provide valuable information on the quality of water, the source of the variations and their impacts on the functions and biodiversity of the pond. Hence the present study deals with the assessment of fluctuations in the physico-chemical characteristics of three ponds in Kokkallur region that would form a reminder to conserve these precious ecosystems that were facing high threat due to high anthropogenic activities. The conservation of these water-bodies are necessary for implementing solutions for water shortage problems.

II. MATERIALS AND METHODS

Water samples were collected during the year June 2019-June2020 from the study area using wide mouthed 1000ml polyethylene plastic bottles from three sampling points by direct immersion of bottles at water sampling points handled by rope. The containers must be capable of being tightly sealed either by stopper or cap. The collections were made once in a month at the time i.e., 7.00 to 8.30 am and from same sites throughout the period of study.Bottles were preserved using icebox and transported to the laboratory bottles and the physico-chemical parameters were analysed following standard methods of APHA (2005).

Study Area

Kokkallur is located in Balussery gramma panchayath, Kozhikode district, Kerala. Kokkallur is a village in Balussery panchayat in Kozhikode district. People of this area earns their lives by farming. More than 6 ponds situated in Kokkallur village. Of these 3 ponds were selected for the analysis of physico-chemical factors.

Site 1 (Chenery pond)

Chenery is a place in Kokallur geographical area of Kokallur is 1617 hectares. Agriculture is the main professional livelihood of people of this village. Many plants and trees are located around the pond. People use this pond for washing purpose.

Site 2 (Parakulam pond)

Parakulam, pond is situated in Narikodankandy region of Kokkallur. Pisciculture is conducted in this pond. It is situated 1 km away from the highway side. It is covered by rocky area so the name Parakulam native people come to this pond for fish yield. Fish hunting practised in this pond for nearly past 4 years. This pond give economy for the local people through the fish yield.

Site 3 (Muryan kulangara pond)

Muryankulangara pond is located in Muryan kulangara region of Kokallur. This pond is situated in Puthoor vattom road. It is situated nearly to the road side. It is a region covered by lots of shrubs and trees. Local people use this pond for washing and irrigation purpose.

III. RESULTS

Temperature

The temperature showed a minimum range of 26 ^oC and exhibited maximum range of 31^oC. All these sites showed an average temperature ranges from26^oC to 31^oC. In pre monsoon period, the temperature ranges 28^oC to 31^oC. A high range of temperature was observed in site 2 (30^oC) and a lowest temperature was observed in site 1 and 3 (28^oC). In monsoon period, the temperature ranges from 26^oC to 27^oC. Ahigh range of temperature was observed in site 2 and site 3

(27 ^{o}C) and low was exhibited in site 1 (26^{o}C). The temperature of water samples in the post monsoon period ranges from 29^{o}C to 31^{o}C. A higher temperature was shown in the site 3 (31^{o}C) and lower range was noticed in the site 1 (29^{o}C). (Table 1 and Fig 1). The mean ± standard deviation ranges from 28.6 ± 1.15 to 30±1.

Map Showing the Study Sites in Kokkallur Region

Site 1 (Chenery pond)

Site 2 (Parakulam pond)

Site 3 (Muryanklangara pond)

pH

From the study, in pre monsoon season pH ranges from 6 to 6.5. In pre monsoon season a higher level of pH was observed in site 1(6.5) and lower pH was observed in site 2 and 3 (6). In monsoon season the pH ranges from 6 to 6.2. A higher level of pH was observed in site 3 (6.2) and lower pH in site 1 (6). The pH of water sample in post monsoon season ranges from 5.5 to 6.3. A higher level of pH was observed in site 1 (6.3) and lower pH in site 3 (5.5). The three sites showed almost acidic pH in all seasons. (Table 1 and Fig 2). The mean ± standard deviation ranges from 6.16 ± 0.28 to 5.93 ±0.4.

Transparency

Transparency range showed variations in all the seasons. A higher transparency value was noticed about 36.5cm in site 3 of post monsoon season. The lower range was 5cm in site 1 of pre monsoon season. In pre monsoon season the transparency of water ranges from 5 to 29 cm. Transparency of water in monsoon season ranges from 8.5 to 32.5cm. A high range of transparency observed in site 3 in all seasons and a lower range was observed in site 1 in all seasons. (Table 1 and Fig. 3). The mean ± standard deviation ranges from 17.3 ± 12.01 to 22.83 ± 11.87.

Hardness

Hardness of the water sample in the pre monsoon season ranges from 22 to 42mg/l. Highest range was observed in site 3 (42mg/l) and lowest range was shown in site 2 (22mg/l). In monsoon season, hardness ranges from 28 to 46 mg/l. In monsoon season maximum hardness showed in site 3 (46mg/l) and minimum hardness showed in site 2 (28mg/l). In post monsoon season hardness ranges from 16 to 36.5 mg/l. A high range of hardness was observed in site 3 (46mg/l) and lower range of hardness was observed in site 2(16mg/l). (Table1 and Fig. 4). The mean ± standard deviation was about 32.6 ± 12.22 to 28.83±11.18.

Salinity

Salinity of water samples in the pre monsoon season ranges from 3.2 to 9.7mg/l. A highest range was obtained in site 3(9.7mg/l) and lowest range was observed in site 1(3.2mg/l). In monsoon season salinity ranges from 3.2 to 9.6 mg/l. Maximum range was observed on site 3 (9.6mg/l) and minimum range was shown in site 1 (3.2mg/l). Salinity of water sample in the post monsoon season ranges from 3.1 to 9.4 mg/l. The site1 shows comparatively minimum range of salinity in all seasons. (Table 1 and Fig 5). The mean ± standard deviation ranges from 6.4±3.25 to 6.3±3.15.

Ammonia

Ammonia of water sample in the pre monsoon season ranges from 17 to 42.5mg/l. The maximum range was observed in site 3 (42.5 mg/l) and minimum range was observed in site 2 (17 mg/l). In monsoon season ammonia of water sample ranges from 17 to 34 mg/l. The maximum range was obtained in site 3 (34 mg/l) and minimum range was observed in site 1 (17 mg/l). Ammonia of water sample in post monsoon season ranges from 25.5 to 51 mg/l. A highest range was observed in site 3 (51 mg/l) and lowest range was observed in site 2 (25.5mg/l). The site 3 shows comparatively highest range of ammonia in all seasons. (Table1 and Fig 6). The mean ± standard deviation ranges from 31.16 ± 12.9 to 39.6 ± 12.9.

Carbon dioxide

Carbon dioxide in water sample in pre monsoon season ranges from 10.6 to 33.4mg/l. The maximum range was observed in site 3 (33.4 mg/l) and minimum range was observed in site 2 (10.6 mg/l). In monsoon season, carbon

dioxide of water samples ranges from 16.4 to 45 mg/l. The maximum range was observed in site3 (45 mg/l) and minimum range was observed in site 2 (16.4 mg/l). Carbon dioxide of water sample in post monsoon season ranges from 20 to 29.4 mg/l. Maximum range was observed in site 3 (29.4 mg/l) and minimum range was observed in site (20mg/l). (Table 1 and Fig 7). The mean ± standard deviation ranges from 19.4±12.3 to 23.8 ± 4.95.

Dissolved oxygen

Dissolved oxygen of water samples in the pre monsoon season ranges from 6 to 10.5 mg/l. The maximum range was observed in site1 (10.5mg/l) and minimum range was obtained in site2 (6 mg/l). Dissolved oxygen of water sample in monsoon season ranges from 7.4 to 9.1 mg/l. Maximum range was observed in site 1(9.1 mg/l) and minimum range was observed in site 3 (7.4 mg/l). Dissolved oxygen of water sample in post monsoon season ranges from 5.9 to 8.5 mg/l. The maximum range was observed in site 2(8.48 mg/l) and minimum range was showed in site 3 (5.9 mg/l). (Table 1 and Fig. 8). The mean ± standard deviation ranges from 8.3 ± 2.3 to 7±1.3.

Biological Oxygen Demand

Biological oxygen demand of water sample in the pre monsoon season ranges from 0.6 to 1 mg/l. highest range was observed in site 2 (1mg/l) and minimum range was showed in site 3 (0.6 mg/l). In monsoon season Biologial Oxygen Demand ranges from 0.5 to 0.8mg/l. Maximum range was observed in site 2 (0.8 mg/l) and minimum range was observed in site 1 and 2 (0.5 mg/l). Biological Oxygen Demand of water samples in the post monsoon season ranges from 0.5 to 1.5 mg/l. Maximum range was observed in site 3 (1.5 mg/l) and minimum range was observed in site 2 (0.5 mg/l). (Table 1 and Fig. 9). The mean ± standard deviation was about 0.8 ± 0.2 to 1.06 ± 0 .51.

Primary productivity

Gross primary productivity (GPP) of water sample ranges from 0.20 to 0.55mgC/m^3/hr in pre monsoon season. Maximum range was observed in site 3 (0.55 mg/l) and minimum range was observed in site1(0.20 mgC/ m^3/hr). in monsoon season GPP varies from 0.28 to 0.5 mg/l. maximum range was observed in site 1(0.5 mgC/m^3/hr) and minimum range was observed in site 3(0.28 mg C/m^3/hr).In post monsoon period GPP ranges from 0.2 t0 0.23mg/l. maximum range was observed in site 2(0.23 mgC/m^3/hr)and minimum range was observed in site 1 and 3(0.2 mgC/ m^3/hr).(Table1 and Fig10). The mean ±standard deviation ranges from 0.33±0.18to 0.21±0.01.

Net primary productivity(NPP) of water sample ranges from 0.041to 0.092 mgC/ m^3/hr in pre monsoon season. Maximum range was observed in site 3 (0.092 mgC/ m^3/hr). minimum range was observed in site1(0.04 mgC/ m^3/hr). In monsoon period NPP ranges from 0.041 to 0.09. maximum range was observed in site 3(0.092 mgC/ m^3/hr) and minimum range was observed in site 1(0.04 mgC/ m^3/hr). In post monsoon season NPP ranges from 0.04 to 0.07 mgC/ m^3/hr. Maximum range was observed in 2(0.07 mgC/ m^3/hr) and minimum range was observed in site 1 and 3(0.04 mgC/m^3/hr). (Table 1 and Fig. 11). The mean ± standard deviation ranges from 0.07 ± 0.02 to 0.05 ± 0.01.

Chemical Oxygen Demand

Chemical Oxygen Demand of water sample in pre monsoon ranges from 1.6 to 6.3 mg/l. Maximum range was observed in site 1 (6.3 mg/l) and minimum range was observed in site 2 (1.6 mg/l). In monsoon season Chemical Oxygen Demand ranges from 4.8 to 8 mg/l. The maximum range was observed in site 2 (8 mg/l) and minimum range was observed in site 3 (4.8 mg/l). Chemical Oxygen Demand water sample in post monsoon season ranges from 1.6 to 4.8 mg/l. The maximum range was observed in site 1 (4.8 mg/l) and minimum range was observed in site 2 (1.6 mg/l). (Table 1 and Fig 12). The mean ± standard deviation ranges from 4.2 ±2.4 to 3.2 ± 1.

IV. DISCUSSION

Hydrographical features of water are highly influenced by the richness of biota, its exploitation and distribution (Unanum & Apkan ,2006). Ponds are important hotspots of biodiversity. They support more species than any other water habitat. They are more abundant than any other fresh water habitats and are found in virtually all environments.

The pond water temperature is highly influenced by local climatic conditions. Temperature has an important role in physical, chemical and biological properties of water. Water temperature values ranged from 26^{o}C to 31^{o}C. The minimum value was recorded in monsoon period and maximum in post monsoon period. The temperature difference might be either due to geographical differences in the location or due to difference between the collection times (Madhuri Pejaver & Minakshi Gurav**,** 2008). Considering the three sites, high temperature was recorded in site 3 (31^{o}C) during the post monsoon period. The concentration of dissolved oxygen in surface water is affected by temperature and has both a seasonal and a daily cycle. Cold water can hold more dissolved oxygen than warm water. In winter and early spring, when the water temperature is low, the dissolved oxygen concentration is high. In summer and fall, when the water temperature is high, the dissolved-oxygen concentration is often lower. According to Desai (1995) water temperature varies depending on the season. This is reflected by lower water temperature at site 1 in monsoon due to cloudy weather and rainfall.

TABLE

Parameters	**Season**	**Site 1**		**Site 2**	**Site 3**	**Mean±STD**
Temperature (^oC)	PREMONSOON (February-May)	28		30	28	28.6±1.15
	MONSOON(June-September)	26		27	27	26.6±0.57
	POSTMONSOON (October-January)	29		30	31	30±1
pH (BIS 10500:1991)(6.5-8.5)	PREMONSOON	6.5		6	6	6.16±0.28
	MONSOON	6		6.1	6.2	6.1±0.1
	POSTMONSOON	6.3		6	5.5	5.93±0.4
Transparency (cm)	PREMONSOON	5		29	18	17.3±12.01
	MONSOON	8.5		20	32.6	20.36±12.05
	POSTMONSOON	15		17	36.5	22.83±11.87
Hardness (mg/l) (BIS 10500:1991)(100)	PREMONSOON	30		22	46	32.6±12.22
	MONSOON	32		28	42	34±7.21
	POSTMONSOON	34		16	36.5	28.83±11.18
Salinity (mg/l)	PREMONSOON	3.2		6.4	9.7	6.4±3.3
	MONSOON	3.2		6.2	9.6	6.3 ±3.2
	POSTMONSOON	3.1		6.4	9.4	6.3 ± 3.1
Ammonia (mg/l)	PREMONSOON	34		17	42.5	31.1 ±12.9
	MONSOON	17		25.5	34	25.5± 8.5
	POSTMONSOON	42.5		25.5	51	39.6 ±12.9
CO_2 (mg/l)	PREMONSOON	14.2		10.6	33.4	19.4 ±12.3
	MONSOON	22.4		16.4	45	27.9±15
	POSTMONSOON	20		22	29.4	23.8 ±4.1
Dissolved Oxygen (mg/l) (BIS 10500:1991)(4-6)	PREMONSOON	10.5		6	8.3	8.3 ±2.3
	MONSOON	9.1		8.5	7.4	8.3 ±0.9
	POSTMONSOON	6.8		8.5	5.9	7±1.3
BOD (mg/l)) (BIS 10500:1991)(5)	PREMONSOON	0.8		1	0.6	0.8±0.2
	MONSOON	0.5		0.8	0.5	0.6±0.17
	POSTMONSOON	1.2		0.5	1.5	1.06±0.51
Primary Productivity ($mgC/m^3/hr$)	PREMONSOON	GPP	0.2	0.25	0.55	0.33±0.18
		NPP	0.041	0.091	0.092	0.07±0.02
	MONSOON	GPP	0.50	0.42	0.28	0.39±0.11
		NPP	0.04	0.07	0.090	0.06±0.02
	PO ST MONSOON	GPP	0.2	0.23	0.2	0.21±0.01
		NPP	0.04	0.07	0.04	0.05±0.01
COD (mg/l)	PREMONSOON		6.3	1.6	4.8	4.2±2.4
	MONSOON		6.4	8	4.8	6.4±1.6
	POSTMONSOON		4.8	1.6	3.2	3.2±1.6

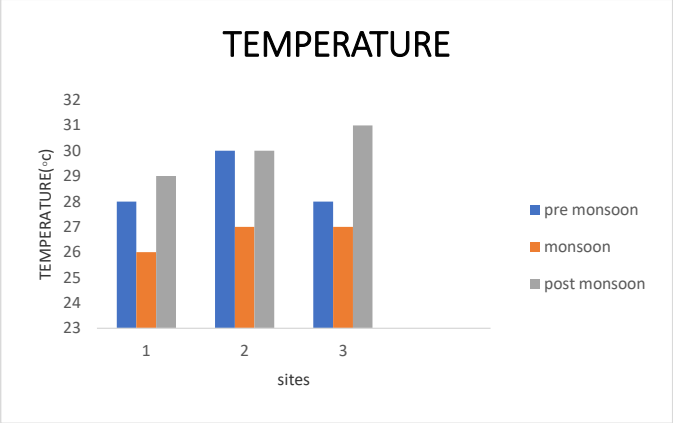

Fig. 1: Graph showing seasonal variations of temperature

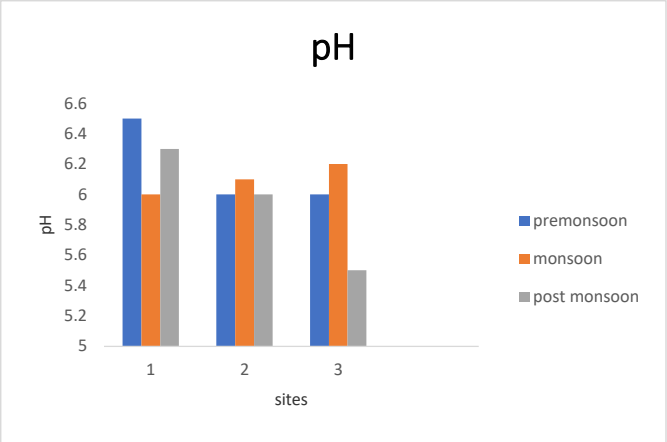

Fig. 2: Graph showing seasonal variations of pH

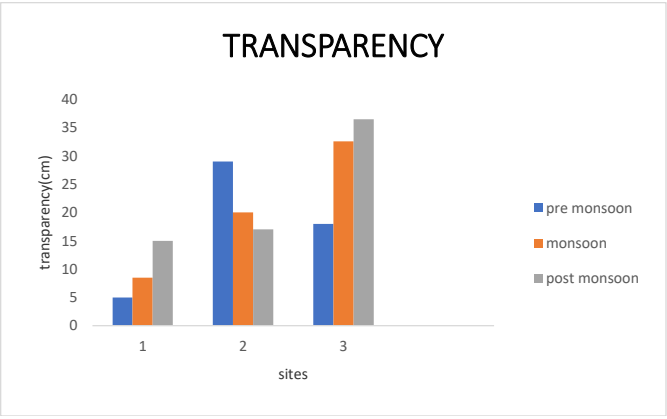

Fig. 3: Graph showing seasonal variations of transparency

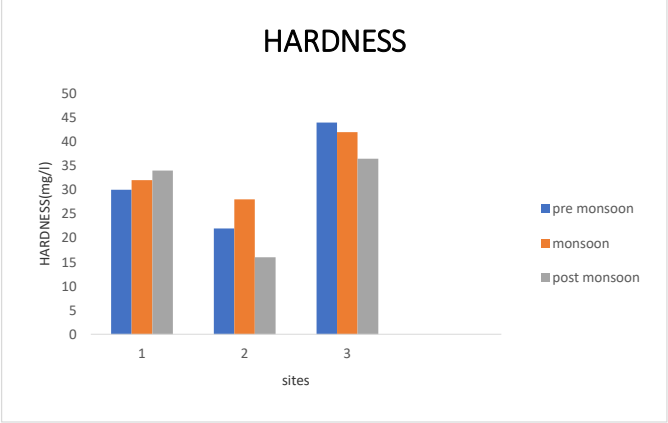

Fig 4: Graph showing seasonal variations of hardness

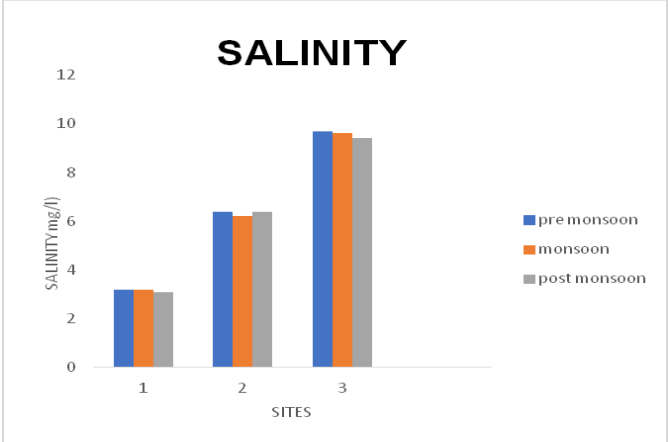

Fig. 5: Graph showing seasonal variations of salinity

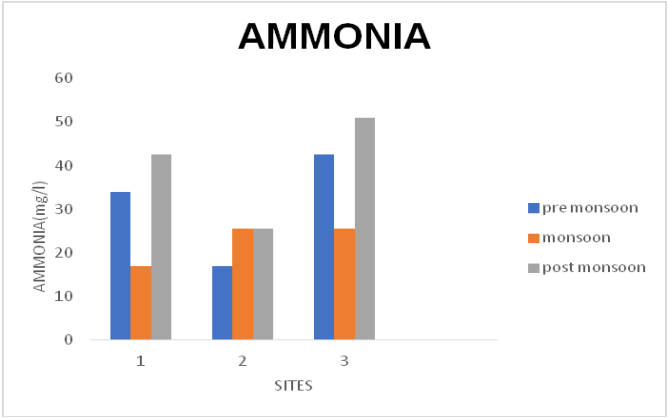

Fig. 6: Graph showing seasonal variations of ammonia

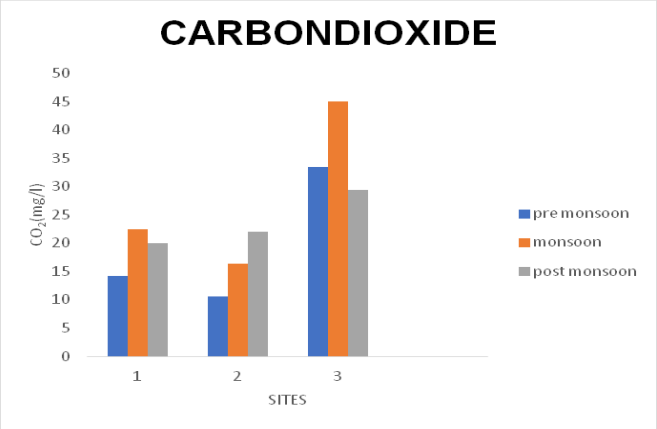

Fig. 7: Graph showing seasonal variations of Carbondioxide

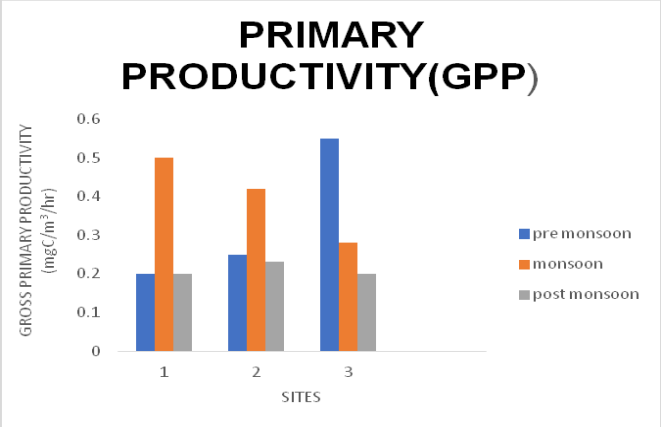

Fig. 10: Graph showing seasonal variations of primary productivity

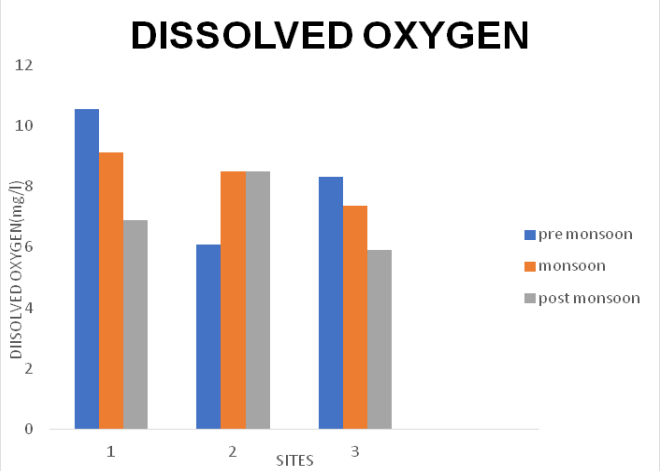

Fig. 8: Graph showing seasonal variations of dissolved oxygen

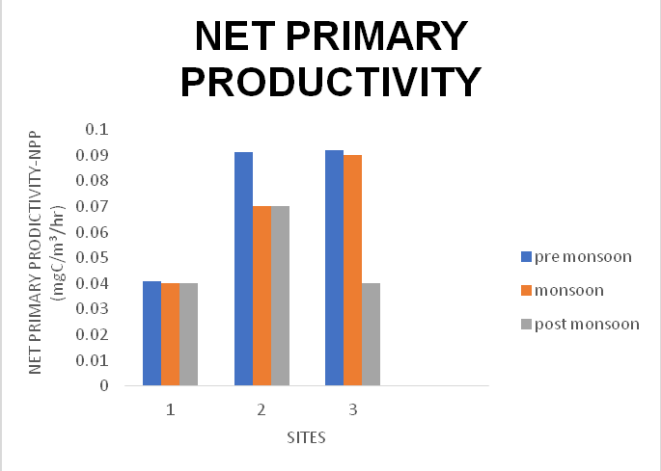

Fig. 11: Graph showing seasonal variations of primary productivity

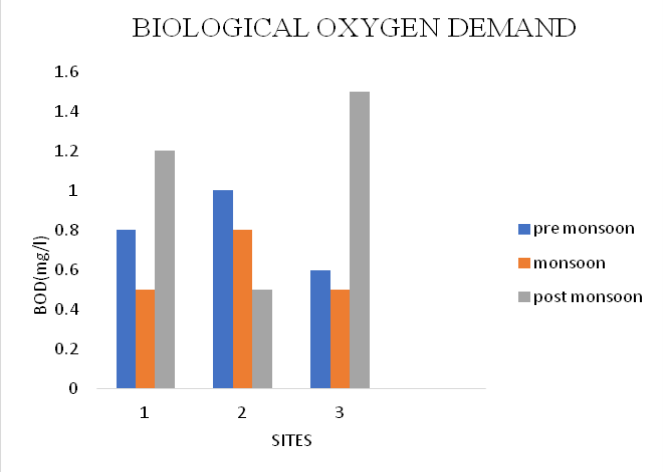

Fig. 9: Graph showing seasonal variations of BOD

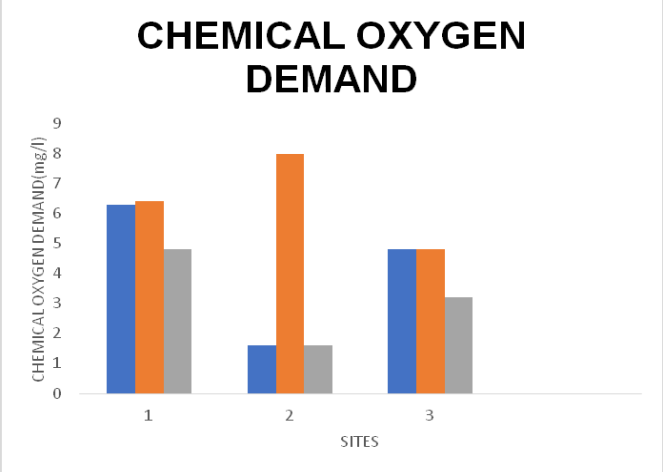

Fig. 12: Graph showing seasonal variations of COD

The pH of pond water is considered as an index of environmental conditions. It affects the biochemical reactions and controls the activities and distribution of aquatic fauna and flora. A slight variation, in the p H can change the acidity or alkalinity of water. In the present study the pH value was maximum in pre monsoon period (6.5) and minimum in post monsoon period (5.5). The high value of pH 6.5 observed in site1 during pre-monsoon period. The amount of calcium increases during pre-monsoon period due to rapid oxidation or decomposition of organic matter and pH becomes an alkaline state (Billore, 1981). Site 3 showed a low pH value of 5.5 during post monsoon season. Slight deviation can be attributed to the anthropogenic activities like improper irrigation and weathering process (Sajitha *et al*, 2016).

Transparency is the measurement of light penetration in the water body. The secchi disc transparency correlates closely with the percentage of transmission of light. The average range of transparency was 17.3 cm to22.83 cm. High transparency was of 36.5 cm was observed in site 3 during post monsoon season. Transparency of water is generally influenced by factors like wind action, suspended silt particles, plankton concentration and decomposition of organic matter at the bottom (Gorde *et al*.,2013).

Water hardness is mainly caused by the presence of iron, magnesium and calcium ions and also because of Al,Zn, Ni and some other heavy metals in water. In the present study hardness varied from 16 to 46 mg/l in different seasons. Maximum hardness is recorded in site 3 (46 mg/l) during the monsoon season and minimum hardness was recorded in site 2 (16mg/l) during the post monsoon period. According to APHA (2005) the desirable limit for hardness is 300 mg/l. Compared to the desirable limit, the values of the sample are found to be within the limit. Hardness is an important parameter in the detection of water pollution and causes various diseases.

Salinity is the saltiness or dissolved salt content of a body of water. In the present study it has been observed that salinity ranged from 3.1 to 9.7mg/l. Maximum salinity is recorded in site 3 (9.7mg/l) during the pre-monsoon period and minimum is recorded in site 1 (3.1 mg/l) during the post monsoon period.

Ammonia is lethal to aquatic life even if present in small concentration. In the present study , the amount of ammonia ranged from 17 to 51 mg/l. The maximum range of ammonia was observed in site 3 (51 mg/l) during the post monsoon season. Higher value of ammonia was observed in all sites during the post monsoon season. When algae and other suspended microorganisms die and settle down to bottom and release their nitrogen content during decomposition. Ammonia in natural waters can be traced to percolating nitrates from sources such as decaying plant and animal material, agricultural fertilizers and domestic sewage(Adeyeye *et al* ., 2004) . Drinking water containing more than 500 mg/l ammonia can cause methamoglobinemia in infants (Uba & Aghogho, 2011). High amount of ammonia in water bodies cause over growth of algae and other organisms and produce foul smell.

Carbon dioxide is the end product of organic carbon degradation in almost all aquatic environments and its variation is often a measure of net ecosystem metabolism (Hopkinson , 1985) . In the present study the maximum carbon dioxide range was recorded in site 3 (45 mg/l) during the monsoon period and minimum range was recorded in site 1(14.2mg/l)pre monsoon period. (Gurumayum *et al* ., 2002)also reported higher values of free CO_2 during monsoon months . According to Joshi *et al.,* (1995), the increase in carbon dioxide may be due to decay and decomposition of organic matter.

Dissolved oxygen is one of the most important parameters of the water quality and fundamental requirement of plant and animal life in water. Dissolved oxygen indicates the level of water quality and organic production in the water. In the present study, the range of dissolved oxygen varied from 5.9 to 10.5 mg/l. According to Chaurasia and Pandey (2007), the quantity of dissolved oxygen in water is directly or indirectly depends on water temperature, partial pressure of air. Rodgi and Nimbergi (1978) found that disposal of domestic sewage and other oxygen demanding wastes reduced the dissolved oxygen of the receiving water body. The maximum range of DO was recorded in site 1 (10.5 mg/l) during the premonsoon and minimum range was recorded in site 3 (5.9) during post monsoon period.

Biological Oxygen Demand is the measure of organic material contamination in water. It is the measure of degradable organic matter present in water. The BOD and other microbial activities are generally increased by the introduction of sewage (Hynes, 1971). BOD values ranged from 0.5 to 1.5 mg/l. The maximum value of BOD was observed in the site 3 (1.5 mg/l) during the post monsoon season. Higher values of BOD indicate the higher consumption of oxygen and higher microbial population load in the pond water (Sayeswara *et al* ., 2010).

Primary productivity is the synthesis of organic compounds from aqueous carbon dioxide. Phytoplanktons are the major producers in aquatic ecosystems. Ecologists define primary productivity in flora as the efficiency in collecting carbon in the form of CO_2. Primary productivity in a standing water ecosystem depends on the chemical nature of the basin ,the nature of imports from streams and land, and the depth of water body.

The GPP value ranged from0.2 to 0.55 mg/l and NPP value ranged from 0.04 t0 0.092. No ponds showed a complete absence of primary productivity.This might be due to desirable p H , temperature, nutrient contents and phytoplanktons. The maximum range of GPP and NPP are recorded in site 3(GPP-0.55 , NPP-0.092) during pre-monsoon period.Higher primary productivity during pre-monsoon period might be due to longer hours of sunshine and higher temperature as reported by Khan and Siddiqui(1971), Sharma and Sahai (1988).

Chemical Oxygen Demand is an important parameter assessing the carbonaceous fraction of organic matter. COD of water sample ranged from 1.6 to 8 mg/l. Highest range of COD was observed in monsoon season (8 mg/l) lowest range was observed in pre monsoon season (16 mg/l).(APHA 2005).

V. Conclusion

The present study indicates that the seasonal variations of physico-chemical parameters of three different ponds in Kokkallur region of Balussery panchayath namely (1)Chenery pond (2) Parakulam pond (3)Muryankulangara pond. The study indicates that there is a pronounced variation of most of the water quality parameters with variations in season. The temperature range was maximum in post monsoon period and minimum value was recorded in monsoon period .pH value was maximum in pre monsoon period and pH value was minimum in post monsoon period.Moderately high levels of transparency was observed in post monsoon period.High levels of hardness was recorded in the monsoon season. Salinity was maximum in the pre monsoon period. Ammonia was maximum in the post monsoon period. Higher values of ammonia were observed in all sites during post monsoon season.Carbon dioxide is maximum in the monsoon period. Increased carbon dioxide affects the pH which affects the biota of that region. Dissolved oxygen and Biological Oxygen Demand are depended each other. The maximum value of BOD is noticed in the post monsoon season. Maximum range of primary productivity was observed in pre monsoon period. Higher range of COD was observed in monsoon season. Ponds have been used as a traditional source of water supply from time immemorial in India. These water bodies are now polluted mainly due to discharge waste water, water from residential areas , sewage outlets etc. The study indicates that the hydrographical features investigated exhibited well marked variations with distinct minima and maxima. The investigation reveals the necessity for rejuvenation of these ponds or preventing the dark future of these ponds if no effective measures are under taken.

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VII. References

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