Journal of Experimental Sciences 2011, 2(10): 09-15
ISSN: 2218-1768
Available Online: http://jexpsciences.com/

journal of
experimental sciences

A Study on Physico-Chemical Characteristics of Water in Wetlands of Hebbe Range in Bhadra Wildlife Sanctuary, Mid Westernghat Region, India

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Abstract

A systematic study has been carried out to evaluate physico chemical characteristics of the selected wetlands of the Bhadra Wildlife sanctuary from May 2009 to April 2010. Three major wetlands which come across the temperate zone of the sanctuary have been selected for the study. Seventeen physico-chemical water quality parameters have been analyzed for pre, post and monsoon seasons. Idan ban kere has a less Catchment area compared to the other two. The pH of the water was found to be more alkaline in Idan ban kere compared to the others. The values of DO and BOD fluctuate according to the seasons and sectors, COD was very less due to absence of chemical pollution. The value of all the parameters are found to be more during pre monsoon season when compared to monsoon and post monsoon in Idan ban kere with comparison to Heggarna kere and Gonimara hadla kere, due to their differences in the catchment area and occurrence of high amount of rainfall during monsoon. Other parameters such as calcium, magnesium, sulphate and phosphate were under permissible limits and widely fluctuated according to seasons and sectors.

Keywords: Wetlands, physico-chemical characteristics of water

INTRODUCTION

The Indian sub continent is well known for its species richness, highly varies climate and associated habitats. In this subcontinent lakes and reservoirs are one of the least studied habitats, although, such systems have a great potential for biological productivity and diversity. Wetlands are defined as "lands transitional between terrestrial and aquatic ecosystems where the water table is usually at or near the surface or the land is covered by shallow water" (Cowardin *et al.,* 1979). Wetlands are often referred to as "biological supermarkets" for the extensive food chain and rich biodiversity they support (Mitsch and Gosselink, 1993). Wetlands are one of the most important ecosystems, which have multiple utilities and covers 58.2 million hectares in India, out of which 40.9 million hectares are under rice cultivation (Anon, 2007). Wetlands provide variety of functions and values like, biodiversity, nutrient recycling, purification of water, flood control and ground water recharge. The products obtained from wetlands are forest resources, wildlife, fisheries, agricultural resources, water supply, energy resources etc. Water is most important chemical compound for the perpetuation of life on this planet. It is not only essential for lives but also important chemical compound from engineering point of view. Nearly 2/3 portion of this planet is occupied by water. It is present in three physical forms e. g. Solid, Liquid and Gaseous. It has many unique properties. It is the compound which becomes rarer on solidification. It finds extensive use in the field of agriculture, hydro electric power generation and air conditioning. (Prasad *et al.,* 2009)Water is the one of most important compound to ecosystem. Good quality of water described by its physical, chemical and microbial characteristics. But some correlation were possible among these parameters and the significant one would be useful the indicate quality of water (Kamble *et al.,* 2009). Contamination of water bodies might lead to a change in their trophic status and render them unsuitable for aquaculture. Several Physicochemical or biological factors could act as stressors and adversely affect growth and reproduction (Iwama *et al.,* 2000).

Received: July 21, 2011; Revised September 18, 2011; Accepted September 18, 2011.

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MATERIAL AND METHODS

The Bhadra Wildlife Sanctuary of Karnataka lies in the tropical forests of the Western Ghats in Chikmagalur district of Karnataka covering an area of 492.46 sq. km. Temperature varies from 10° C in winter Maximum 32° C in summer, Here we made an effort to cover one range of Bhadra Wildlife Sanctuary that is Hebbe range. Hebbe section lies from 13°22' to 13°47' N latitude, 75°29' to 75°45' E longitude. The total study area comprising of 3 station i.e. Heggarna kere, Idan ban kere , Gonimara hadlae kere (Table.1). The study was carried out for a period of 12 months from May 2009 to April 2010 and we consider June to September as Monsoon season and October to January as a Post monsoon season and February to March as Pre monsoon season. Water sample was collected in the morning 7 am to11 am. The exact sample location were fixed by Global Positioning System (GPS). Water samples were collected by 2 liters blue polythene bottle, physicochemical parameters like pH, air temperature, water temperature of the sample was determined on the spot, dissolved oxygen was also was fixed on the spot, electrical conductivity, total dissolved solid, biochemical oxygen demand, chemical oxygen demand, alkalinity, acidity, free carbon dioxide, chloride, calcium hardness, magnesium hardness, total hardness, phosphate, sulphate and iron are analyzed in the laboratory by following standards methods as prescribed by APHA (2005). Statistical analysis was done by using PAST software.

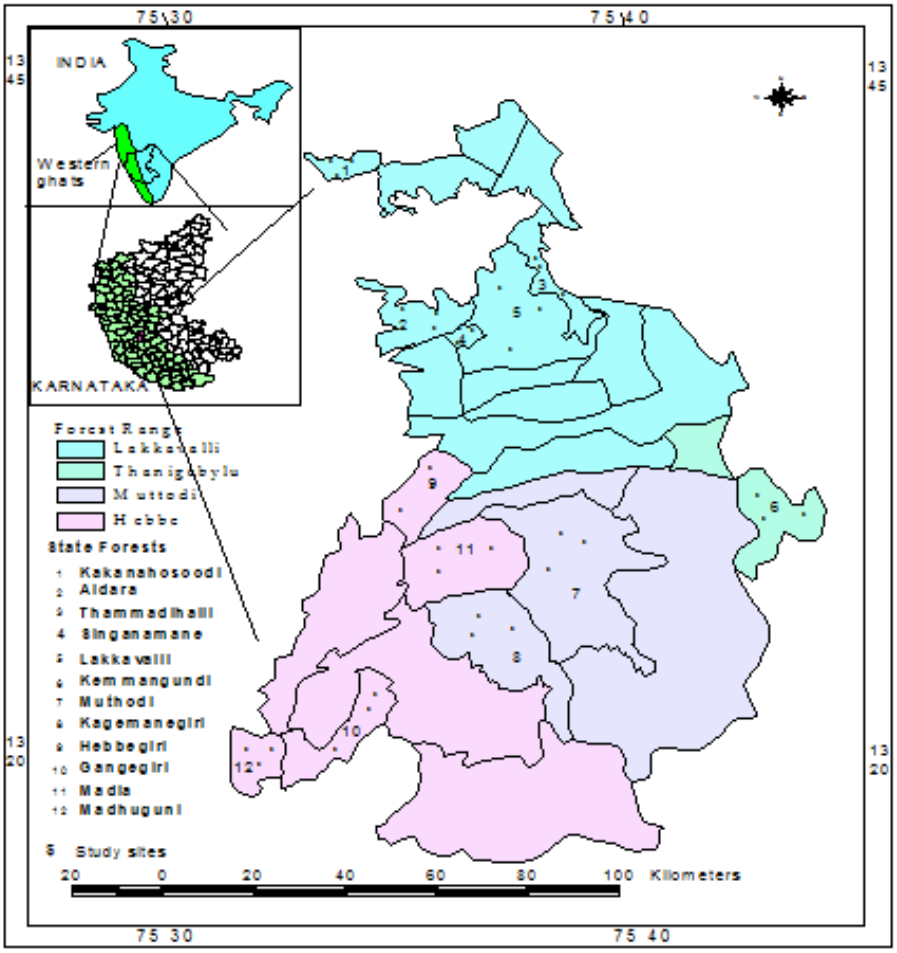


Fig. 1. Map showing the Bhadra wildlife sanctuary with Hebbe range

Table 1. Sampling locations with codes

Code	Sampling Location	Latitude	Longitude	Elevation
HB1	Heggarna kere	13°28'965"	75°33'354"	2291 ±12
HB2	Idan ban Kere	13°29'442"	75°34'015"	2512 ±13
HB3	Gonimara hadlae kere	13°29'617"	75°34'715"	2388 ± 21

Note: Elevations are expressed in mts.

RESULTS AND DISCUSSION

The physicochemical parameter of water samples were collected from different sampling station from May 2009 to April 2010 is presented in the tables. The average values of physicochemical parameters of water was shown in (Table 2), Graphical representation of average value are shown in the figure (Fig. 2 to 4), Season wise average value of physicochemical character of water of the wetlands are shown in Tables 3 to 8 and Spearman's regression correlation co-efficient of the water are shown in (Tables 9 to 11).

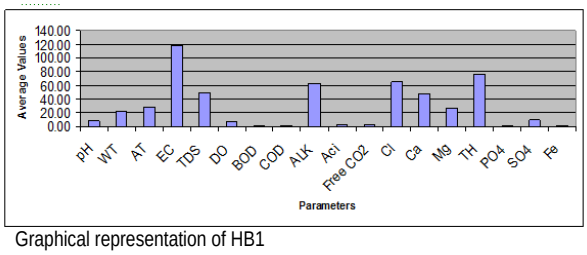
It is found that the pH of the water was very alkaline during the pre monsoon 7.84±0.03, when compare to the monsoon and post monsoon seasons i.e., 7.17±0.12 and 7.46±0.3 respectively (Table 3). Jadhav and Deshmukh (2006) and Jindal and Gusain (2007) also have recorded lowest pH values during post-monsoon and maximum during pre-monsoon season. Gupta and Gupta (2006) stated that intense photosynthetic activities of phytoplankton will reduce the free carbon dioxide content resulting in increased pH values.

Table 2. Average values of physicochemical parameters of the water

Parameters	HB1	HB2	HB3
pH	7.55 ±0.34	7.56 ±0.40	7.36 ±0.56
WT	22.38 ±3.00	23.30 ±1.83	23.63 ±1.60
AT	29.00 ±3.34	28.38 ±2.68	28.17 ±2.15
EC	118.58±18.76	102.28±15.39	108.24 ±10.16
TDS	48.79 ±4.41	48.33 ±3.82	49.20 ±4.22
DO	7.06 ±0.56	6.99 ±0.75	7.02 ±0.64
BOD	1.96 ±0.41	2.16 ±0.57	2.07 ±0.74
COD	1.37 ±0.48	1.01±0.19	0.90 ±0.14

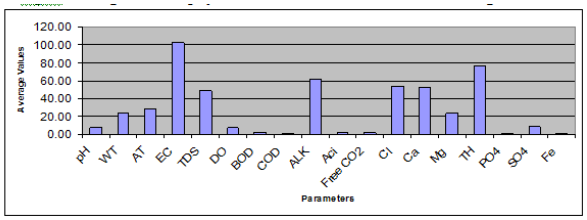
ALK	63.08 ±6.63	61.58 ±13.37	58.75 ±10.33
Aci	2.98 ±0.33	2.77 ±0.24	2.84 ±0.38
Free CO_2	2.08 ±0.63	1.98 ±0.70	2.03 ±0.47
Cl	64.75 ± 7.41	53.72 ±9.46	59.49 ±6.50
Ca	48.23 ±7.80	52.30 ±3.28	47.13 ±7.98
Mg	27.64 ±4.94	23.12 ±6.06	23.34 ±4.83
TH	75.86 ±7.86	75.42 ±6.85	70.47 ±10.00
PO_4	0.93 ±0.23	0.89 ±0.25	0.89 ±0.25
SO_4	9.12 ±1.96	8.72 ±3.72	9.01 ±1.86
Fe	0.90 ±0.20	0.69 ±0.08	1.01 ±0.24

Note: All the parameters are in mg/L except air and water temperature (°C), pH, electrical conductivity (μmhos/cm)



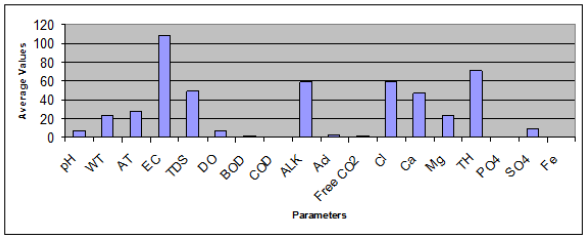
Graphical representation of HB1

Fig. 2. Average value of physicochemical characteristics HB1 during 2009-2010



Graphical representation of HB2

Fig. 3. Average value of physicochemical characteristics HB2 during 2009-2010



Graphical representation of HB3

Fig. 4. Average value of physicochemical characteristics HB3 during 2009-2010

The water and air temperature were observed in and on by the mercuric thermometer in Degree Celsius. The water and air temperature was very high during the post monsoon 25.04±0.47ºC and 31.68±0.92ºC and very low at Monsoon season that is 20.75±1.67ºC and 26.63±0.62ºC and during Post monsoon the temperature was 23.52±0.34ºC and 27.25±0.62ºC (Table 3).

The electrical conductivity during pre monsoon was very high i.e.116.75±5.30, during monsoon and post-monsoon electrical conductivity was102.53±3.07 and 109.83±13.04 respectively (Table.4). Lowest electrical conductivity during monsoon season may attribute to the increase level of water in the wetlands due to rainfall, whereas increase in electrical conductivity may be attributed to decrease in the water level due to evaporation and increase in organic matters such as plant debris enter the wetlands. Similar observation was made by Sulabha and Prakasam (2006).

In the present study we have found that total dissolved solid of water was very high during the post monsoon season 50.87±0.32 compare to pre and post monsoon (Table.4). The present findings are in conformity with Rajurkar *et al.* (2003). There is a slight variation in the DO during monsoon 7.43±21 mg/l was the DO during pre monsoon and monsoon it found that the7.23 ±0.11 mg/l and 6.41±0.19 mg/l (Table 4). Sahu *et al.* (2000) reported that dissolved oxygen is generally reduced during pre-monsoon due to increase respiration of biota, decomposition of organic matter, and raise in temperature, oxygen demanding waste and organic reduction such as hydrogen sulphate, ammonia, nitrite and ferrous iron.

Table 3. Seasonal average values of the physicochemical characters of water

	pH			WT			AT		
	Mon soon	Post Mon soon	Pre Mon soon	Mon soon	Post Mon soon	Pre Mon soon	Mon soon	Post Mon soon	Pre Mon soon
HB1	7.13	7.73	7.80	18.50	23.28	25.38	25.75	28.50	32.75
HB2	7.05	7.75	7.88	21.25	23.28	25.38	27.13	26.25	31.78
HB3	7.33	6.90	7.85	22.50	24.00	24.38	27.00	27.00	30.50
Average	7.17	7.46	7.84	20.75	23.52	25.04	26.63	27.25	31.68
SD	±0.12	±0.39	±0.03	±1.67	±0.34	±0.47	±0.62	±0.94	±0.92

Table 4. Seasonal average values of the physicochemical characters of water

	EC			TDS			DO		
	Mon soon	Post Mon soon	Pre Mon soon	Mon soon	Post Mon soon	Pre Mon soon	Mon soon	Post Mon soon	Pre Mon soon
HB1	104.00	127.75	124.00	46.44	51.31	48.63	7.30	7.38	6.50
HB2	98.25	97.09	111.50	47.04	50.55	47.40	7.73	7.10	6.15
HB3	105.33	104.64	114.75	46.31	50.74	50.55	7.25	7.23	6.58
Avg	102.53	109.83	116.75	46.59	50.87	48.86	7.43	7.23	6.41
Sd	±3.07	±13.04	±5.30	±0.32	±0.32	±1.30	±0.21	±0.11	±0.19

Table. 5. Seasonal average values of the physicochemical characters of water

	BOD			COD			ALK		
	Mon soon	Post Mon soon	Pre Mon soon	Mon soon	Post Mon soon	Pre Mon soon	Mon soon	Post Mon soon	Pre Mon soon
HB1	1.54	1.675	2.38	1.09	1.32	1.72	58.50	63.25	67.50
HB2	1.68	1.975	2.83	1.09	1.03	0.92	56.00	64.75	64.00
HB3	1.48	2.825	2.75	0.85	0.90	0.96	60.00	62.50	53.75
Avg	1.56	2.16	2.65	1.01	1.08	1.20	58.17	63.50	61.75
Sd	±0.08	±0.49	±0.20	±0.11	±0.17	±0.37	±1.65	±0.94	±5.83

Table. 6. Seasonal average values of the physicochemical characters of water

	Aci			Free CO_2			Cl		
	Mon soon	Post Mon soon	Pre Mon soon	Mon soon	Post Mon soon	Pre Mon soon	Mon soon	Post Mon soon	Pre Mon soon
HB1	2.81	2.78	3.34	1.54	1.96	2.75	66.50	58.25	69.50
HB2	2.78	2.60	2.94	1.21	2.01	2.73	50.81	51.56	58.80
HB3	2.73	2.94	2.87	1.68	2.05	2.35	59.31	55.16	64.00
Avg	2.77	2.77	3.05	1.47	2.01	2.61	58.87	54.99	64.10
Sd	±0.03	±0.14	±0.21	±0.20	±0.04	±0.18	±6.41	±2.73	±4.37

Table. 7. Seasonal average values of the physicochemical characters of water

	Ca			Mg			TH		
	Mon soon	Post Mon soon	Pre Mon soon	Mon soon	Post Mon soon	Pre Mon soon	Mon soon	Post Mon soon	Pre Mon soon
HB1	51.03	52.62	41.05	27.11	26.99	28.83	78.14	79.61	69.88
HB2	56.00	49.58	51.31	20.75	22.93	25.69	76.75	72.50	77.00
HB3	47.88	42.51	51.00	22.77	21.99	25.25	70.65	64.50	76.25
Avg	51.64	48.23	47.79	23.54	23.97	26.59	75.18	72.20	74.38
Sd	±3.34	±4.23	±4.76	±2.65	±2.17	±1.59	±3.25	±6.17	±3.19

Table. 8 Seasonal average value of the physicochemical characters of water

	PO_4			SO_4			Fe		
	Mon soon	Post Mon soon	Pre Mon soon	Mon soon	Post Mon soon	Pre Mon soon	Mon soon	Post Mon soon	Pre Mon soon

HB1	0.84	0.99	0.96	9.52	7.48	10.36	0.78	0.85	1.08
HB2	0.80	1.03	0.84	11.00	9.58	5.58	0.67	0.66	0.73
HB3	0.80	1.03	0.84	10.83	8.75	7.46	1.18	0.95	0.89
Avg	0.81	1.01	0.88	10.45	8.60	7.80	0.87	0.82	0.90
Sd	±0.02	±0.02	±0.06	±0.66	±0.86	±1.97	±0.22	±0.12	±0.14

In pre monsoon season maximum value of BOD was 2.65 ± 0.4 mg/l and minimum amount was found to be 1.56 ± 0.08 mg/l in monsoon season and 2.16 ± 0.49 mg/l during the post monsoon season (Table 5). Sachidanandamurthy and Yajurvedi (2004) have reported that decrease of BOD during post-monsoon may be due to decrease in temperature which results in decrease in microbial activity and algal bloom. The present study supports the above findings.

Chemical oxygen demand was found to be very low in monsoon season 1.01 ± 0.11 mg/l and very high during 1.20 ± 0.3 mg/l in pre monsoon and during post monsoon it was found to be 1.08 ± 0.1 mg/l (Table 5). The above finding agrees with Kulasherstha and Sharma (2006). Alkalinity of the water was found to be more during post monsoon i.e., 63.50 ± 0.94 mg/l and very less during monsoon 58.17 ± 1.65 mg/l and during pre monsoon alkalinity was found to be 61.75 ± 5.83 mg/l (Table 5). Acidity of the water was found to be more during pre monsoon 3.05 ± 0.21 mg/l and during the monsoon and post monsoon it was found to be 2.77 ± 0.03 mg/l and 2.77 ± 0.14 mg/l (Table 6). Free CO2 of the water during pre monsoon was 2.61 ± 0.18 mg/l and during monsoon it was found very low 1.47 ± 0.20 mg/l and during post monsoon free CO2 was 2.01 ± 0.04 mg/l (Table 7). Chloride content of water during pre monsoon season was 64.10 ± 4.37 mg/l and 58.87 ± 0.41 mg/l in monsoon and 54.99 ± 2.73 mg/l in the post monsoon (Table 6).

Calcium hardness of the water was found to be more during monsoon 56.64 ± 3.34 mg/l and very less during the pre monsoon season 47.79 ± 4.76 mg/l and during post monsoon it was found to be 48.23 ± 4.03 mg/l. The values of the calcium have revealed the greater fluctuation among the various seasons of the study sites during the study period. Magnesium hardness of the water was found to be more in pre monsoon 26.59 ± 1.59 mg/l and during monsoon and post monsoon, it was found to be 23.54 ± 2.65 mg/l and 23.97 ± 2.17 mg/l (Table 7). Total hardness of the water was found very high during monsoon 75.18 ± 3.25 mg/l and during pre monsoon it was found to be 74.38 ± 13.19 mg/l and during post monsoon it was found to be 72.20 ± 6.17 mg/l (Table 7). Similar behavior of total hardness was recorded by Khadade and Mule (2003).

The phosphate content was found to be very low in monsoon season 0.81 ± 0.02 mg/l and maximum value of phosphate was during post monsoon 1.01 ± 0.02 mg/l and during pre monsoon it was found to be 0.88 ± 0.06 mg/l (Table 8). Sulphate content was found to be more during monsoon season 10.45 ± 0.65 mg/l and less during pre monsoon season 7.80 ± 1.97 mg/l during post monsoon it was found to be 8.60 ± 0.80 mg/l (Table 3). The iron content was found to be more during pre monsoon 0.90 ± 0.4 mg/l and during monsoon and post monsoon it was found to be 0.87 ± 0.22 mg/l and 0.82 ± 0.12 mg/l (Table 8). The values of the iron have revealed the greater fluctuation among the various seasons of the study sites during the study period. Panda *et al.* (2004) have recorded high value of iron during pre monsoon season.

Table. 9. Spearman's r s correlation co-efficient of the water of Heggarna kere.

	pH	WT	AT	EC	TDS	DO	BOD	COD	ALK	Aci	Free CO_2	Cl	Ca	Mg	TH	PO_4	SO_4	Fe
pH	0.00	0.00	0.00	0.20	0.30	0.26	0.00	0.16	0.31	0.08	0.04	0.62	0.06	0.39	0.30	0.67	1.00	0.00
WT		0.00	0.00	0.16	0.53	0.05	0.00	0.08	0.35	0.01	0.00	0.86	0.02	0.60	0.11	0.87	0.67	0.01
AT			0.00	0.37	0.95	0.01	0.00	0.05	0.30	0.04	0.00	0.88	0.03	0.80	0.05	0.68	0.37	0.01
EC				0.00	0.02	0.92	0.21	0.85	0.09	0.44	0.28	0.90	0.48	0.57	0.66	0.24	0.15	0.69
TDS					0.00	0.23	0.53	0.34	0.16	0.35	0.44	0.94	0.99	0.95	0.77	0.11	0.46	0.48
DO						0.00	0.03	0.19	0.42	0.17	0.14	0.33	0.05	0.75	0.03	0.91	0.03	0.21
BOD							0.00	0.01	0.22	0.02	0.00	0.88	0.06	0.67	0.18	0.67	0.37	0.01
COD								0.00	0.38	0.21	0.04	0.39	0.58	0.30	0.74	0.23	0.04	0.15
ALK									0.00	0.17	0.80	0.90	0.27	0.38	0.14	0.03	0.66	0.13
Aci										0.00	0.01	0.96	0.13	0.83	0.18	0.60	0.35	0.00
Free CO_2											0.00	0.60	0.19	0.42	0.36	0.62	0.61	0.03
Cl												0.00	0.70	0.09	0.94	0.91	0.24	0.61
Ca													0.00	0.29	0.00	0.47	0.24	0.17
Mg														0.00	0.65	0.19	0.30	0.72
TH															0.00	0.81	0.21	0.26
PO_4																0.00	0.76	0.36
SO_4																	0.00	0.49
Fe																		0.00

Table.10 Spearman's r s correlation co-efficient of the water of Idan ban Kere kere

	pH	WT	AT	EC	TDS	DO	BOD	COD	ALK	Aci	Free CO_2	Cl	Ca	Mg	TH	PO_4	SO_4	Fe
pH	0.00	0.00	0.09	0.11	0.53	0.03	0.00	0.75	0.27	0.51	0.00	0.84	0.18	0.15	0.41	0.77	0.07	0.42
WT		0.00	0.00	0.51	0.72	0.00	0.00	0.46	0.69	0.87	0.00	0.12	0.18	0.06	0.39	0.77	0.02	0.90
AT			0.00	0.32	0.09	0.00	0.01	0.62	0.94	0.56	0.04	0.13	0.46	0.41	0.44	1.00	0.07	0.97
EC				0.00	0.19	0.70	0.33	0.15	0.22	0.71	0.75	0.15	0.58	0.98	0.74	0.82	0.48	0.24
TDS					0.00	0.33	0.99	0.54	0.38	0.80	0.85	0.09	0.65	0.80	0.41	0.92	0.73	0.56
DO						0.00	0.00	0.21	0.88	0.78	0.00	0.04	0.24	0.25	0.33	0.59	0.04	0.53
BOD							0.00	0.59	0.65	0.74	0.00	0.32	0.32	0.03	0.73	0.87	0.03	0.94
COD								0.00	0.12	0.47	0.11	0.05	0.90	0.89	0.46	0.63	0.71	0.07
ALK									0.00	0.38	0.75	0.04	0.46	0.30	0.39	0.62	0.46	0.90
Aci										0.00	0.77	0.78	0.41	0.63	0.05	0.04	0.76	0.18
Free CO_2											0.00	0.10	0.19	0.13	0.60	0.86	0.08	0.96
Cl												0.00	0.81	0.97	0.62	0.39	0.74	0.84
Ca													0.00	0.20	0.00	0.94	0.10	0.58
Mg														0.00	0.99	0.17	0.79	0.89
TH															0.00	0.20	0.06	0.35
PO_4																0.00	0.52	0.58
SO_4																	0.00	0.83
Fe																		0.00

Table.11 Spearmans's r s correlation co-efficient of the water of Gonimara hadlae ker

	pH	WT	AT	EC	TDS	DO	BOD	COD	ALK	Aci	Free CO_2	Cl	Ca	Mg	TH	PO_4	SO_4	Fe
pH	0.00	0.38	0.04	0.57	0.22	0.56	0.15	0.93	0.32	0.93	0.79	0.00	0.74	0.70	0.48	0.95	0.38	0.52
WT		0.00	0.25	0.18	0.29	0.68	0.23	0.12	0.43	0.88	0.46	0.36	0.72	0.25	0.65	0.29	0.20	0.23
AT			0.00	0.84	0.18	0.66	0.25	0.65	0.25	0.83	0.20	0.05	0.26	0.86	0.16	0.88	0.03	0.33
EC				0.00	0.97	0.15	0.51	0.81	0.96	0.55	0.33	0.63	0.73	0.31	0.72	0.66	0.54	0.67
TDS					0.00	0.78	0.32	0.51	0.35	0.24	0.73	0.41	0.06	0.70	0.07	0.49	0.03	0.07
DO						0.00	0.01	0.18	0.55	0.24	0.57	0.78	0.40	0.83	0.63	0.27	0.46	0.60
BOD							0.00	0.38	0.74	0.93	0.24	0.73	0.76	0.74	0.99	0.69	0.07	0.92
COD								0.00	0.78	0.63	0.61	0.32	0.61	0.19	0.28	0.64	0.05	0.90
ALK									0.00	0.04	0.08	0.60	0.62	0.26	0.32	0.06	0.76	0.15
Aci										0.00	0.73	0.84	0.36	0.49	0.30	0.56	0.45	0.44
Free CO_2											0.00	0.56	0.62	0.19	0.35	0.57	0.27	0.50
Cl												0.00	0.37	0.70	0.21	0.42	0.91	0.72
Ca													0.00	0.46	0.00	0.89	0.86	0.03
Mg														0.00	0.64	0.17	0.27	0.24
TH															0.00	0.97	0.73	0.23
PO_4																0.00	0.63	0.57
SO_4																	0.00	0.73
Fe																		0.00

Note: r value most significant at 1, significant at 0.80 to 0.90.

All the hydrological and physicochemical parameter studied showed noticeable seasonal variation. The correlation co-efficient ® among the various water quality parameter of HB1 (Table, 9) shows that the sulphate is significantly correlated with the pH, total dissolved solid is significantly correlated to water temperature, dissolved oxygen and chloride is significantly correlated with the electrical conductivity, chloride, calcium hardness and magnesium hardness are also significantly correlated to total dissolved solids, phosphate is significantly correlated to dissolved oxygen, chloride significantly correlated to alkalinity and acidity, total hardness and phosphate is significantly correlated to chloride. The correlation co-efficient of HB2 (Table, 10) reveals that the iron and alkalinity is significantly correlated with the water and air temperature, magnesium hardness is also positively correlated with the electrical conductivity, biological oxygen demand and phosphate is most significantly correlated with the total dissolved solid iron is significantly correlated to biological oxygen demand, calcium is significantly correlated with the chemical oxygen demand, iron is significantly correlated with the alkalinity and free carbon di oxide, magnesium hardness, total hardness and phosphate are positively correlated to the chloride, calcium and total hardness respectively .The correlation co-efficient of HB 3 (Table, 11) shows

that the Chemical oxygen demand, acidity, phosphate is significantly correlated with pH, total dissolved solid, alkalinity, is positively correlated with electrical conductivity, acidity, and total hardness is significantly correlated with the biological oxygen demand, sulphate is significantly correlated with the chloride and phosphate is most significantly correlated phosphate.

CONCLUSION

As the season changes there is a fluctuation in the physicochemical characters of the water this will be due to in flow and change in the temperature as season changes and what ever the wetland, we are selected for our study is perennial. The values of all the parameters analyzed during the present study are under permissible limits and water is free from pollution.

ACKNOWLEDGMENTS

We wish to express our gratitude to University Grant Commission for providing financial assistance, Kuvempu University for necessary infrastructure facilities and Karnataka state forest department for their help to carry out field work.

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