Vol. 6, Issue 12, December 2017

ISSN: 2319-9490

IJCRLS

Impact Factor 2017:5.379

International Journal of Current Research in Life Sciences

A Peer-Reviewed International Monthly Research Journal

Journal Indexed in:

CiteFactor

Google

VIBUS INNOVATIVE PUBLISHING SOLUTIONS

Available online at http://www.ijcrls.com

International Journal of Current Research in Life Sciences
Vol. 07, No. 06, pp.2262-2267, June, 2018

ISSN: 2319-9490

RESEARCH ARTICLE

HYDROLOGICAL STUDY OF BARDA BANDHARAN WETLAND REGARDING THE INFLUENCE OF VARIOUS PHYSICO-CHEMICAL PARAMETERS ON MICROBIAL DENSITY

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Received 17th April, 2018; Accepted 20th May, 2018; Published 30th June, 2018

ABSTRACT

Wetland ecosystems are among the most productive ecosystems in the biosphere. Wetland ecosystem supports the growth of Biodiversity. Hydrology of wetland water gives an idea about physical and chemical properties of water and their relationship with ecosystem diversity. In the present study we have investigated the relationship between abiotic factors andmicrobial population densities. It is observed that microbial growth intensity is directly influenced by a number of physico-chemical parameters and other abiotic factors. In preset study we have investigated microbial intensity fluctuation with abiotic factors during Pre, Middle and post winter during 2016-17 at Barda Bandharan (Temporary wetland) near Barda Village (Mul-Dwaraka), Kodinar.

Key words: Hydrology, Microbial Density, Physico-Chemical Parameter, Temporary wetland.

Citation: Mehul P Dave and Nikul B. Chavda, 2018. "Hydrological Study of Barda Bandharan Wetland regarding the influence of various Physico-Chemical Parameters on Microbial Density" *International Journal of Current Research in Life Sciences*, 7, (06), 2262-2267.

INTRODUCTION

Wetland ecosystems are among the most productive ecosystems in the biosphere. Wetlands receive surface water inputs from streams (surface run off), precipitation and overland flow and subsurface water inputs from surface infiltration, stream hyporheic zones and ground water. These different inputs are important to wetland productivity because they contain markedly different quantities of transported nutrients (American Public Health Association, 2012) and organic matter Attayde, 1998). Wetlands are recognized as ecosystems that harbor high biological diversity, provide sustenance for millions of people and face ongoing threats as results of human activities throughout the world (Balcer et al., 1984). As ecosystems, wetlands are highly volatile being particularly vulnerable to environmental fluctuations. Although wetland biodiversity constitutes a significant portion (e.g., 15-20%), of the total biodiversity of the Indian Subcontinent (Bertram, 1999), studies of wetland ecosystems are limited (Berzins, 1989). Increasing anthropogenic interventions and their influence in and around aquatic systems as well as their catchment areas have contributed to a larger extent towards deterioration of water quality leading to accelerated eutrophication.

The hydro geochemical characteristics and phytoplankton biomass of water bodies are not constant and fluctuate with seasonal variations as well as with degree of pollution (Berzins, 1989). Bacteria found in water belong by definition to plankton but because of special techniques required for sampling and identification, they are considered separately. These organisms are important in the transformation of dead organic materials to inorganic plant nutrients. Some of these marine and freshwater microorganisms (including blue-green algae) fix molecular nitrogen from water containing dissolved air, forming ammonia or related nutrients important for phytoplankton growth. Although little is known about the extent of nitrogen fixation, such bacteria are always found in water samples. Biological interactions in the ocean are not between populations or between tropic levels, as many box-model representations of pelagic food webs might lead us to think. This allows us to build models and to extrapolate observations beyond the system in which the observations were made. Traditionally, scientists who go on cruises and examine distribution patterns of both biota and environmental properties using sampling are considered biological oceanographers and those who explore the functioning of individuals, for example by conducting laboratory experiments with organisms are considered marine biologists. We need to combine the two approaches to understand the ecology of the oceans.

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MATERIAL AND METHOD

Sample collection Points

Three sample points selected at Barda Bandharan (Sampling Points) with specific GPS location and suitable depth and surface. Sample Collected in plastic bottle (non metallic, free-flushing sample recommended for general purpose of water sampling). 5 liter samples Collected for physicochemical analysis approximately less than 2 feet of river water. Time and temperature measured and transferred all sample as soon as possible to laboratory for study further testing. Temperature range between 18 to 21 ^{0}C of samples (Winter Period).

Sr.No	Barda Bandharan Site Location (Mul-Dwarka)
1	N 20.45.53 E 70.39.6
2	N 20.45.54 E 70.39.7
3	N 20.45.52 E 70.39.4

Bacteriological Analysis

Bacteria found in water belong by definition to plankton but because of special techniques required for sampling and identification are considered separately.

Fig. Barda Bandharan Site Location (Mul-Dwarka)

These organisms are important in the transformation of dead organic materials to inorganic plant nutrients. Some of these marine and freshwater microorganisms (including blue-green algae) fix molecular nitrogen from water containing dissolved air, forming ammonia or related nutrients important for phytoplankton growth. Although little is known about the extent of nitrogen fixation bacteria always are found in water samples. Biological interactions in the ocean are not between populations or between tropic levels, as many box-model representations of pelagic food webs might lead us to think. This allows us to build models and to extrapolate observations beyond the system in which the observations were made. Traditionally, scientists who go on cruises and examine distribution patterns of both biota and environmental properties using sampling are considered biological oceanographers and those who explore the functioning of individuals, for example by conducting laboratory experiments with organisms are considered marine biologists. We need to combine the two approaches to understand the ecology of the oceans.Standard plate count method used for enumeration of bacteria/.biochemical Analysis used for identification of bacterial isolated from water Samples (APHA 2012)

Physicochemical Analysis

Primary Examination has done Base on Physical examination of water sample by Color, odor and turbidity. pH and Conductivity measured by pH meter and Conductivity meter.

Estimation of Total solid (T.S.)

Porcelain dish is used for this method; Heat it for 103 to 105 C for 1 hrs. Store and cool dish in desiccators until needed weight immediately before use. (Pre weight)Shake the water sample very well and add 100ml of it in to evaporating Petri dish. Put evaporating dish in to oven at 103 to 105 C for overnight. Next day take out it from oven and cool it in desiccators dish would be having dried residues in it. Measure the weight of evaporating dish.

(Post weight)Put the data or pre weight and post weight of the dish in following equation and calculate the amount of total solid present in the sample. Calculation: mg total solids/L= (A-B).1000/Sample volume (ml)

Where,

A=post weight of dish (weight of dried residues +dish mg)
B= Pre weight (weight of dish mg.)

Estimation of Total dissolved solid (T.D.S.)

Porcelain dish is used for this method; Heat it for 103 to 105 C for 1 hrs. Store and cool dish in desiccators until needed weight immediately before use.

Table 01. Physico-chemical Parameter

DATE	12/11/2016			21/12/2016			01/01/2017			11/02/2016		
Location	1	2	3	1	2	3	1	2	3	1	2	3
Time	8.20AM	8:30AM	8:46AM	09:26AM	09:32AM	09:45AM	09:30AM	09:42AM	09:59AM	09:02AM	09:25AM	09:45AM
Temp.	20.0^{0C}	20.0^{0C}	20.1^{0C}	19.0^{0C}	18.9^{0C}	20.1^{0C}	21.0^{0C}	21.2^{0C}	21.0^{0C}	19	19.5	19.2
Color	Clear	Clear	Clear	Clear	Clear	Clear	clear	clear	clear	clear	Clear	Clear
Order	Slightly Smelly	Slightly Smelly	Slightly Smelly	Slightly Smelly	Slightly Smelly	Slightly Smelly	Slightly Smelly	Slightly Smelly	Slightly Smelly	Slightly Smelly	Slightly Smelly	Slightly Smelly
Ph	9.21	8.78	9.2	9.31	9.25	9.45	8.6	8.9	8.7	7.92	7.8	7.8
Conductivity	0.39 µs/200	0.40 µs/200	0.43 µs/200	0.42 µs/200	0.51 µs/200	0.47 µs/200	0.41 µs/200	0.39 µs/200	0.42 µs/200	24.6 µs/20	24.4 µs/20	24.6 µs/20
T.S.	2.2g/L	2.0g/L	2.1g/L	2.0g/L	2.2g/L	2.1g/L	2.3g/L	2.4g/L	2.1g/L	2.42 g/L	2.49 g/L	2.52 g/L
T.D.S.	550mg/L	621mg/L	579mg/L	600mg/L	670mg/L	652mg/L	625mg/L	628mg/L	610mg/L	690 mg/L	648 mg/L	655mg/L
D.O.	9.8mg/L	8.9mg/L	9.3mg/L	11.0mg/L	10.8mg/L	10.7mg/L	8.2mg/L	9.2mg/L	9.4mg/L	9.3 mg/L	9.8 mg/L	9.5 mg/L
B.O.D.	2.1mg/L	2.9mg/L	2.3mg/L	2.0mg/L	2.2mg/L	2.1mg/L	3.0mg/L	2.3mg/L	2.3mg/L	2.7 mg/L	2.3 mg/L	2.0 mg/L
Water Hardness	192mg/L	188mg/L	186mg/L	188mg/L	191mg/L	182mg/L	201mg/L	198mg/L	199mg/L	384mg/L	360mg/L	396mg/L
Clorinity	2.03g/L	2.01g/L	2.02g/L	2.01g/L	2.05g/L	2.07g/L	2.2g/L	2.0g/L	2.0g/L	2.04	2.07	2.09
Salinity	3.0g/L	2.7g/L	2.6g/L	3.2g/L	3.1g/L	3.4g/L	3.01g/L	2.7g/L	2.5g/L	3.268g/L	3.31g/L	3.34 g/L
Alkalinity	2.1g/L	2.15g/L	2.2g/L	2.9g/L	2.7g/L	2.72g/l	3.2g/L	2.92g/L	3.0g/L	5900	5750	5800
Acidity	2.2g/L	2.0g/L	2.1g/L	2.2g/L	2.4g/L	2.3g/L	3.1g/L	3.0g/L	2.8g/L	4200	3800	3680
NaCl Cons.	2.9g/L	2.8g/L	2.9g/L	3.3g/L	3.0g/L	3.4g/L	2.93g/L	2.8g/L	2.1g/L	3.36g/L	3.45 g/L	3.44 g/L

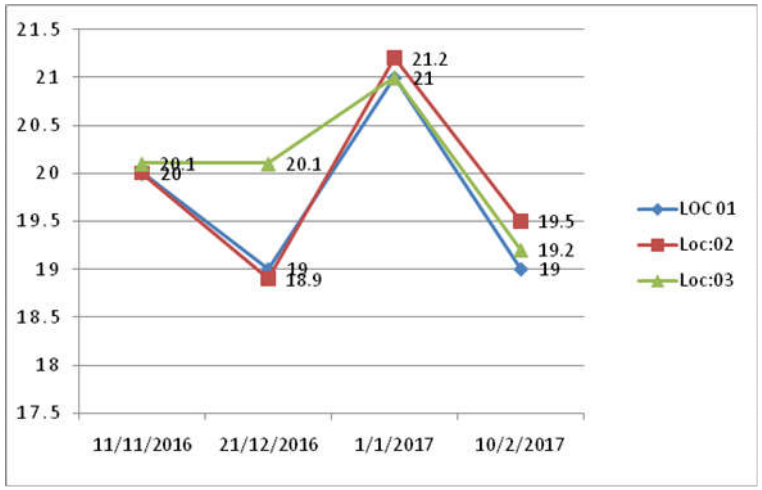

Figure 01. Temperature data Analysis of water sample

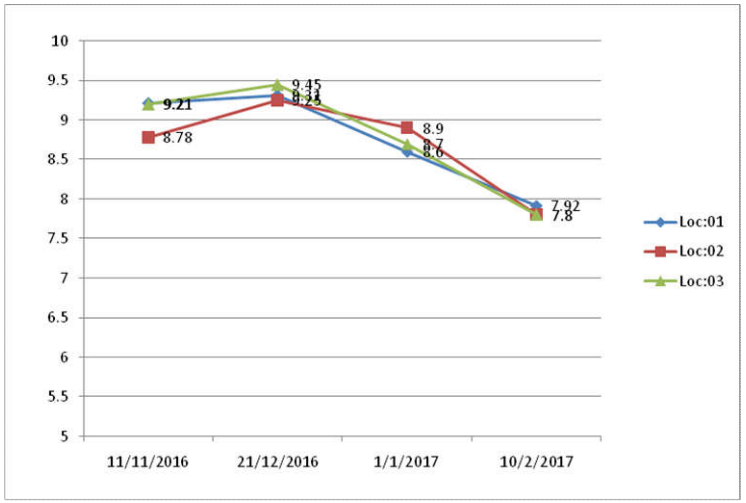

Figure: 02 pH data Analysis of water sample

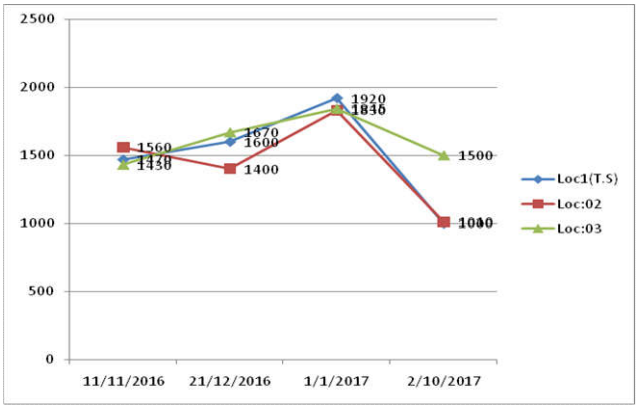

Figure 03. T.S. data Analysis of water sample

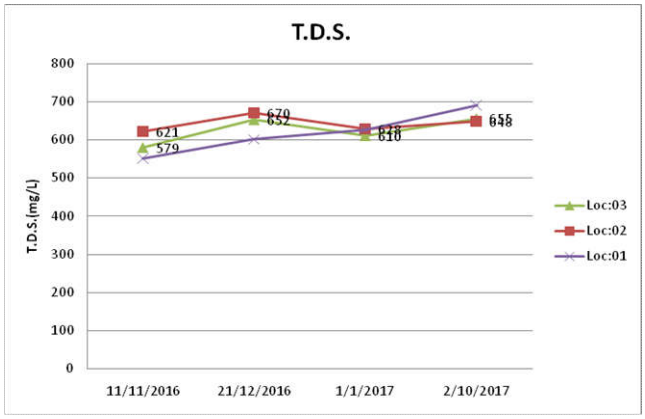

Figure 04. T.D.S. data Analysis of water sample

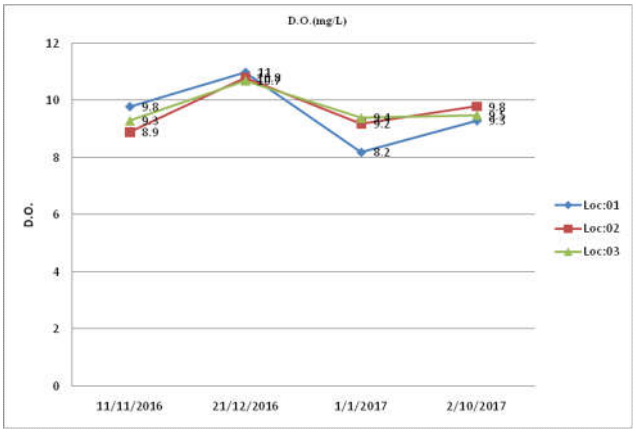

Figure 05. D.O. data Analysis of water sample

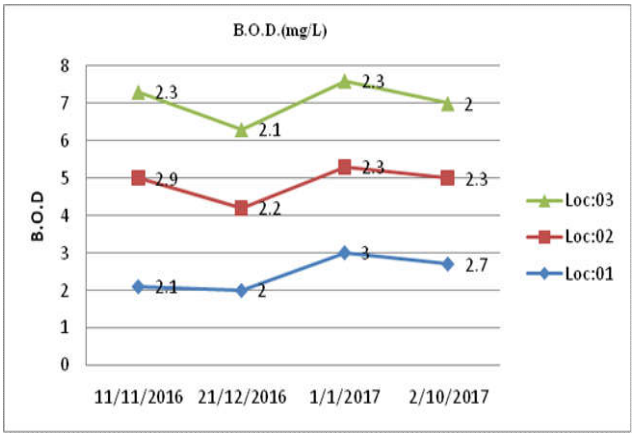

Figure. 06 B.O.D. data Analysis of water sample

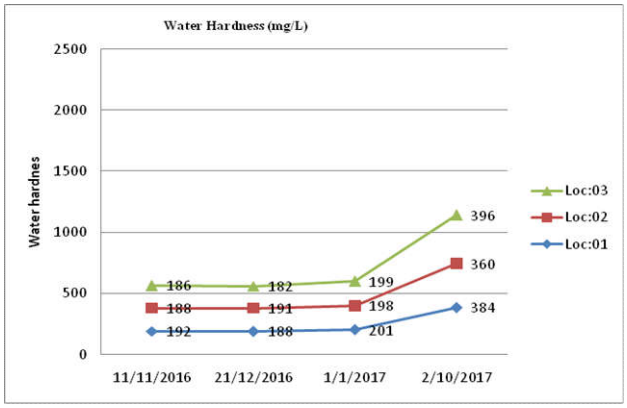

Figure 07. Water Hardness data Analysis of water sample

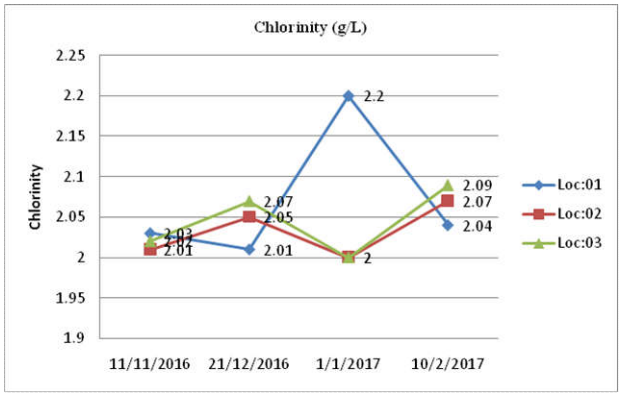

Figure 07. Salinity data Analysis of water sample

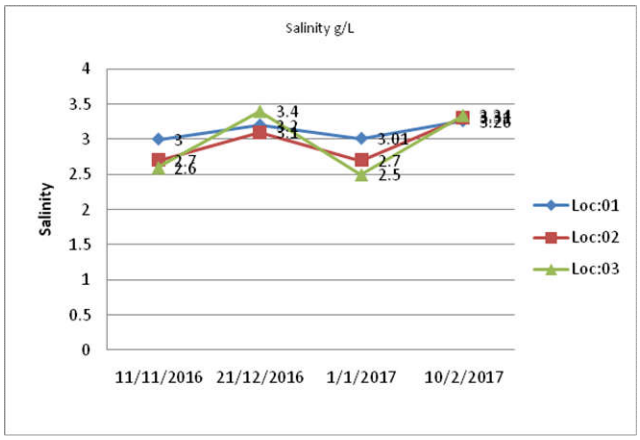

Figure: 07 Clorinity data Analysis of water sample

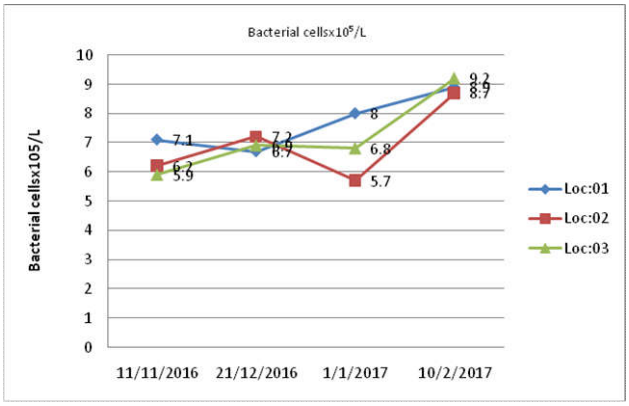

Figure 08. Bacteriological data Analysis of water sample

Table 02. Bacteriology Analyses

12-Nov-2016

Location	Bacterial Cells/L
01	$7.1X10^5$
02	$6.2 X10^5$
03	$5.9 X10^5$

21-Dec-2016

Location	Bacterial Cells/L
01	$6.7 X10^5$
02	$7.2 X10^5$
03	$6.7 X10^5$

01-Jan-2017

Location	Bacterial Cells/L
01	$8.0 X10^5$
02	$5.7 X10^5$
03	$6.8 X10^5$

11-Feb-2017

Location	Bacterial Cells/L
01	$8.9 X10^5$
02	$8.7 X10^5$
03	$9.2 X10^5$

(Pre weight)Shake the water sample very well and add 100 ml of it in to filtration device that is having glass fiber on it. Apply vacuum and filter out 100ml of sample. Collect the filtrate in to evaporating dish. Put evaporating Petri dish in to oven at 103 to 105 C for overnight. Next day take out it from oven and cool it in desiccators dish would be having dried residues in it. Measure the weight of evaporating dish. (Post weight) Put the data of pre weight and post weight of the dish in following equation and calculate the amount of total solid present in the sample.

Calculation: mg total dissolved solid/L= (A-B).1000/sample volume (ml)

Where,

A=Post weight of dish (weight of dried resdues+dish, mg)
B=pre weight (weight of dish, mg)

Estimation of chloride in water sample

Sample preparation: Take 100ml of sample in 250ml conical flask. If chlorine is higher inthe sample, dilute the sample and then take 100ml of diluted sample. If the sample is highly colored add3ml Al (OH) $_3$ suspension, mix, settle and filter. Titration: Set the pH of the sample in the range of 7-10 with the help of H_2SO_4 /NAOH. Add 1ml K_2CrO4 indicator solution. Titrate it with standard AgNO3 Titrate to a pinkish yellow end point. Be consistent in end point recognition.

Calculation: [1] mg Cl/L= (A-B).N.35450/ml of sample (100ml) Where, A=ml titration for sample, B=ml titration for blank, C=normality of $AgNO_3$(0.0141N) [2] mg NaCl /L=(mg Cl/L).1.65

Total water hardness

Take 1ml of water samples than added few drops of the ammonium bisulphate solution add to black-T as indicator.

We observed that water sample color is occurrence pink. Then added EDTA slowly drops by drop and water color is blue.

Calculation: Formula: 1000.1ml of used in EDTA/ml of water sample.

Estimation of dissolved oxygen (D.O) and biological oxygen demand (B.O.D)

300 ml of B.O.D. bottle was used for water sample Analysis. In this bottle add 1ml MnSo4 solution followed by addition of 1ml alkali iodide acide reagent. Stopper the bottle carefully to exclude and mix by inverting bottle a few times. Add 1ml concentrated H_2So_4. Res topper the bottle and mix it thoroughly too completely dissolve the precipitates. Take 200ml of this mixture from bottle to flask. Add 1ml 2% starch solution as indicator. Titrate it with 0.025 $Na_2S_2O_3$ solutions. Record the end point, when the blue color of starch disappears.

Calculation: V_1.0.1.1000/200 Where, v1=Burette no.

Determination of acidity of water

Hydrogen ions present in a sample as a result of dissociation or hydrolysis of solute react with addition of standard alkali thus acidity depends on end point of the indicator used this colour change of phenolphthalein indicator is used to PH 8.3 at 25'c response to stoichemetric utilization of carbonic acid to bicarbonate.

Mineral acidity

$$\frac{\text{Volume of NAOH (V1)} * N * 50 * 1000}{\text{Sample taken}}$$

Total acidity

$$\frac{\text{Volume of NAOH (V2)} * N * 50 * 1000}{\text{Sample taken}}$$

Determination alkalinity of water

Alkalinity of water can be dermine by titrate in water sample with sulfuric acid or hydrochloric acid based on the reaction and no of moles of hydrochloric acid needed toreach end point conc. Of alkalinity in water is calculated when a water sample that has pH greater than 4.5 is titrated with acid to a end pointof PH 4.5 all ion oH -, co3 and HCO3- will be neutralized for the PH more than 8.3 at phenolphthaleinindicator the colour changes to pink colour due to presence of hydroxyl ions on titrating with acid H_2SO_4 and HCL. Hydroxyl ions will be neutralized and pink colour will change to colorless. Then add methyl orange colour of the solution with turn to yellow on further titrating with acid the colour will change to red blue to decrease in PH.

Mineral alkalinity:

$$\frac{\text{Volume of HCL (V1)} * N * 50 * 100}{\text{Sample taken}}$$

Total alkalinity:

$$\frac{\text{Volume of HCL (V2)} * N * 50 * 100}{\text{Sample taken}}$$

RESULTS AND CONCLUSION

Wetland is great ecosystem and it supports a great biodiversity. In present work we have investigated interaction between physicochemical parameters with their impact on Microbial biodiversity and plankton biodiversity during pre, middle and post winter time period of 2016-2017 at Barda Bandharan wetland (Temporary wetland) Near Barda Village, Kodinar taluka (Mul-Dwarka). During research we took 15 physico-chemical parameters for analysis of wetland water and compare it with standard data of Indian standard guide line on water analysis. Parameters included Temperature, pH, Conductivity, T.S., T.D.S., D.O., B.O.D., Water Hardness., Clorinity, Alkalinity, Acidity and NaCl concentration of water samples. Biological Parameter included chlorophyll estimation in which Analysis of Chlo A, chlo B and Total Chlorophyll with carotenoids concentration. Chlorophyll plays important role in production of organic molecules in water body ecosystem and it maintains food web chain in water body ecosystem. Plankton Analysis in which zooplankton and phytoplankton are very important biotic factor maintain water body ecosystem. Phytoplankton is primary food producer which is consumied by zooplankton and fish with many other water body animals. The consumption depends on zooplankton concentration in wetland ecosystem. Microbial biodiversity is the fourth very important factor of ecosystem in water body because it converts complex organic material to simple organic and inorganic compounds which are utilized by plankton, so we concluded that all biological parameters are interlinked and they are influenced by physico-chemical parameters (Abiotic factor). Water samples were collected from wetland of Barda Bandharan around under 2 feet. Under Physicochemical Analysis we included 15 parameters like Temperature, pH, Conductivity, T.S,T.D.S., D.O., B.O.D., water Hardness and chloride. Winter time temperature of wetland water is in range of 19.0^0C to 21.2^0C. pH range of wetland water is 7.8 to 9.45, pH of water samples were normal Range as per standard but higher pH of water was noted on DEC-21 Month. After analysis of recorded results pH of Wetland water is normal water which indicates some salts concentration may be higher. Conductivity of water of wetland was higher in the sample on this month Dec-21, higher conductivity indicates more salts concentration is dissolved in water sample. Dissolved oxygen (D.O) and Biological oxygen demand (B.O.D) data indicated that dissolved oxygen level range 9.2 to 11.00 in water. Higher D.O. value indicates good condition for aquatic life inside the water. T.S. and T.D.S. data of water samples are higher and fluctuate more during time period of Analysis. T.S. range of sample 2.0 g/L to 2.5 g/L, Higher, TDS of samples range 550 mg/L to 690 mg/L the data of T.S and T.D.S is higher than normal range and it indicated that water should not directly be used for Agriculture and drinking purpose, higher value is also dangerous for normal aquatic life. Water hardness is another parameter which indicated salts quality in water samples like carbonate and many other salts in water sample. Water hardness Ranges were 188 mg/L to 396 mg/lit, salt concentration were increased during sampling time period. Chlorophyll estimation of collected wetland water was indicating that total chlorophyll. Concentration increased during data Analysis with Time period, its indicated organic concentration increase during time period and due to that Bacterial concentration may increase.

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