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Studies on Fish Fauna of Certain Lakes in Relation to Seasonal Variations of their Productivity

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Abstract: ***Water physico chemical parameters and planktons density are an essential factors for fish productivity. In Lake Jakaram have been studied through seasonal surveys in two years 2015-16 and 2016-17.The present study was aimed to assess the seasonal variation on physico-chemical parameters such as temperature, pH, alkalinity, dissolved oxygen, BOD and COD and their relationship with zooplankton and phytoplankton community. The seasonal variation of nutrients like nitrate, phosphate was recorded to determine the utilization of nutrients by phytoplankton in aquatic environment. The results revealed that physico chemical parameters showed significant difference among the seasons. The statistical analysis of physico-chemical parameter showed well-defined seasonal variation, relatively high temperature, high value of dissolved oxygen and highest production range of alkalinity were observed which are favourable factors for the production of air breathing fishes. The maximum of temperature was recorded during summer season it showed a significant inverse relationship with dissolved oxygen positive relationship with PH. Dissolved oxygen shows a negative relation with alkalinity, total hardness, nitrate, phosphate, chlorides. The correlation analysis exposed that physico-chemical parameter and nutrients are effective dynamics to control the seasonal variations on plankton diversity therefore the present study reveals that Lake Jakaram has rich in plant and community due to presence of high nutrient content and consisting appropriate environmental factor zooplanktons (species) in lake Jakaram during the study period holds a key position in the food web as it was directly related to the consumption of organic energy produced by phytoplanktonic photosynthesis and then by transforming it to the higher trophic levels of heterotrophs such as fish. Some Zoo plankton population was decreased due to unfavourable condition. Plankton diversity and physico- chemical parameters of water or important criteria for evaluating the suitability of water for culture practices. Therefore, structure of different fish food organisms assumes greater significance to fishery management. Seasonal variation of the plankton population of Jakaram Lake Mulugu district was carried out during June 2015 to may 2017 .phytoplankton density was slightly higher during summer. Chlorophyceae appeared as the dominant group of phytoplankton in Lake Jakaram during both the study years. During the first year of study period this group exhibited maximum density of (2851 org/L) followed by Gynophycea (1805 org/ L) Bacillariophyceae (2726 org/ l) and Euglenophyceae (416 org/ l). Similarly chlorophyceae also registered maximum density of (3168 org/l) during second year period followed by Gynophyceae(1516 org/L) Bacillariophyceae (2687 org/ l),and euglenophyceae(180 org/ l). Annual densities of zooplanktons during the first year copepoda appeared as dominant group of zooplanktons with higher density (7619 org/ l) during the first year of the study period followed by cladocera(3775 org/ l) Rotifera (4230 org/ l) and ostracoda (2202 org/l). During the second year of the study period copepod again contributed maximum density (9547 org/l) followed by Rotifera (4614 org/ l) cladocera (3498 org/L and ostracoda (2226 org/L). The minimum number of zoo planktons and was recorded in the rainy. Phytoplankton and zooplanktons have a nominal positive relationship. Phytoplankton was increased or decreased with the relation with zooplanktons***

Keywords: Lake Jakaram, physico chemical parameters, phytoplanktons, zooplanktons

1. Introduction

Water is essential natural resources for all living organisms, whether unicellular or multicellular. Biological production in any aquatic body gives direct correlation with its physico-chemical status, which can be used as trophic status and fisheries resources potential (Jhingran, et al.1969). Life in aquatic environment is largely governed by physico chemical characteristics and their stability. The maintenance of a healthy aquatic ecosystem is dependent on the physico chemical properties of water and biological activity. The polluted state of water resources has led to a steady decline in an aquatic productivity. Therefore, limnological investigation is needed. So that monitoring of the lake water is necessary step to mark the trend pattern of pollutants and their effect on living organisms.

In freshwater system the zooplankton forms are important group and constitute basic link of the food chain, planktons are very sensitive to the environment they live and any alternation in the environment leads to changes in the environment in the plankton communities in terms of tolerance abundance, diversity and dominance in the habitat (Mathivonam, 2007. The plankton study is very useful tool for the assessment of water quality in any type of water body and also contributes to an understanding of the basic nature and general economy of the water body. Plankton being the primary producer from the lowest trophic level in the food chain of freshwater ecosystem and plays a key role in fish culture .The density and diversity of the plankton are greatly influenced by the different physico chemical parameters of water (wet zel. 1975).

The maintenance of a healthy aquatic ecosystem is dependent on the physico-chemical properties of water and biological activity. Further water condition play a very important role in the production of a breathing fishes. The polluted state of water resources has led to steady decline in aquatic productivity. Therefore, limnological investigation is needed. The maintenance of healthy aquatic ecosystem is dependent on the physico chemical properties of water. So that monitoring of the lake water is necessary step to mark the trend pattern of pollutants and their effect on living organisms. Aquatic biodiversity, is threatened primary by

human abuse and management of both living resources and the ecosystem that support them. Most of the ponds are getting pollution due to domestic waste, sewage, industrial aquatic and agricultural effulents. The requirement of the water in all lives, from microorganisms to human beings is a serious problem of present day because of water resources have reached to a point of crisis due to unplanned urbanization, industrialisation and man-made activities. Many Biotic and abiotic processes contribute to variability in plankton diversity in aquatic ecosystems. Seasonal requirement of plankton assemblages are closely linked to seasonal changes in temperature, the external hydraulic nutrient loads and light availability (Malten et al. 1991) other process acting as a time periods on days to week, like material logical and hydrological events (Guillermo, 20090 and also pollution stress on them (Raja et al. 2008). Zooplankton diversity responds rapidly to changes in the aquatic environment. Several zooplankton species as bioindicators (Ahmed et al.2011). A number of studies has been carried out on ecological condition of fresh water bodies in various parts of India (Sing et. al.. 2002, smith et.al.. 2007, Rajagopal et. al.. 2010)

Biological production in any aquatic body gives direct correlation with its physico-chemical status, which can be used as trophic status and fisheries resources potential (Jhin gran et. al.. 1969) . Life in an aquatic environment largely governed by physico- chemical characteristics and their stability. These characteristics have enabled by biota to develop many adaptations that improve sustain productivity and regulate the Lake metabolism. The most important characteristics Criterion to assess the trophic structure of a lake remains to be primary productivity studies. The food chain in lake ecosystem is very simple comprising phytoplankton and aquatic vegetation as primary producers, zooplanktons as primary consumers, small fishes as secondary consumers and large fishes as tertiary consumers. Plankton is the most sensitive floating community which is being the first target of water pollution, does any undesirable change in aquatic ecosystem diversity as well as Biomass of this community. The measurement of planktons productivity helps to understand conversation ratio at various trophic level and Resources an essential input for proper management of Lake. Some notable studies on phytoplankton and zooplankton diversity have been made by (RAO and CHOUBEY, 199O, DEORARI, 1993 ARIYADEJ et.al. 2004; MISHRA et. al , 2010 and Joseph and YAMAKANAMARDI, 2011).

Fishes occupy all three level such as primary ,secondary, tertiary consumer of Food Web in aquatic ecosystem .Man being the top carnivore in this food system as it is very good source of protein. Fish protein is supposed to be cheapest source. So study on limnological characteristic of lake JAKARAM has high importance, the study of their trophic status may help in optimum utilization and conservation. Therefore, the present investigation attempt to study of limnological parameter and their relationship, of phytoplankton, zooplankton status and diversity of fishes

2. Materials and Methods

2.1 Study Area

Jakaram (oora cheruvu) Lake situated in jakaram village in Mulugu Mandal in Mulugu district of Telangana state at latitude 18.73and longitude 79.8. It is located the altitude 261 metres above sea level. The water spread area of the lake 1.12 kilometre square the total catchment area of 276acres. Jakaram lake is surrounded by Regonda Mandal towards west, Ghanpur (mulugu) Mandal towards North ,Nalla Belli Mandal towards south,venkatapur mandal towards North.

Figure A and B shows the study Area (JAKARAM LAKE).

Physico chemical analysis: The present investigation was carried out in Jakaram Lake the water samples were collected in the monthly intervals from June 2015to May 2017. Most of the parameters were analysed at the sampling sites .Water temperature was recorded with Mercury thermometer and pH of water measured by portable pH meter. The transparency of the lake water was found out by the help of sacchidisc. The analysis of dissolved oxygen free carbon dioxide, hardness, alkalinity, TDS, nitrates, Phosphates, chlorides BOD and COD were done according to methods of APHA (1975).

Planktons analyses: The pond survey was carried out from June 2005 to May 2017. Water samples were collected from periodically every fortnight of the selected pond early hours between 8.00 to 10 a.m. The date was articulated Seasons only as rainy (June - September) winter (October - Jan) and summer (February- may). The plankton samples were collected by filtering by 50 litres of water through plankton net (77 meshes bolting sink) and concentration samples fixed in 5% of Formalin. The quantitative analysis of planktonic organisms was carried out using sedwick rafter plankton counting cell and planktonic organisms numerically counted and identified.

3. Results

Physico chemical parameters of water body serves as a measure of water quality,changes in the source of water and rainfall affect physico chemical parameters of water, which also affects the Biomass of the aquatic organisms.

The monthly fluctuations of physico chemical properties of Jakaram Lake water are shown in Table-1 and 2 during 2015-2017.

Table 1 shows the monthly Averages of physic chemical parameters of Jakaram Lake in 2015-16

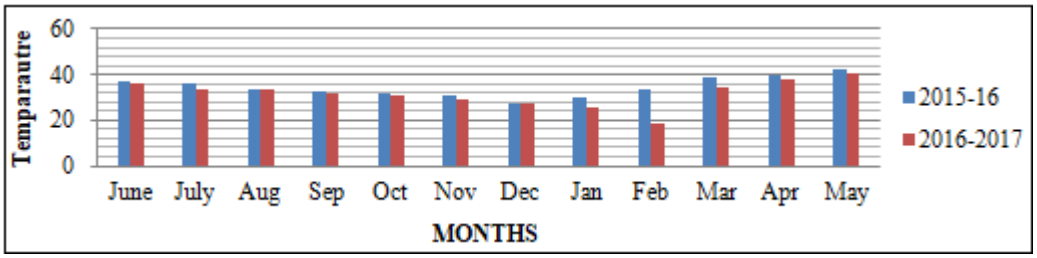
Sno	Parameters	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	Temperature	37.21	36.66	34.26	33	32.1	31.58	28.11	30.21	33.66	39.12	40.35	42.3
2	Ph	7.87	6.9	6.55	6.2	7.93	8.08	7.11	7.51	7.4	8.11	8.51	8.55
3	Dissolved oxygen	5	5.15	5.9	5	6.33	7.51	7.9	6.9	6.8	3.35	3.75	3.15
4	Turbidity	23.13	29.41	30.16	29.9	28.76	26.56	26.06	25.1	24.88	24.1	21	21.76
5	Alkalinity	106.84	108.6	106.7	108.69	107.74	103.51	100.67	101.37	101.5	123.23	126.13	126.99
6	Free carbon dioxide	8.76	9.13	10.06	9	7	6.53	6	7.86	8.7	4.6	3.31	3.2
7	Hardness	93	91	83	78	74.33	74	66.66	70.33	72.66	104	111.33	108
8	TDS	204.33	207.33	206.66	196	193	190.66	180	181.66	185	233.33	247	252
9	Chlorides	34.706	37.06	38.93	45.01	48.01	55.12	62.35	65.91	69.51	79.116	79.13	56.08
10	Nitrates	1.66	1.67	2.95	1.73	2.01	1.55	1.43	1.46	1.73	2	2.07	2.08
11	Phosphates	0.93	0.88	0.85	0.82	0.78	0.72	0.58	0.63	0.74	1.3	1.01	1.06
12	BOD	3.62	3.46	3.14	2.93	2.73	2.53	2.55	2.77	4.08	4.28	4.29	4.5
13	COD	9.88	9.82	9.7	9.28	9.15	9.03	8.76	8.9	8.83	10.82	10.9	10.9

Table 2 shows the monthly Averages of physico chemical parameters of Jakaram Lake in 2016-17

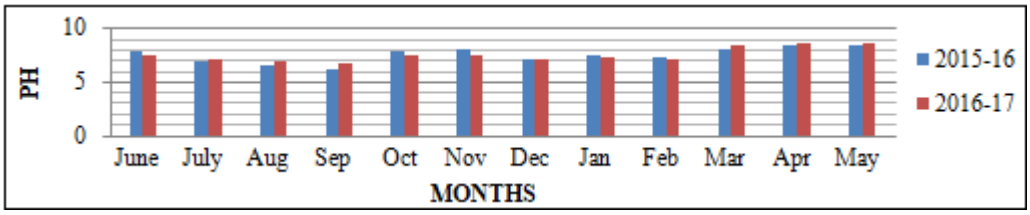
S. No	Parameters	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1	Temperature	36.1	34.15	33.6	32.34	31.2	29.36	27.82	26.09	18.9	35.01	38.42	40.75
2	Ph	7.51	7.13	6.91	6.76	7.55	7.46	7.1	7.33	7.25	8.45	8.64	8.71
3	Dissolved oxygen	5.81	5.15	5.53	5.3	6.33	6.51	6.9	6.8	6.4	3.46	3.35	3.23
4	Turbidity	29.46	31.93	30.97	31.71	30.73	29.36	27.93	26.84	25.3	23.25	21	20.93
5	Alkalinity	104.54	108.92	112.04	108.82	105.77	107.67	101.67	100.82	104.35	121.2	120.6	121.44
6	Free carbon dioxide	8.36	9.08	9.13	8.15	8.26	6	6.2	7.5	6.45	5.93	5.61	4.5
7	Hardness	50	51	53.33	52	53	63.66	63.33	65.66	72.33	74.33	77.33	81.33
8	TDS	149.66	151	150.33	143.33	141.66	140	133.33	110	131	133.33	147.33	165
9	Chlorides	47.15	44.58	50.41	69.01	69.75	75.38	80.73	84.08	97.01	97.78	90.15	89.7
10	Nitrates	1.81	1.81	1.71	1.61	1.53	1.4	1.23	1.3	1.55	1.7	1.83	1.81
11	Phosphates	1.45	1.31	0.97	0.81	0.75	0.71	1.05	1.43	1.88	1.95	2	2.01
12	BOD	3.18	3.25	2.99	2.88	2.74	2.71	2.68	2.53	2.96	5.08	5.35	5.55
13	COD	9.93	9.91	8.8	8.8	8.75	8.6	8.16	8.08	8.25.	11	12.06	12.06

Temperature:

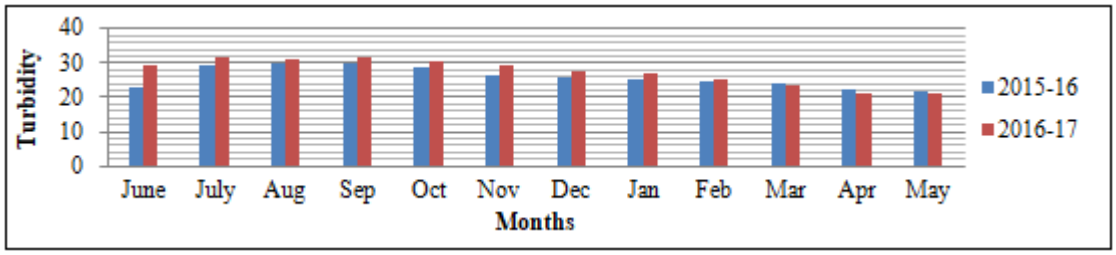
The data obtained on the temperature content of water samples from Jakaram Lake during the year from June 2015 -May 2017 are presented in the table no(1 and 2). The data pertaining to temperature C^0 of Jakaram Lake during the month of May in the year 2015-16 was observed as highest temperature 42.3Whereas lowest temperature 18.9 was observed during the year 2016-17in the month of Feb in 2016-17. Temperature controls the rate of all chemical reactions, and affects fish growth and their reproduction. Drastic change in temperature can be fatal to fish. In the present investigation the water temperature ranged from 18.9 to 42.3 which is found suitable for both carps and air breathing fishes.



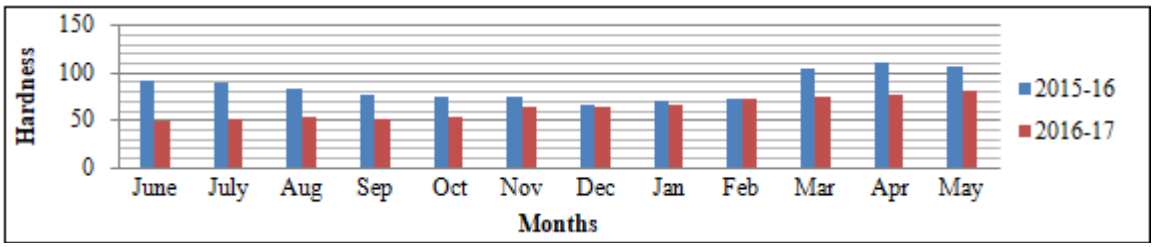
pH: pH is measure of intensity of acidity or alkalinity and measures the concentration of hydrogen ions in water. In the present investigation pH value ranges from 6.2 - 8.55 (table-1) 6.76- 8.71 (table -2).The highest pH value was observed during summer 8.71 in the month of May 2016-17, appear to be influenced bys large number of phytoplanktons, whereas the lowest pH recorded 10.2 in the month of October 2016 -17. According to Banerjee and Ghosh(1967)6.5 -7.8 pH water range is most favourable for the fish production and 7.5 to 8.5 for average fish production. Thus the present value of pH of water may be considered suitable for the fish production.



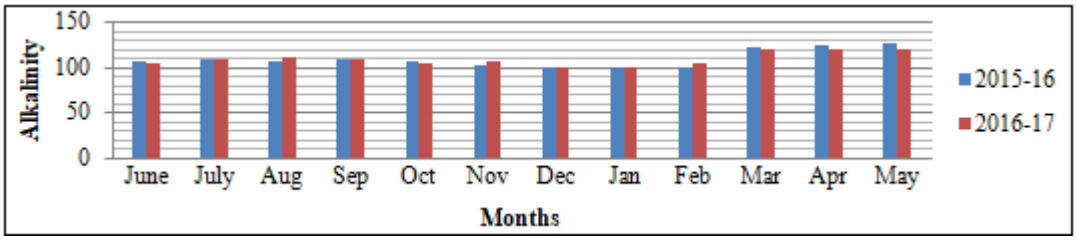
Turbidity: Turbidity in water is caused by the substances not present in the form of true solution. Maximum turbidity was recorded 31.93 in the month of August 2016–17. Whereas the lowest was observed 20.9 3 in the month of May 2015-16. Turbidity was maximum observed in rainy season which was due to monsoon in rain which brought additional water from catchment areas, transforming the water muddy and turbid. Higher phytoplankton densities in the water may leads s to increase the turbidity. Turbidity is caused by the occurance of suspended matter such as clay and silt finely divided organic and inorganic matter, plankton other microscopic organisms



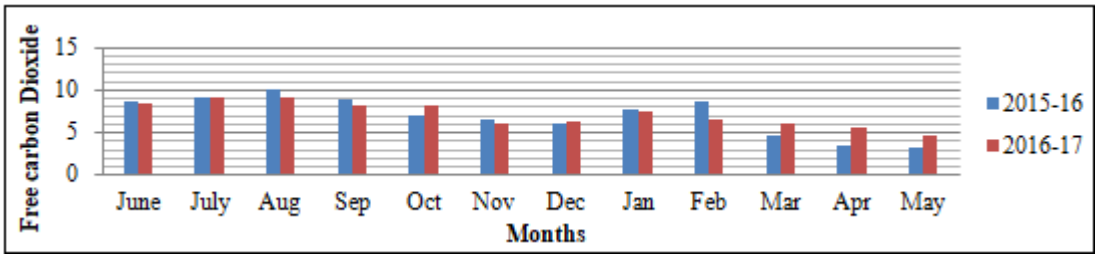
Hardness: The total hardness was maximum recorded 11 1.33 in the month of May 2015 - 16 where as minimum recorded 50 in the month of June 2016 -17.The Higher Total hardness value in summer was also reported by Devi, (1985 and 1977). The total hardness more than 300 mg/l is generally uncongenial for fish production because of higher pH. Optimum total hardness for fish culture has been found to be around 75 - 150 mg/l (Das, 1996) sugunan (1990). The total hardness above 70 ppm is indicator of the better productivity.



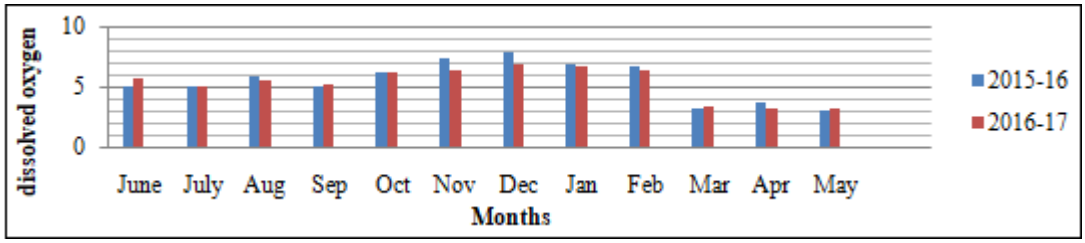
Alkalinity: Alkalinity in freshwater is due to the presence of three types of substances bicarbonates, carbonates, and Hydroxides. In the natural and polluted water there are many other salts of weak acids such as silicates phosphstes, and borates etc .which cause alkalinity in addition to that of carbonates and Bicarbonates. The normal range of alkalinity is 100 - 125 mg/l. In the present investigation as maximum alkalinity was recorded 126..99 in the month of May 2015 - 16 where are the lowest recorded100.82 in the month of February 2016 - 17. So the ranges of alkalinity in Jakaram Lake are suitable for fish growth.



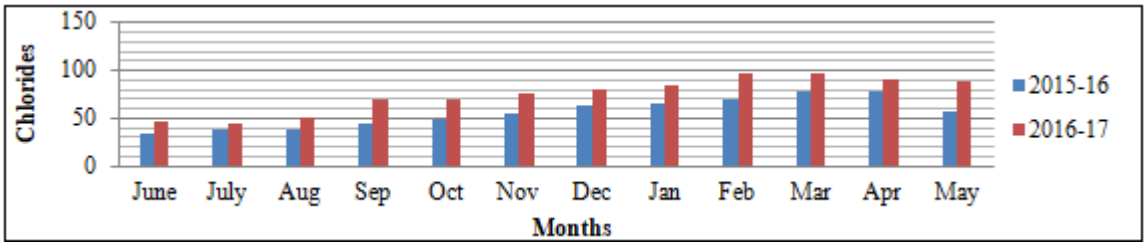
Free carbon dioxide: Free carbon dioxide comes in water due to activity of Aquatic organisms. Free carbon dioxide helps in buffering the aquatic environment against rapid fluctuations in the acidity or alkalinity and also regulates biological process of Aquatic communities. The free carbon dioxide was recorded maximum 10.06mg/l in the month of August in 2015-16, where are the lowest observed 3.21 in the month of May 2015 – 16. The high value of free carbon dioxide during rainy season might be due to the high rate of decomposition of organic matter by microbes resulting rapid production of CO2.



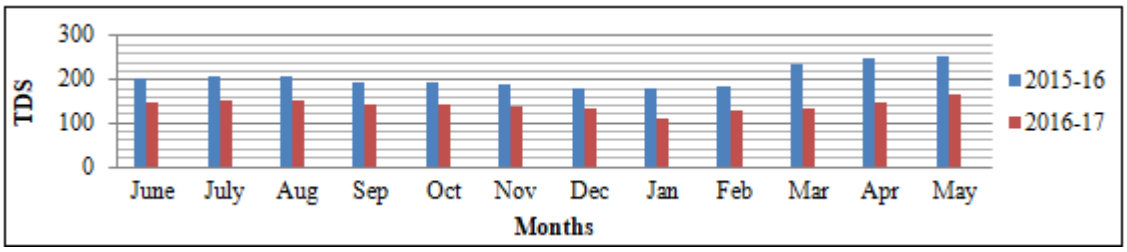
Dissolved oxygen: The solubility of dissolved oxygen in winter is increased with decrease in water temperature the present investigation the dissolved oxygen was maximum recorded 7.9 mg/l in the month of November in 2015-16, whereas the low levels was observed 3.15 mg/l in the month of May 2015 – 16.The present study does not support this view, as there were several factors are responsible for reduction of dissolved oxygen contents are decomposition of the organic matters of the bottom, agetation of water during fishing activities and also due to excessive human influences.



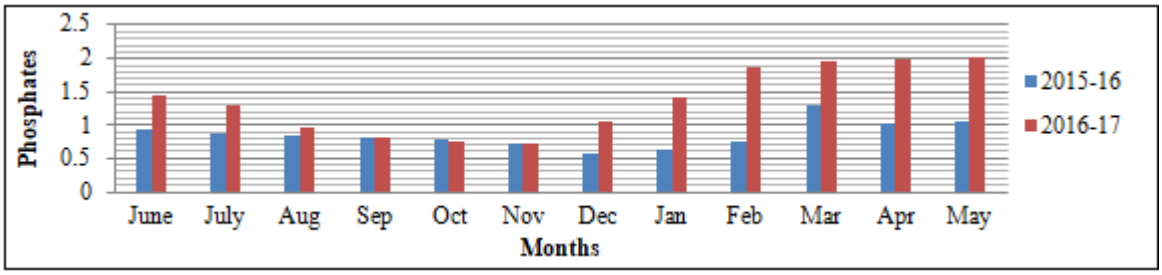
Chlorides: Chlorides is considered to be an important factor as it is one of the essential ions in assessing the status of natural water bodies (Hutchinson, 1957).Chloride occur in most freshwater, as the salts of sodium or calcium. Chloride ions are essential for plants and animals generally unpolluted water contents low concentration of chloride i.e. lower than 10 mg/l. The chloride data recorded at Jakaram Lake maximum recorded 97.78 in the month of March 2016 - 17 minimum 34.706 in the month of June 2015 – 16. High values of chlorides in summer could be due to their concentration as a result of evaporative water loss lower values in rainy could attributed to dilution effect and renewal of water mass after summer stagnation.

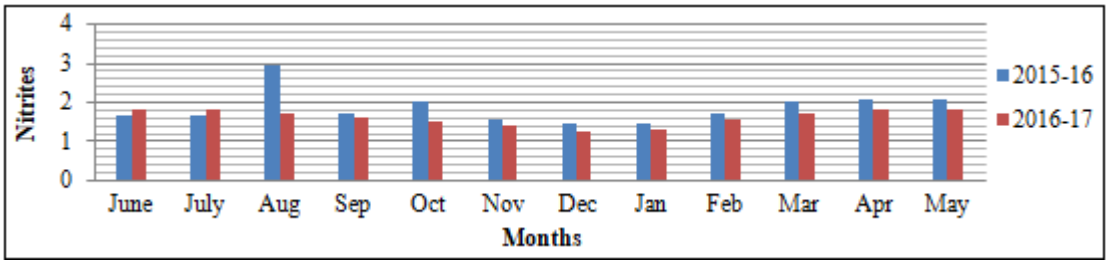


TDS: In the present investigation TDS is maximum recorded 190.66 in the month of December in 2015-16 where as minimum recorded 110 in the month of February 2016 -17. TDS in natural water less than 300 mg/l is suitable for fish growth. The sudden change in TDS levels which greatly affects Osmotic pressure, the fish's regulatory mechanism cannot adapt fast enough to the change and hence fish goes in shock and can kill in many cases die.

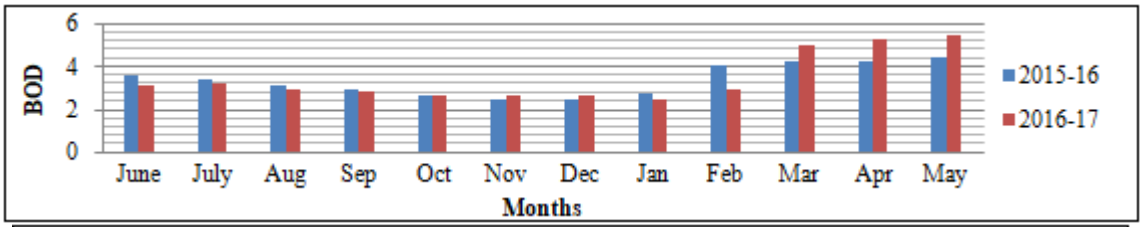


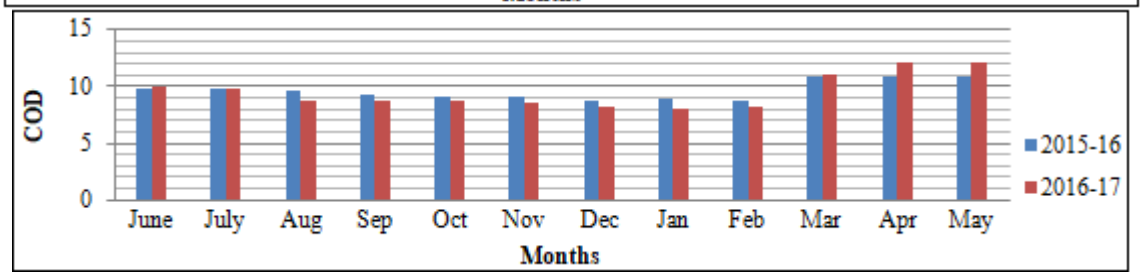
Nutrients: As mentioned table 1 and 2 nitrate was highly presented 2.95 micrograms per litre in the monsoon in the month of August in 2015-16 and least amount of nitrates 1.4 µ g/l. The amount of phosphate was high during summer in a month of May 2.0 µ g/l. In 2016-17 and the minimum values during winter in 0.58 µ g/ In the month of January in 2015-16.The high value recorded during summer months may be due to decomposing plant materials and its subsequent. The low value of phosphates during winter may be due to abundance of phytoplankton which utilizes it.





BOD and COD: In the present investigation in Jakaram Lake the BOD is maximum recorded 5.55 during summer in the month of May in 2016-17 and minimum was observed 2.53 in the month of December in 2015 -17.BOD is maximum in summer season may be due to organic pollution. The increasing oxygen consumed in the decomposition process robs other aquatic organisms of the oxygen they need to live. Cod is maximum observed in summer season 12.06 in the month of May 2016 – 17.Whereas low value observed 8.6 in the month of December in 2016 – 17. COD is increased in summer season due to aquatic pollution.





Zooplanktons: In Ecologically zooplanktons are one of the most important biotic components influencing all the functional aspects of an aquatic ecosystem such as Food Chain and Food Webs energy flow and cycling of mater (Park and Shin 2007).

zooplanktons consists of protozoas, cladocera, coepod, rotifers, etc. which may serve as indicators of water quality. Temperature directly affects plankton population during summer the temperature is high the plankton population is also reach to maximum and when the temperature is low during winter the plankton population is also reach to the minimum. In the present investigation zooplanktons are highest recorded in the summer season. The annual densities of zooplanktons copepodas, are appeared as a dominant group of zoo planktons with higher density of 7619 org/l in 2015 -16 and 9547 org/l in 2016-17.Lowest total density of zooplanktons group was observed Ostrcoda 2202 org/l in 2015-16 and 2226 org/l in 2016 - 17.

Phytoplankton: The bulk of primary producers and on the base of change in any water body the phytoplankton community of water body during the present study was represented by four groups namely chlorophyceae, Gyanophycea, bacillariophycea, and euglenophycea. Population density of phytoplankton was higher during summer months minimum recorded in the rainy.Annual total densities of phytoplanktons glorify Chliphycea as a dominant group 2851 no/l in 2015 - 16 and 31 68 no/l in 2016 - 17 and lowest total density of phytoplanktons group euglenacea 416no/l in 2015 - 16 and 180 no/l in 2016 – 17. The plankton abundance and taxonomic Diversity depend upon the supply of nutrients in natural water.

4. Discussions

The physico-chemical parameters such as temperature, pH salinity, hardness, dissolved oxygen, BOD, COD and nutrients shows the seasonal variations. Temperature is universal factor in the aquatic ecosystem, which influences

the physico- chemical characteristics and also influences the life of organisms. The reduction in the water temperature mainly depends upon the intensity of rainfall during monsoon and lower temperature existed at the time. In the present investigation temperature was maximum observed during summer and lowest recorded in the winter season .Temperature ranges from 18.9 to 42.3 C is to be suitable for the development of planktonic organisms. It is positive correlation with PH and negative correlation with dissolved oxygen. In the present results low pH values were recorded during monsoon periods and slightly higher values during summer period similar seasonal pattern was recorded earlier by Santhanam and Perumal, palpandi and Fatema et. al..Minimum values of PH during monsoon in the study area may be controlled by the influence of fresh water discharge ,rainfall and also due to decomposition of organic matter as stated by Ragotham and Patil and Upadhyaya. The pH fluctuate considerably both daily and seasonally the magnitude of these fluctuations will depend on low well buffered the freshwater system is .These fluctuations are due to photosynthesis and respiration by plants and animals ,which results in the highest pH typically occurring at Dusk and the lowest Dawn .This is because during the night respiration increases the concentration of carbon which interact with water to produce carbonic acid lowering the pH during the day CO2 concentration decrease because of photosynthesis driving pH values up.

Dissolved oxygen is major component in Environmental parameter that determines the ecological health of a water course and act as a shield in aquatic life. Dissolved oxygen showed well marked seasonal variations in Jakaram Lake. This can be controlled by various factors such as rainfall, temperature, phytoplankton, photosynthesis and salinity. The dissolved oxygen content was recorded minimum in summer and maximum in winter due to the influx of fresh water during monsoon, higher solubility and low salinity. There is also a strong relationship between temperature and dissolved oxygen , the warmer the water, the less oxygen it can hold warm water increases the metabolism of fish and therefore increases their consumption of oxygen .Bacteria also consume oxygen as they decompose organic matter . Therefore during the summer months dissolved oxygen levels will be lower because of increased oxygen demands of fish, warmer water that holds less Oxygen and increased the bacterial decomposition of Dead plant and algal material towards the end of growing season.

Whenever dissolved oxygen level falls below 3to 4 ppm oxygen stress will occur lack of adequate dissolved oxygen is the leading cause of fish kills . Normal oxygen content in a healthy pond will range from 5 to 10 ppm ,warm water fish (e.g Bass blue gill, catfish) required about 5 ppm and cold water fish (e.g Trout Salman) required about 6.5 ppm to maintain good health. Dissolved oxygen levels of less than 3 ppm will kill warm water fish. And levels than less than 5 ppm will kill cold water fish. Fish exposed to low non-lethal levels of dissolved oxygen over a prolonged periods will be chronically stressed stop eating and be more susceptible to disease.

The seasonal variations of nutrients like nitrate phosphate and silicate was based on rainfall, freshwater input, tidal ingress and utilization of nutrients by phytoplanktons in aquatic environment. The nitrate content was high in monsoon is mainly due to the river water discharge from agricultural fields containing nitrogenous as particles of various Origins. Low value of nitrates observed during summer seasons might be due to the lesser amount of fresh water inflow and higher salinity. Phosphate is major nutrient for primary productivity in aquatic ecosystem, which enhance growth of organisms and the confines of phytoplankton production, in the present study the high concentration of phosphate during summer due to decomposition of particulate organic matter and agricultural discharges from the adjacent lands . Phosphorus and nitrates are critical to the growth of plants and animals in aquatic systems. Phosphorus has been identified as the limiting factor for algal growth in Jakaram lake .One gram of phosphorus will produce 100 grams of algal biomass. When the excess plants and algae dies , they decompose which leads to a depletion of oxygen that can affect water clarity and smell and can lead to fish kill. In present investigation nutrients are sufficient level for fish growth.

Alkalinity refers to the water buffering capacity or its ability to withstand changes in pH, it is measure of the total concentration of bases in pond water, including carbonates, bicarbonates, hydroxides, phosphates, borates and is expressed in ppm calcium carbonate all these bases react with and neutralize Acids, which in turn buffer changes in pH the pH of well buffered water will normally fluctuate between 6.5 and 9. In the present investigation in Lake Jakaram water or well buffered water. So the alkalinity ranged from 50 to 150 ppm are acceptable. If the alkalinity is low in even a small amount of can cause a large change in pH alkalinity can be increased by adding agricultural lime stone ponds.

Hardness is a measure of divalvent salts are positively charged ions ,are particularly calcium and magnesium ions in water present investigation in Lake Jakaram total hardness maximum recorded in summer where as minimum recorded in monsoon. However sodium bicarbonate is responsible for high alkalinity it is possible for water to have high alkalinity and low calcium and hardness. Calcium and magnesium are essential to fish for biological processes such as bone and scale formation if the water hardness should be above 50 ppm and can be adjusted by adding agricultural lime stone.

The total dissolved solids data recorded at Jakaram Lake during 2015- 217 highest in the summer season and decrease in winter season. The total dissolved solids present in the water in the dissolved state. High concentration of total dissolved solids increases with water turbidity .This in turn decrease the light penetration and thus affects the photosynthesis there by suppressing the primary producers in the form of algae and macrophytes. This in turn affects the micro and macro in vertebrates, which are dependent directly or indirectly on plants for food .Total solids sunlight in Greater proportion thus increasing the temperature of water. They can enrich the nutrient status of water resulting eutrophication. The bulk of the total dissolved solids include bi carbonates, sulphates and chlorides of calcium, magnesium, Sodium and silicon. Potassium Chloride and

nitrate form a minor part of the dissolved solids in the water. High concentration of total dissolved solids increase water turbidity. Total dissolved solids when present in excess in the water create an imbalance in aquatic life. According to Reid (1961) total dissolved solids will be playing an important role for the primary productivity of aquatic environment.

Chloride is considered to be an important factor as it is one of the essential ions in assessing the status of natural water bodies(Hutchinson ,1957). Most of these reports, show maximum value of chloride in summer season and minimum in rainy and winter season. High values of chlorides in summer could be due to their concentration as a result of evoperative water loss. Lower values in rainy could be attributed to dilution effect and renewal of water mass after summer stagnation.

Biochemical oxygen demand is a parameter enables to determine the relative oxygen requirement especially of waste water polluted water and effluents. In the present study B OD values were higher in all the lake during winter season and lower values were observed during summer season .Moderate high BOD values were observed during rainy season similar observations were observed by Tiwari at al.. (1988),senger et al .,(1990) Mishra et al., (1999).The amount of oxygen consumption by aerobic biological organisms to oxidize the organic compounds .Sewage with high BOD can cause a decrease in oxygen of receiving waters, which in turn can cause the death of some organisms.

The COD data recorded at Jakaram lake during the year 2015 – 17. The lowest value recorded in winter and highest value recorded in the summer season .The chemical oxygen demand is an important measurement for the amount of oxygen that is required to break down pollutants (organic substances) in water. COD may also increase as a result of dying bacterial cells, they decompos and release dissolved organic carbon, which in turn increases COD .Higher COD levels mean a greater amount of oxidizable organic material in the sample, which will reduce dissolved oxygen levels .A reduction in the Dissolved oxygen can lead to anaerobic conditions, which is deleterious to higher aquatic life form.

The physico - chemical parameters, salinity and nutrients have been recognised as the major factors controlling primary production. The present study reveals the temperature PH and alkalinity nutrients exhibited the maximum relationship with phytoplankton species, this is an agreement which previous report the correlation between phytoplankton and physico chemical parameters like dissolved oxygen shows negative correlation with the most phytoplankton species and zoo planktons the physico - chemical parameters of zoo plankton communities together form a comprehensive ecosystem and there is the interaction between the zoo plankton and phytoplankton. These interactions are directly or indirectly subjected to the complex influences (Basawa Rajeshwari, et. al 2015). Zooplankton was represented by Rotifera, cladocera and copepods, ostracods. Among the planktons copepoda was dominated and followed by Rotifera, chaldocerans and ostracoda during the study period quantitative variations of zooplanktons was observed in (table 3) zoo planktons richness observed in the summer period where are the lowest number in monsoon and post monsoon period in the aquatic ecosystem zoo planktons place a main role as they consume primary producers (phytoplankton) and form a major food source for tertiary produces . Zoo planktons considered as the basic principle natural fish food for young and some adults of organisms which support fish production (EL –SERAFY et.. al. 2009) the zoo plankton assemblage inhabiting freshwater ,mostly comprises representative of Protozoa rotifer, copepod , cladocera, ostracoda . The zooplanktons of and respond immediately to environmental changes because most of the species have short generation time the high population density of zooplanktons in the summer period may be result of abundant food sources from The Runoff. (Rocha.et.al.. 1999) reported that the increase of primary production (phytoplankton) is accompanied by the increase in zooplankton density increase due to eutrophication. Bhonic suggested that increase zooplankton population in summer due to higher concentration and increased the photosynthetic activity . Water temperature and flow of water have been observed as the most significant controlling factors of zooplankton density as reported by Coffing and Patrick.

The phytoplankton constitue bulk of primary Producers and are the base of food chains in any water body. The phytoplanktonic community of water body during the present study was represented by four groups namely chlorophyceae gynophyceae bacillariophycea and euglenophyceae. In the present study chlorophyceae species dominated group temporal abundance of total phytoplankton density was slightly higher during summer chlorophyceae appeared as the dominant group of phytoplankton in lake Jakaram both the study years with total (2851 org/l in 2015 - 16(3168 org/ l) in 2016-17 bacillariophycea was the second highest among the phytoplankton group and the lowest phytoplankton group euglenophyceae. Chlorophyceae was highest in winter lowest in rainy season. The plankton plays and important role in the biological treatment of organic water loaded in water as during purification of organic matter by bacteria, the oxygen is supplied by them. Plankton abundance and taxonomic Diversity depend upon the supply of nutrients in natural water. In the present study, the highest plankton density was recorded during summer season when N-NO3concentration were found to be highest similarly relationship also present in case of lower abundance of phytoplankton in low nitrogen inN –NO3 concentration phosphate exhibited in verse relation with the growth rate of plankton . The lower value of phosphate corresponded with the higher value of plankton.

Table shows seasonal variations of zooplanktons of Jakaram lake in 2015-2017

Study period	Planktonic group	Jun	Jul	Aug	sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
2015-2016	Rotifera	390	68	25	55	250	330	450	510	510	560	590	462
	Cladodera	242	230	299	350	314	27	227	315	470	399	344	345

	Copepoda	429	240	159	310	390	490	490	642	915	1219	1428	1061
	Ostracoda	25	29	18	42	175	410	410	280	275	296	60	72
2016-2017	Rotifera	226	50	2	64	288	465	512	568	600	619	640	580
	Cladodera	382	270	216	268	305	228	258	362	386	298	195	330
	Copepoda	319	213	220	228	542	680	402	802	1230	1572	1689	1550
	Ostracoda	22	18	4	48	170	421	560	299	284	296	69	35

Plankton grourp	Total density of planktonic group in 2015-2016	Percentages of planktonic group 2015-2016	Total density of Planktonic group in 2016-2017	Percentages of planktonic group 2016-2017
Rotifera	4230	24%	4614	23%
Cladodera	3775	21%	3498	18%
Copepoda	7619	43%	9547	48%
Ostracoda	2202	12%	2226	11%

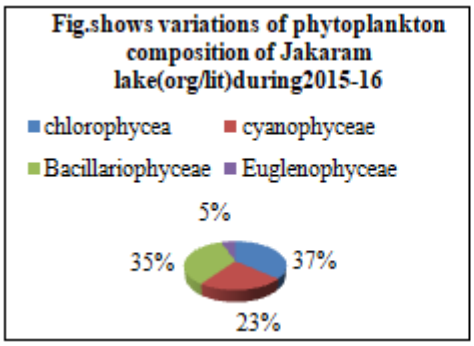
Table shows the percentages of zooplanktons of Jakaram lake in2015-2017

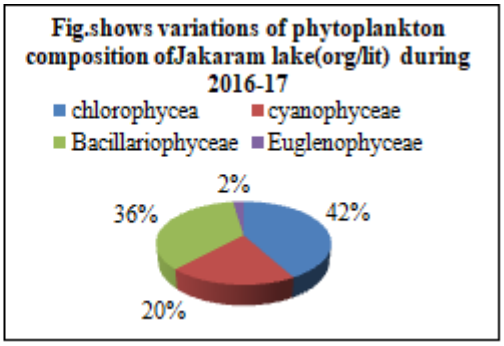
Table shows seasonal variations of Phytoplanktons of Jakaram lake in 2015-2017

Study period	Planktonic group	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
2015-2016	Chlorophyceae	153	278	100	172	240	302	415	345	255	281	270	240
	Gyanophyceae	240	201	135	104	98	65	45	49	178	210	235	245
	Bacillariophycea	103	117	90	210	213	325	351	352	255	250	260	200
	Euglenophycea	32	13	7	17	41	52	60	59	51	24	24	35
2016-2017	Chlorophyceae	161	96	135	250	269	320	361	375	285	331	335	250
	Gyanophyceae	210	105	79	135	100	55	38	29	120	185	210	250
	Bacillariophycea	165	43	39	49	220	316	346	324	280	275	310	320
	Euglenophycea	25	6	14	22	15	22	20	15	23	12	10	21

Plankton group	Total density of planktonic group in 2015-2016	Percentages of planktonic group 2015-2016	Total density of Planktonic group in 2016-2017	Percentages of planktonic group 2016-2017
Chlorophycea	2851	37%	3168	42%
Cyanophyceae	1805	23%	1516	20%
Bacillariophyceae	2726	35%	2687	36%
Euglenophyceae	416	5%	180	2%

Table shows the percentages of Phytosplanktons of Jakaram lake in2015-2017.





5. Conclusion

The present study examines a seasonal variation in physico - chemical parameters on phytoplankton community at Jakaram lake. The correlation results proved that the physico-chemical parameters are important for distribution, abundance and occurrence of phytoplankton species with esteemed to seasonal changes in Environmental parameters. Based on the present observation lake Jakaram is in rich in species diversity and composition and the nutrients status is high enough to support the plankton community.

The water temperature is always found to be less than atmosphere temperature it is suitable for fish growth. pH was almost alkaline and suitable for fish growth. Higher value of oxygen during some months may be due to increased photosynthetic activity while lower may be due to its utilisation during decomposition of organic matter and respiration by micro and macro organisms. Higher value of nitrates and phosphates during the study period was due to incoming agriculture due to run off. On the basis of studied parameters in the lake Jakaram water appears to be moderate for all trophic levels.

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