

Analysis of physico-chemical water quality parameters of fresh water lake of Warangal district, Telangana state, India

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Abstract

In the present work an attempt has been made to assess the physico-chemical properties of Wardhannapet Fresh Water Lake, Warangal District, Telangana State, India. The present study deals with physico-chemical parameters of the lake carried out for a period from June 2018 to May 2020. The water samples were collected from the lake and analyzed using standard laboratory procedures. The physico-chemical parameters such as Water Temperature(25.50 -29.80°C); Total Dissolved Solids(37.00-46.67mg/l); Water Transparency(47.92-52.17Cm); PH(6.88-7.50); Dissolved Oxygen(7.57-8.67mg/l); Biological Oxygen Demand(3.47-6.82mg/l); Free Co₂(1.64-2.07); Total Alkalinity(40.22-52.55mg/l); Chlorides(39.02-47.92mg/l); Phosphates(1.52-1.93mg/l); Nitrates(0.29-0.58mg/l); Sulphates(29.50-43.77mg/l); Ammonia(0.81-1.47ppm) and Electrical Conductivity(113.61-125.27µmhos/cm), were studied. The results obtained confirmed seasonal variations and fluctuations of various physico-chemical parameters during the study period. These results revealed that, the physico-chemical parameters of the fresh water lake were within the permissible limits and can be used for home, irrigation and pisciculture purposes.

Keywords: Wardhannapet fresh water lake, physico – chemical parameters, seasonal variation

Introduction

Water is one of the most valuable resources on planet earth and is the lifeline of almost all living creatures on earth. Water resources are of critical importance to both natural ecosystem and human development. It is vital factor of life and it is considered as precious compound on the earth. Water occupied 71% of our earth's surface, in this 97% of water available as in the form saline water in oceans and 3% fresh water in form of polar ice caps, surface and ground water resources. The natural aquatic resources like rivers, ponds, streams and lakes are causing heavy and varied pollution in environment leading to changes in water quality and depletion of aquatic biota. Due to increased pollution, urbanization rapid growth of industrialization and disposal of sewage, domestic waste, industrial effluents and other human being activities. The quality of water affects the species composition, abundance, productivity and physiological conditions especially, the indigenous population of aquatic organisms. (Wetzel R.G, 2001). The alteration in physico-chemical parameters leading to eutrophication has become widely recognized problem of water quality deterioration.

Materials and methods

Study area

An important fresh water lake in Warangal District has been identified to assess its water quality. This lake is located at Wardhannapet. The objective of the study is to take up fish culture in this lake. Weir and Sluice are present in this lake. This lake shows good diversity of Ichthyofauna along with other fauna

Sampling program

The present investigation carried out 24 months from June 2018 to May 2020 (for two years) during different seasons in Wardhannapet Lake. The season defined as Rainy (June to September), winter (October to January) and summer (February to May). The water samples were collected during morning hours of the day at 8.00 am to 10.00 am. The physico-chemical characteristics of water including water temperature, transparency, pH, dissolved oxygen, free carbon-dioxide, total alkalinity, chlorides were analyzed at the sampling stations, while other parameters including phosphates, sulphates, nitrates, ammonia and electrical conductivity, total dissolved solids, biological oxygen demand were analyzed in the laboratory methods of APHA (1985) [1] and Trivedy and Goel (1986) [25].

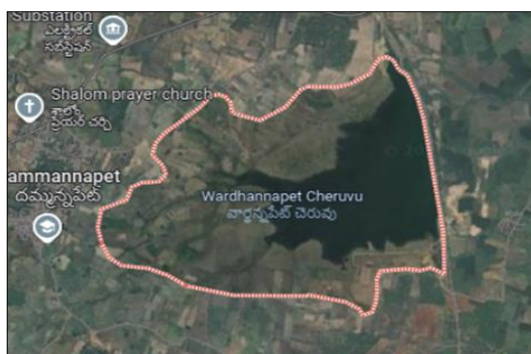


Fig 1: Satellite map of Wardhannapet Lake

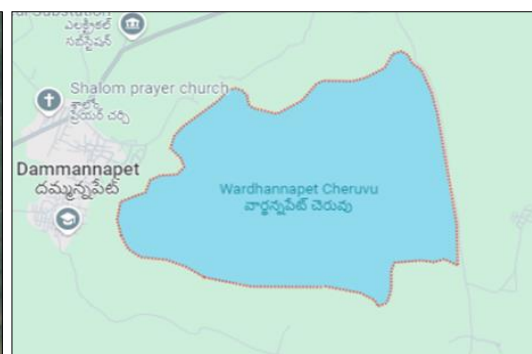


Fig 2: Location of Wardhannapet Lake

Result and discussion

In the present study of the physico-chemical parameters of wardhannapet fresh water lake Warangal district, for the period from June, 2018 to May, 2020 has been done the data thus obtained was given below (Table no-1, 2 and 3). The parameters studied were Water Temperature, Total Dissolved Solids, Transparency, PH, Dissolved Oxygen, Biological Oxygen Demand, Carbon di Oxide, Total Alkalinity, Chloride, Phosphate, Sulphates, Nitrate, Ammonia and Electrical Conductivity. The monthly and seasonal variation in physico-chemical parameters was presented in Table -1, 2 &3. There are some variations in different physico-chemical parameters have been observed during the study period. The physical and chemical properties of fresh water bodies are characterized by the climatic, geochemical, geomorphologic and pollution conditions. The quality of aquatic life depends on the water quality. In order to utilize fresh bodies successfully for fish production, it is very important to study the physico-chemical factors which influence the biological productivity of the water bodies.

Temperature

Water temperature measurement is useful in indicating trends for various chemical, bio-chemical and biological activities. Temperature is a physical factor that alters the water characteristics and consider as an important for in controlling the fluctuation of plantation and functioning of aquatic ecosystem Wetzel (1975) [27]; Dwivedi and Pande (2002) [6]. The data obtained on the temperature content water samples from Wardhannapet Lake during the year from June 2018 to May 2020 are presented in (Table no-1&2). Seasonal variations of physico-chemical parameters were analyzed in three different seasons such as Rainy season, winter season and summer season. The data pertaining to temperature of wardhanapet lake during the year 2018-2019 ranges from 23.00 to 31.00°C. Highest temperature 31.00°C were recorded in the month of May, while the lowest temperature 23.00°C were recorded in the month of December (Table no-1). Mean value of the temperature in Rainy Season (27.95 ± 0.31), Winter Season (25.50 ± 1.80), Summer Season (29.02 ± 1.40) were recorded (Table no-3) which is due to greater solar radiation and higher atmospheric temperature due to high water level Hiware, C.J. & Ugale, B.J. (2003) [8]. The water temperature ranged from 24.00°C to 31.50°C. The highest temperature was recorded in the month of May 31.50°C, while the lowest temperature was recorded in the month of December 24.00°C in the year from 2019-20 (Table no-2). Mean value of the temperature in Rainy Season (28.95 ± 0.66), Winter Season (26.15 ± 1.57), Summer Season (29.80 ± 1.48) were recorded (Table no-3). This observation has been true for the several water bodies in India Narayana, J, *et al* (2008) [8]; Garg, R.K., *et al* (2009) [7]; Prabhakar, C., *et al* (2012) [21]; Jayabhaye, (2013) [11].

Total dissolved solids

TDS is an important parameter in determining the water quality standards. TDS is an important parameter show impact on water quality. Water with more TDS value usually has disagreeable taste. TDS indicates the salinity of water. TDS is a good indicator of water quality due to the fact that it affects the taste, colour and smell of the water. Increased levels of TDS makes water unfit for drinking and

irrigation, cause decreased photosynthetic capacity and rise in water temperature (Simeon *et al.*, 2019). The data obtained on the total dissolved solids content water samples from Wardhannapet Lake during the year from June 2018 to May 2020 are presented in table no-1, 2. In the present investigation, the Total Dissolved Solids ranges from 35.50 to 47.60mg/l in the year 2018-19. Highest TDS 47.60mg/l were recorded in the month of July, while the lowest TDS 35.50mg/l were recorded in the month of January (Table no-1). Mean value of the TDS in Rainy Season (44.90 ± 3.02), Winter Season (37.00 ± 1.24), Summer Season (40.46 ± 1.94) were recorded (Table no-3). The Total Dissolved Solids ranged from 36.10mg/l-48.20mg/l. The Total Dissolved Solids value ranges from 36.10 to 48.20 (mg/l). The highest Total Dissolved Solids value was recorded in the month of June 48.20(mg/l), while the lowest Total Dissolved Solids value was recorded in the month of January 36.10(mg/l) in the year from 2019-20 (Table no-2). Mean value of the TDS in in Rainy Season (46.67 ± 1.69), Winter Season (37.77 ± 1.30), Summer Season (41.27 ± 1.91) were recorded (Table no-3). Similar observations were made by Gowd and Kotaih 1999; Kadam *et al.*, (2007) [5].

Transparency

Transparency is a physical variable significant to primary production. The transparency of water body is mainly affected by the suspended particles and indirectly influenced by the physicochemical parameters. The data obtained on the transparency content water samples from Wardhannapet Lake during the year from June 2018 to May 2020 are presented in table no-1, 2. The data pertaining to transparency of Wardhanapet Lake during the year 2018-2019 ranges from 40.00 to 55.70(cm). Highest transparency 55.70(cm) were recorded in the month of January, while the lowest transparency values 40.00cm was recorded in the month of September (Table no-1). Mean value of the transparency in Rainy Season (43.37 ± 2.43), Winter Season (50.25 ± 4.19), Summer Season (47.92 ± 1.59) were recorded (Table no-3). The transparency ranged from 44.20 to 57.00(Cm). The highest water transparency value were recorded in the month of January 57.00(Cm), while the lowest water transparency value were recorded in the month of September 44.20(Cm) in the year from 2019-20 (Table no-2). Mean value of the transparency in Rainy Season (45.62 ± 1.26), Winter Season (52.17 ± 3.85), Summer Season (6.92 ± 0.34) were recorded (Table no-3). Similar observations were made by Oomachand (1981) [20]; Patil *et al.*, (2008).

PH

pH indicates the concentration of hydrogen ions. Being one of the most important factors in measuring water quality. Practically every aspect of water, like acid and base neutralization, water softening, precipitation, coagulation and acidification is pH dependent. It is greatly affected by photosynthetic activity of aquatic plants by exposure of air temperature, disposal of sewage and disposal of industrial water Khanna and Bhatia (2003). The data obtained on the PH content water samples from Wardhannapet Lake during the year from June 2018 to May 2020 are presented in (Table no-1&2). The data pertaining to PH of Wardhanapet Lake during the year 2018-2019. The PH value ranges from 6.45 to 7.50. The highest PH value were recorded in the

month of June 7.50, while the lowest PH value was recorded in the month of February 6.45 (Table no-1). Mean value of the PH in Rainy Season (7.32 ± 0.17), Winter Season (6.88 ± 0.26), Summer Season (6.92 ± 0.34) were recorded (Table no-3). The PH value ranges from 6.52 to 7.70. The highest PH value were recorded in the month of June 7.70, while the lowest PH value was recorded in the month of February 6.52 in the year from 2019-20 (Table no-2). Mean value of the PH in Rainy Season (7.50 ± 0.16), Winter Season (7.11 ± 0.08), Summer Season (7.04 ± 0.39) were recorded (Table no-3). Similar observations were made by Angadi *et al.*, (2005) [5].

Dissolved oxygen

Dissolved Oxygen is one of the most important on-site parameters that gives an indication of organic pollution in water body Kaushik *et al.*, (2004) [13]. The data obtained on the Dissolved Oxygen content water samples from Wardhannapet Lake during the year from June 2018 to May 2020 are presented in table no-1, 2. The data pertaining to Dissolved Oxygen of Wardhanapet Lake during the year 2018-2019. In the present study the Dissolved Oxygen ranges from 7.5 to 8.6 (mg/l). The highest Dissolved Oxygen values (8.6mg/l) were recorded in the month of June, while the lowest Dissolved Oxygen value (7.5mg/l) were recorded in the month of February & April (Table-1). Mean value of the Dissolved Oxygen in Rainy Season (8.50 ± 0.08), Winter Season (7.77 ± 0.17), Summer Season (7.57 ± 0.09) were recorded (Table no-3). The Dissolved Oxygen ranges from 7.5 to 8.9 (mg/l). The highest Dissolved Oxygen value were recorded in the month of June 8.9(mg/l), while the lowest Dissolved Oxygen value were recorded in the month of February 7.5(mg/l) in the year from 2019-20 (Table no-2). Mean value of the Dissolved Oxygen in Rainy Season (8.67 ± 0.17), Winter Season (5.72 ± 0.53), Summer Season (7.75 ± 0.19) were recorded (Table no-3). The values were observed high during rainy and winter as low temperature favored dissolution of DO. Low DO during summer in the present investigation was probably due to two reasons. In summer at high temperature rate of oxidation of organic matter in water increase and oxygen was consumed in the process, secondly at higher temperature the water had a lesser oxygen holding capacity and surplus oxygen was lost to the atmosphere. Many workers Singh *et al.*, (1993) [23]; Mani and Gaikwad (1998) [15] and Prakasham and Joseph, (2000) have discussed the seasonal fluctuations in the DO content of various water bodies in India at length. Dissolved oxygen in water is often attributed to the fact that the oxygen is dissolved more during the period of active photosynthesis. The high temperature and addition of sewage and other waste might be responsible for low value of DO Saksena and Kaushik, (1994) [24]. Similar observations were made by Singh and Trivedi, (1979).

BOD

BOD is the amount of dissolved oxygen needed by aerobic biological organisms in body of water to break down organic material present in a given water sample at certain temperature over a specific time period and considered as an important water quality indicator J.Mahendar *et al.*, (2016) [12] The data obtained on the BOD content water samples from Wardhannapet Lake during the year from June 2018 to May 2020 are presented in table no-1,2. The data pertaining to BOD of Wardhanapet Lake during the year 2018-2019. In

the present study the BOD ranges from 3.0 to 6.3(mg/l). Highest BOD values 6.3(mg/l) were recorded in the month of January, while the lowest BOD values (3.0mg/l) were recorded in the month of February (Table-1). Mean value of the BOD in Rainy Season (4.65 ± 0.65), Winter Season (5.72 ± 0.53), Summer Season (3.47 ± 0.42) were recorded (Table no-3). In the present study the BOD ranges from 4.1 to 7.5(mg/l). The highest Biological Oxygen Demand value were recorded in the month of January (7.5mg/l), while the lowest Biological Oxygen Demand value were recorded in the month of February 4.1(mg/l) in the year from 2019-20 (Table no-2). Mean value of the BOD in Rainy Season (5.57 ± 0.37), Winter Season (6.82 ± 0.55), Summer Season (4.60 ± 0.41) were recorded (Table no-3). Similar observations were observed by Mishra *et al.* (1999) [6]. Jain and Dhanija (2000) have identified BOD as an important parameter in aquatic ecosystems to establish the status of pollution.

Co₂

The Free Co₂ is released during the decomposition of certain substances and metabolic activities of the living organisms. Free carbon dioxide dissolve in water is essentially the only source of carbon that can be assimilated and incorporated into the skeleton of living matter of all the aquatic autotrophs. The data obtained on the Co₂ content water samples from Wardhannapet Lake during the year from June 2018 to May 2020 are presented in table no-1,2. The data pertaining to CO₂ of Wardhanapet Lake during the year 2018-2019. In the present study the free carbon dioxide values ranges from 1.60 to 2.10 (mg/l). The highest Co₂ values 2.10(mg/l) was recorded in the month of January; while the lowest Co₂ value 1.60(mg/l) was recorded in the month of February (Table-1). Mean value of the Co₂ in Rainy Season (1.79 ± 0.05), Winter Season (1.95 ± 0.10), Summer Season (1.64 ± 0.03) were recorded (Table no-3). The Carbon di Oxide During ranges from 1.70 to 2.20(mg/l). The highest Carbon di Oxide value were recorded in the month of January 2.20(mg/l), while the lowest Carbon di Oxide value were recorded in the month of February 1.70(mg/l) in the year from 2019-20 (Table no-2). Mean value of the Carbon di Oxide in Rainy Season (1.91 ± 0.06), Winter Season (2.07 ± 0.09), Summer Season (1.75 ± 0.04) were recorded (Table no-3). Similar observations were made by Mokappa Naik and Hina Kouser (2012) [18].

Total alkalinity

Alkalinity is a measure of buffering capacity of the water. It is generally imparted by salts of carbonates, bicarbonates, phosphate, nitrates, borax, silicates etc., together with the hydroxyl ions in a free states Jain and Seethapathi, (1996) [9]; Yalavarthy, (2002) The data obtained on the total alkalinity content water samples from Wardhannapet Lake during the year from June 2018 to May 2020 are presented in table no-1, 2. The data pertaining to total alkalinity of Wardhanapet Lake during the year 2018-2019. In the present study, the total alkalinity ranges from 35.10 to 55.60(mg/l). Highest total alkalinity values 55.60(mg/l) were recorded in the month of September, while the lowest values 35.20(mg/l) were recorded in the month of February (Table-1). Mean value of the total alkalinity in Rainy Season (51.65 ± 3.04), Winter Season (46.40 ± 4.62), Summer Season (40.22 ± 4.53) were recorded (Table no-3). The Total Alkalinity ranges from 38.00 to 56.30(mg/l). The highest

Total Alkalinity value were recorded in the month of September 56.30(mg/l), while the lowest Total Alkalinity value were recorded in the month of February 38.00(mg/l) in the year from 2019-20 (Table no-2). Mean value of the total alkalinity in Rainy Season (47.31 ± 1.66), Winter Season (43.23 ± 0.95), Summer Season (41.80 ± 3.52) were recorded (Table no-3).

Chloride

Chloride as anion occurs in all natural waters in widely varying concentrations. The origin of chloride in surface water is from weathering and leaching of sedimentary rocks, domestic and industrial wastes discharge municipal influence etc. Chloride plays an important role in water quality determination. The data obtained on the chloride content water samples from Wardhannapet Lake during the year from June 2018 to May 2020 are presented in table no-1, 2. The data pertaining to chloride of Wardhanapet Lake during the year 2018-2019. The chloride ranged from 35.20 to 49.55(mg/l). Highest chloride values 49.55(mg/l) were recorded in the month of August, while the lowest chloride values 35.20(mg/l) were recorded in the month of February (Table no-1). Mean value of chloride in Rainy Season (47.31 ± 1.66), Winter Season (43.23 ± 0.95), Summer Season (39.02 ± 2.98) were recorded (Table no-3). The Chloride ranges from 37.00 to 50.00(mg/l). The highest Chloride value were recorded in the month of August 50.00(mg/l), while the lowest Chloride value were recorded in the month of February 37.00(mg/l) in the year from 2019-20 (Table no-2). Mean value of chloride in Rainy Season (47.92 ± 1.60), Winter Season (44.70 ± 1.03), Summer Season (40.55 ± 3.18) were recorded (Table no-3).

Phosphate

Phosphates are essential nutrient for organism growth in water body. The data obtained on the Phosphate content water samples from Wardhannapet Lake during the year from June 2018 to May 2020 are presented in table no-1, 2. The data pertaining to Phosphate of Wardhanapet Lake during the year 2018-2019. Phosphate ranges from 1.45 to 2.00(mg/l). The highest phosphate values (2.00mg/l) were recorded in the month of September, while the lowest phosphate values 1.45(mg/l) were recorded in the month of February (Table no-1). Mean value of Phosphate in Rainy Season (1.80 ± 0.14), Winter Season (1.80 ± 0.14), Summer Season (1.52 ± 0.06) were recorded (Table no-3). Phosphate ranges from 1.70 to 2.15(mg/l). The highest Phosphate value were recorded in the month of September 2.15(mg/l), while the lowest Phosphate value were recorded in the month of February 1.70(mg/l) in the year from 2019-20 (Table no-2). Mean value of Phosphate in Rainy Season (1.93 ± 0.15), Winter Season (1.92 ± 0.12), Summer Season (1.75 ± 0.03) were recorded (Table no-3). Similar observations were made by Satyamohan and Zafar (1986) [22].

Sulphate

Sulphates are found appreciably in all natural waters to detect the permanent hardness. Sulphate form an important constituent of hardness and used by organisms for protein synthesis. It enters in to water body by the weathering of sedimentary rocks, bathing and washing clothes Jain *et al.*, (1996) [9]. The data obtained on the sulphate content water samples from Wardhannapet Lake during the year from June 2018 to May 2020 are presented in table no-1, 2. The

data pertaining to sulphate of Wardhanapet Lake during the year 2018-2019. Sulphate ranged from 25.20 to 45.10(mg/l). Highest sulphate values 45.10(mg/l) were recorded in the month of August, while the lowest sulphate value 25.20(mg/l) were recorded in the month of February (Table no-1). Mean value of sulphate in Rainy Season (41.70 ± 3.09), Winter Season (41.41 ± 0.98), Summer Season (29.50 ± 4.42) were recorded (Table no-3). Sulphate ranges from 30.30 to 47.00(mg/l). The highest Sulphate value were recorded in the month of August 47.00(mg/l), while the lowest sulphate value were recorded in the month of February 30.30(mg/l) in the year from 2019-20 (Table no-2). Mean value of sulphate in Rainy Season (43.77 ± 3.09), Winter Season (43.32 ± 0.96), Summer Season (34.25 ± 3.68) were recorded (Table no-3).

Nitrate

Nitrate is the highest oxidized form of nitrogen and in water its most important source is biological oxidation of nitrogenous organic matter of both autochthonous and allochthonous origin. Domestic sewage and agricultural runoff are the chief source of allochthonous nitrogenous organic matter. Metabolic waste of aquatic community and dead organisms add to the autochthonous nitrogenous organic matter. The high concentration of nitrate in water is indicative of pollution. The data obtained on the Nitrate content water samples from Wardhannapet Lake during the year from June 2018 to May 2020 are presented in table no-1, 2. The data pertaining to nitrate of Wardhanapet Lake during the year 2018-2019. Nitrate ranged from 0.22 to 0.55(mg/l). Highest Nitrate values 0.55(mg/l) were recorded in the month of August, while the lowest Nitrate values 0.22(mg/l) were recorded in the month of February (Table no-1). Mean value of nitrates in Rainy Season (0.49 ± 0.04), Winter Season (0.39 ± 0.02), Summer Season (0.29 ± 0.05) were recorded (Table no-3). The Nitrate ranges from 0.30 to 0.65(mg/l). The highest Nitrate value were recorded in the month of July 0.65(mg/l), lowest Nitrate value were recorded in the month of February 0.30(mg/l) in the year from 2019-20 (Table no-2). Mean value of nitrates in Rainy Season (0.58 ± 0.05), Winter Season (0.45 ± 0.03), Summer Season (0.38 ± 0.07) were recorded (Table no-3). Similar data was recorded by Jawale A.K. *et al.* (2009) [10]. The high nitrate concentration during monsoon might be due to influx nitrogen rich flood water that brings about large amount of contaminated sewage water. The monsoon season was the period with the highest nitrate-nitrogen concentration which is known to support the formation of blooms Blomqvist *et al.*, (1994) [4] and Anderson, *et al.*, (1998) [2].

Ammonia

The data obtained on the Ammonia content water samples from Wardhannapet Lake during the year from June 2018 to May 2020 are presented in table no-1, 2. The data pertaining to Ammonia of Wardhanapet Lake during the year 2018-2019. Ammonia ranges from 0.65 to 1.46(ppm). Highest ammonia values 1.46(ppm) were recorded in the month of October, while the lowest values 0.65(ppm) were recorded in the month of February (Table no-1). Mean value of Ammonia in Rainy Season (1.30 ± 0.11), Winter Season (1.33 ± 0.10), Summer Season (0.81 ± 0.13) were recorded (Table no-3). Ammonia ranges from 0.72 to 1.53 (ppm). The highest Ammonia value were recorded in the month of October 1.53 (ppm), while the lowest Ammonia value were

recorded in the month of February 0.72 (ppm) in the year from 2019-20 (Table no-2). Mean value of Ammonia in Rainy Season (1.33 ± 0.16), Winter Season (1.47 ± 0.05), Summer Season (0.85 ± 0.11) were recorded (Table no-3). During the winter season high ammonia, where as low ammonia in summer season.

Electrical conductivity

Electrical conductivity is the ability of water to convey electric current and is a method for determining the water's purity Murugesan *et al.*, (2006) [17]. It also indicates the presence of biogenic and abiogenic impurities in water Upadhyay *et al.*, (2012) [26]. The data obtained on the Conductivity content water samples from Wardhannapet Lake during the year from June 2018 to May 2020 are presented in table no-1, 2. The data pertaining to Conductivity of Wardhannapet Lake during the year 2018-2019. EC ranges from 110.00 to

130.10 ($\mu\text{mhos/cm}$). Highest EC values 130.10 ($\mu\text{mhos/cm}$) were recorded in the month of September, while the lowest values 110.00 ($\mu\text{mhos/cm}$) were recorded in the month of February (Table no-1). Mean value of EC in Rainy Season (124.23 ± 4.62), Winter Season (117.43 ± 2.03), Summer Season (113.61 ± 3.19) were recorded (Table no-3). The Electrical Conductivity ranges from 112.25 to 131.40 ($\mu\text{mhos/cm}$). The highest Electrical Conductivity value were recorded in the month of September 131.40 ($\mu\text{mhos/cm}$), while the lowest Electrical Conductivity value were recorded in the month of February 112.25 ($\mu\text{mhos/cm}$) in the year from 2019-20 (Table no-2). Mean value of EC in Rainy Season (125.27 ± 4.86), Winter Season (119.24 ± 1.66), Summer Season (115.02 ± 3.34) were recorded (Table no-3). Similar observations were made by Gowd and Kotaih (1999) [5]; Kadam *et al.*, (2007). During the monsoon season high electrical conductivity, where the low electrical conductivity in summer season.

Table 1: Showing Monthly Variations of Wardhannapet Fresh Water Lake 2018-2019

Month	TEM	TDS	TRS	PH	DO	BOD	CO ₂	TA	CL	PO ₄	SO ₄	NO ₃	NH ₃	EC
Jun-18	28.20	45.30	45.20	7.50	8.6	4.0	1.72	48.60	45.60	1.66	38.23	0.45	1.15	119.35
Jul-18	28.10	47.60	45.10	7.45	8.4	5.5	1.80	50.10	47.40	1.75	40.15	0.51	1.28	122.10
Aug-18	28.00	46.10	43.20	7.20	8.5	4.3	1.82	52.30	49.55	1.81	45.10	0.55	1.37	125.40
Sep-18	27.50	40.60	40.00	7.15	8.5	4.8	1.85	55.60	46.70	2.00	43.35	0.45	1.47	130.10
Oct-18	27.10	38.40	46.10	6.52	8.0	5.1	1.86	52.40	44.45	1.95	42.54	0.43	1.46	120.20
Nov-18	26.50	37.50	48.00	6.85	7.8	5.5	1.89	47.20	43.35	1.90	40.15	0.40	1.35	117.65
Dec-18	23.00	36.60	51.20	7.00	7.7	6.0	1.95	44.50	43.00	1.70	41.63	0.37	1.33	116.32
Jan-19	25.40	35.50	55.70	7.15	7.6	6.3	2.10	41.50	42.15	1.65	41.35	0.39	1.20	115.56
Feb-19	27.80	38.00	50.00	6.45	7.5	3.0	1.60	35.10	35.20	1.45	25.20	0.22	0.65	110.00
Mar-19	28.30	40.00	46.20	6.90	7.7	4.0	1.63	38.20	38.50	1.50	27.30	0.28	0.78	112.10
Apr-19	29.00	41.30	47.40	7.20	7.5	3.3	1.65	42.10	40.10	1.53	30.10	0.31	0.88	115.15
May-19	31.00	42.55	48.10	7.15	7.6	3.6	1.68	45.50	42.30	1.61	35.42	0.36	0.96	117.20

Table 2: Showing Monthly Variations of Wardhannapet Fresh Water Lake 2019-2020

Month	TEM	TDS	TRS	PH	DO	BOD	CO ₂	TA	CL	PO ₄	SO ₄	NO ₃	NH ₃	EC
Jun-19	29.50	47.50	47.00	7.70	8.9	5.1	1.82	49.50	46.10	1.80	40.20	0.55	1.10	120.00
Jul-19	29.30	48.20	46.30	7.56	8.6	6.0	1.91	51.20	48.00	1.86	42.30	0.65	1.36	123.20
Aug-19	29.00	46.70	45.00	7.45	8.7	5.5	1.95	53.20	50.00	1.93	47.00	0.60	1.40	126.50
Sep-19	28.00	44.30	44.20	7.30	8.5	5.7	1.97	56.30	47.60	2.15	45.60	0.52	1.47	131.40
Oct-19	27.60	39.00	48.30	7.00	8.2	6.2	1.99	53.10	46.00	2.05	44.70	0.50	1.53	121.33
Nov-19	27.00	38.60	50.00	7.10	8.0	6.6	2.00	48.50	45.00	2.00	43.30	0.46	1.50	119.70
Dec-19	24.00	37.40	53.40	7.15	7.9	7.0	2.10	46.30	44.20	1.85	42.75	0.41	1.46	118.50
Jan-20	26.00	36.10	57.00	7.20	7.8	7.5	2.20	44.20	43.60	1.78	42.55	0.45	1.40	117.45
Feb-20	28.20	39.30	55.10	6.52	7.5	4.1	1.70	38.00	37.00	1.70	30.30	0.30	0.72	112.25
Mar-20	29.00	40.20	50.00	6.95	7.9	5.1	1.75	40.00	39.30	1.75	32.40	0.36	0.81	113.46
Apr-20	30.50	42.00	49.10	7.40	7.7	4.5	1.78	43.20	41.40	1.77	35.60	0.42	0.88	114.55
May-20	31.50	43.60	50.20	7.30	7.9	4.7	1.80	46.00	44.50	1.79	38.70	0.47	1.00	119.85

Table 3: Showing Seasonal Variations of Wardhannapet Fresh Water Lake 2018-2020

S.no	Parameters	Duration	Range	Rainy	Winter	Summer
				Mean \pm SD	Mean \pm SD	Mean \pm SD
1	Temperature °C	2018-19	23.00-31.00	27.95 \pm 0.31	25.50 \pm 1.80	29.02 \pm 1.40
		2019-20	24.00-31.50	28.95 \pm 0.66	26.15 \pm 1.57	29.80 \pm 1.48
2	TDS(mg/l)	2018-19	35.50-47.60	44.90 \pm 3.02	37.00 \pm 1.24	40.46 \pm 1.94
		2019-20	36.10-48.20	46.67 \pm 1.69	37.77 \pm 1.30	41.27 \pm 1.91
3	Transparency(cm)	2018-19	40.00-55.70	43.37 \pm 2.43	50.25 \pm 4.19	47.92 \pm 1.59
		2019-20	44.20-57.00	45.62 \pm 1.26	52.17 \pm 3.85	51.10 \pm 2.70
4	pH	2018-19	6.45-7.50	7.32 \pm 0.17	6.88 \pm 0.26	6.92 \pm 0.34
		2019-20	6.52-7.56	7.50 \pm 0.16	7.11 \pm 0.08	7.04 \pm 0.39
5	Dissolved Oxygen(mg/l)	2018-19	7.50-8.60	8.50 \pm 0.08	7.77 \pm 0.17	7.57 \pm 0.09
		2019-20	7.50-8.90	8.67 \pm 0.17	7.97 \pm 0.17	7.75 \pm 0.19
6	BOD(mg/l)	2018-19	3.00-6.30	4.65 \pm 0.65	5.72 \pm 0.53	3.47 \pm 0.42
		2019-20	4.10-7.50	5.57 \pm 0.37	6.82 \pm 0.55	4.60 \pm 0.41
7	Co ₂ (mg/l)	2018-19	1.60-2.10	1.79 \pm 0.05	1.95 \pm 0.10	1.64 \pm 0.03
		2019-20	1.70-2.20	1.91 \pm 0.06	2.07 \pm 0.09	1.75 \pm 0.04

8	Total Alkalinity (mg/l)	2018-19	35.10-55.60	51.65 ± 3.04	46.40 ± 4.62	40.22 ± 4.53
		2019-20	38.00-56.30	52.55 ± 2.92	48.02 ± 3.81	41.80 ± 3.52
9	Chloride(mg/l)	2018-19	35.20-49.55	47.31 ± 1.66	43.23 ± 0.95	39.02 ± 2.98
		2019-20	37.00-50.00	47.92 ± 1.60	44.70 ± 1.03	40.55 ± 3.18
10	Phosphate(mg/l)	2018-19	1.45-2.00	1.80 ± 0.14	1.80 ± 0.14	1.52 ± 0.06
		2019-20	1.70-2.15	1.93 ± 0.15	1.92 ± 0.12	1.75 ± 0.03
11	Sulphate((mg/l)	2018-19	25.20-45.10	41.70 ± 3.09	41.41 ± 0.98	29.50 ± 4.42
		2019-20	30.30-47.00	43.77 ± 3.09	43.32 ± 0.96	34.25 ± 3.68
12	Nitrate(mg/l)	2018-19	0.22-0.55	0.49 ± 0.04	0.39 ± 0.02	0.29 ± 0.05
		2019-20	0.30-0.65	0.58 ± 0.05	0.45 ± 0.03	0.38 ± 0.07
13	Ammonia(ppm)	2018-19	0.65-1.46	1.30 ± 0.11	1.33 ± 0.10	0.81 ± 0.13
		2019-20	0.72-1.53	1.33 ± 0.16	1.47 ± 0.05	0.85 ± 0.11
14	EC(μ mhos/cm)	2018-19	110.00-130.10	124.23 ± 4.62	117.43 ± 2.03	113.61 ± 3.19
		2019-20	112.25-131.40	125.27 ± 4.86	119.24 ± 1.66	115.02 ± 3.34

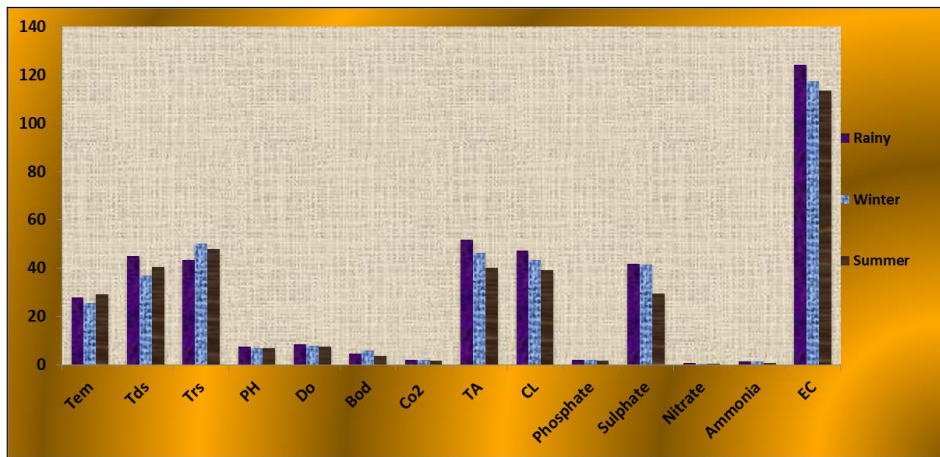


Fig 3: Shows Seasonal variation in physico-chemical parameters of Wardhannapet Fresh Water Lake during the year from June, 2018 to May, 2019

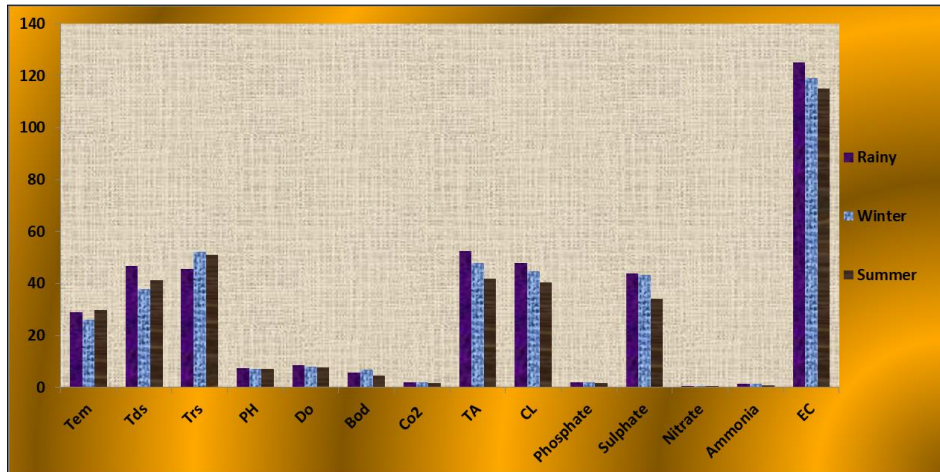


Fig 4: Shows Seasonal variation in physico-chemical parameters of Wardhannapet Fresh Water Lake during the year from June, 2019 to May, 2020

Conclusion

The result obtained from the present investigation revealed that there was significant seasonal variation in some physicochemical parameters and most of the parameters were in the normal range and indicates moderate quality of lake water

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