Available online at www.pelagiaresearchlibrary.com

Pelagia Research Library

Advances in Applied Science Research, 2013, 4(4): 17-21

ISSN: 0976-8610
CODEN (USA): AASRFC

Seasonal variations of hydro-chemistry in certain ephemeral streams in a tropical climate, northeastern India

[1]Rimjim Dutta and [2]Debojit Baruah

[1]Dept. of Life Sciences, Dibrugarh University, Dibrugarh, Assam, India
[2]Dept. of Botany, Lakhimpur Girls' College, North Lakhimpur, Assam, India

---

ABSTRACT

This paper present to study of the physico-chemical parameters of Baghjan, Singijan and Ghagorbasti, three freshwater ephemeral streams of Lakhimpur District of Assam. Seasonal changes in physical and chemical parameters such as Temperature, Depth, Width Dissolved Oxygen, Free CO_2, Total acidity, Total alkalinity, Chloride, , pH, were analyzed for a period of one year from September 2011 to August 2012.

Key words: Ephemeral streams, hydrochemistry.

INTRODUCTION

Ephemeral channels show evidence of fluvial processes but have flows only during and shortly after precipitation events [3].Many ephemeral stream channels in arid and semi-arid climates are characterized by relatively short periods of flow followed by longer no-flow periods[7]. The magnitude, frequency, duration, and fluvial geomorphic processes associated with these periods of flow have been used to describe the suitability of ephemeral stream channels to support riparian vegetation [4],[2],[5],[6].

To date, there have been no published studies describing water environment. This investigation considered the seasonal variations in hydro-chemistry in certain ephemeral streams in a tropical climate.

MATERIALS AND METHODS

Study area:
The three different ephemeral streams viz. Bagh jan,Singi Jan and Ghagor basti are located about 20-25 km away from North Lakhimpur of Assam, North-Eastern India.Bagh Jan lies within the geographic coordinate of $27^0$26'522" N latitude and $94^0$12'599"E longitude, while Singi Jan is located within $27^0$26'701" N latitude and $94^0$12'869"E longitude. Another stream, Ghagor basti lies between geographic coordinate of $27^0$26'608"N latitude and $94^0$12'691"E longitude **(Fig. 1).**

Sampling methodology
All the three streams were surveyed at least twice in a month during the study period (September 2011-August 2012) and the obtained data were pooled in four group's viz. Pre monsoon (Mar-May) Monsoon (Jun-Aug) Post monsoon (Sept-Nov) and winter (Dec-Feb). The different physicochemical parameters that were analyzed are Temperature, depth, width Dissolved Oxygen, Free Carbon dioxide, Total Acidity, Total Alkalinity, Chloride and P^H.15 water samples were collected from each of the 03 segments, (each with 100 meter length) of the 03 streams for analysis of every parameter. All the parameters were measured at the site of collection at the morning hours (8am- 11am).

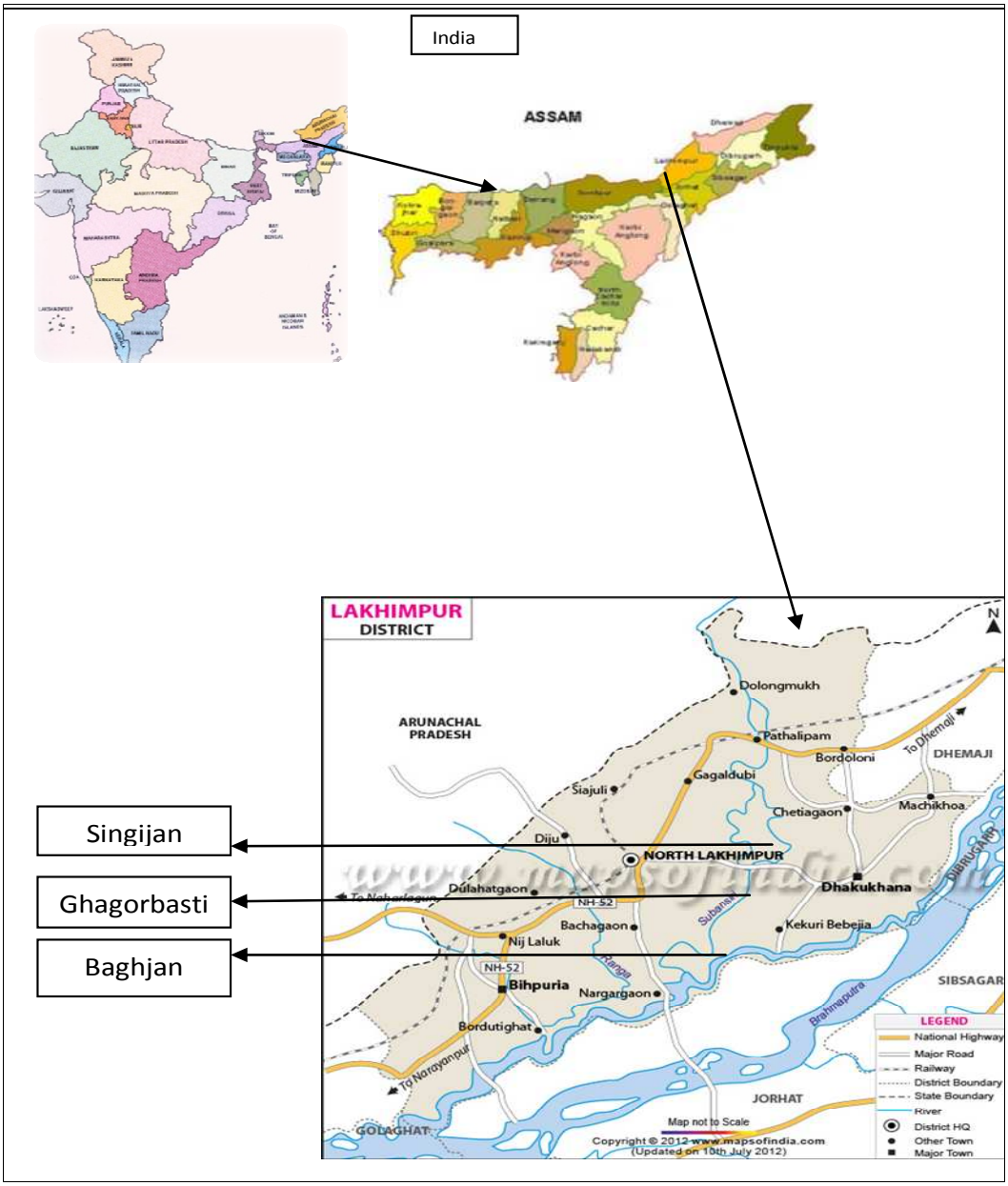

Figure 1: Map showing three sampling stations

Analysis of physicochemical parameters

Water Temperature was recorded by using Mercury Thermometer by placing it inside the water at a depth of 1ft on the three sampling stations, pH were measured by using portable pH meter(Cyber scan ph 300 series). Dissolved Oxygen, Total Acidity, Total Alkalinity, Chloride were determined in accordance with [1]while Free Carbon dioxide was studied according to the methods of[8],Depth and Width were measured by using meter tape in all the three sampling sites. Samples were collected in 250ml glass bottle for Dissolved Oxygen, also sample were collected in large beakers or plastic bottle for other physicochemical parameters. Before sampling, the bottles and beakers were rinsed three times with sample water before being filled with the sample. The actual samplings were done by dipping each sample bottle at approximately 20-30cm. below the water surface, projecting the mouth of the container against the flow direction.

RESULTS AND DISCUSSION

The quantitative analysis of various physicochemical parameters of the three streams recorded during the study period is represented in table 1 and 2 and 3.In all the two streams were remain dry during winter and pre monsoon seasons except Bagh Jan which was found to be dry only in winter season.

Table1: Seasonal variation of physicochemical parameters of Baghijan (Sep2011-Aug2012)

Parameters	sites	POM		W	PRM		M	
		M±S.D	R		M±S.D	R	M±S.D	R
Temperature(^{0}c)	A	25.08±1.71	22.67-28.96	DRY	23.6±1.51	22-25	25.81±0.34	25-26
	B	26.29±2.84	22.71-31.53		28.8±1.64	26-30	26.2±0.42	26-27
	C	24.72±1.55	22.63-27.92		29±1	28-30	25.1±0.73	24-26
Depth(m)	A	0.29±0.14	0.14-0.65		0.23±0.12	0.1-0.8	0.31±0.15	0.11-0.56
	B	0.47±0.22	0.15-0.9		0.26±0.11	0.18-0.7	0.31±0.17	0.13-0.64
	C	0.58±0.31	0.11-1.2		0.23±0.09	0.13-0.7	0.26±0.096	0.13-0.6
Width	A	6.26±0.37	4.3-16.1		2.82±0.37	2.1-3.3	6.61±2.49	4.1-10.8
	B	6.31±0.25	4.31-16.7		2.96±0.45	2.3-3.8	5.58±2.27	3.1-10.7
	C	6.5±0.45	2.16-13.19		2.9±0.52	1.7-4.1	4.69±0.35	4-5.6
Dissolved Oxygen	A	5.61±1.85	1.6-8.47		2.81±0.58	2-3.63	2.71±0.95	1.3-4.85
	B	3.41±1.2	2.01-7.26		3.54±0.48	3.21-4.43	2.98±1.11	1.6-4.85
	C	4.58±2.57	1.6-9.28		4.91±0.96	3.21-6.06	3.78±1.29	2.01-5.65
FCO_2(mg/L)	A	13.33±3.8	10.1-20.2		48.35-8.75	25.96-61.6	16.95±5.61	9.9-26.4
	B	15.06±1.44	12.3-25.6		33.44±8.28	23.1-46.64	21.22±10.01	9.4-37.4
	C	12.78±1.35	13.12-19.67		39.19±2.79	34.76-42.12	17.06±4.18	9.9-24.2
Total. Acidity(mg/L)	A	14.09±3.27	15.09-24.65		55.68±6.74	46.75-67.75	19.48±5.77	11.25-30
	B	16.98±4.8	9.82-21.65		41.81±7.25	28.5-52	19.81±5.15	13.18±28.25
	C	16.01±2.1	18.46-24.14		44.59±2.29	40-48	19.14±3.89	14.25-25.75
Total. Alkalinity(mg/L)	A	89.85±26.77	45-130		82.26±13.36	57-100	86.98±7.43	75-100
	B	81.83±9.27	65-105		63.9±10.88	49-85	68.01±7.65	52.5-95
	C	82.56±19.11	52-107		75.66±10.94	48.5-95	65.4±8.59	48.5-78
Chloride(mg/L)	A	20.44±2.46	15.09-24.65		17.04±1.7	14.76-20.16	20.84±3.08	15.62-26.92
	B	16.05±3.18	9.82-21.65		17.38±3.1	12.78-21.58	19.01±1.81	15.05-22.01
	C	20.85±1.42	18.46-24.14		16.68±3.01	13.34-21.58	17.34±3.11	9.94-21.3
P^H	A	6.26±0.37	5.03-6.75		5.23±0.01	5.21-5.25	5.6±0.39	5.21-6.16
	B	6.31±0.25	5.89-6.79		5.17±0.01	5.15-5.25	5.46±0.33	5.11-5.87
	C	6.5±0.45	5.81-6.97		5.2±0.01	5.18-5.23	5.55±0.14	5.4-5.78

Table2: Seasonal variation of physicochemical parameters of Singijan (Sep2011-Aug2012)

Parameters	sites	POM		W	PRM	M	
		M±S.D	R			M±S.D.	R
Temperature(^{0}C)	A	24.81±1.21	22.77-26.11	DRY	DRY	25.09±1.06	23.33-26
	B	24.87±1.23	22.77-26.11			25.27±1.09	23.33-26
	C	25.98±2.93	22.22-30			25.04±0.71	23.88-26
Depth(m)	A	0.38±0.20	0.1-0.9			0.18±0.04	0.1-0.27
	B	0.46±0.36	0.1-1.3			0.18±0.038	0.14-0.31
	C	0.34±0.28	0.1-0.95			0.21±0.12	0.11-0.74
Width(m)	A	1.71±0.39	1.1-2.8			5.18±0.99	3.72-6.7
	B	1.9±0.38	1.48-2.61			5.01±1.52	3.45-8.4
	C	2.16±0.58	1.34-3.2			4.39±0.51	3.6-5.3
D.O(mg/L)	A	3.61±1.86	1.6-6.86			3.39±0.94	1.2-4.85
	B	5.12±1.85	2.03-7.67			4.23±0.85	3.21-5.65
	C	2.35±0.61	1.22-3.64			6.17±0.58	5.23-7.26
FCO_2(mg/L)	A	16.99±4.42	8.80-25.51			12.74±2.36	8.8-17.60
	B	14.44±4.24	6.07-22			13.56±10.13	6.16-35.20
	C	12.19±3.25	6.07-19.81			15.84±2.63	13.20-19.8
Total. Acidity(mg/L)	A	18.78±5.71	9.92-30.41			14.97±4.48	10-25
	B	15.75±6.21	7.06-27.64			15.7±1.88	12.5-18.75
	C	17.48±2.78	12.06-23.2			13.17±4.16	7.5-21.25
Total. Alkalinity(mg/L)	A	61.87±14.89	34.25-85			47.86±8.9	35-70
	B	71.58±22.17	34.15-100			54.1±8.11	40-65
	C	68.22±18.17	35-95.64			67.48±14.01	45-95
Chloride(mg/L)	A	22.84±3.79	15.05-29.82			19.18±4.08	11.36-26.27
	B	20.78±6.2	12.03-32.66			18.7±3.17	12.07-26.27
	C	18.66±4.18	10.48-26.98			19.3±1.91	14.91-22.73
P^H	A	6.09±0.27	5.65-6.54			5.52±0.41	5.03-5.97
	B	6.15±0.14	5.82-6.34			5.64±0.46	5.09-6.21
	C	6.33±0.41	5.68-6.87			5.65±0.46	5.11-6.28

In all the three streams temperature fluctuated in between 22^{0}C to31.53^{0}C. In Baghjan the highest value of temperature was recorded (31.53^{0}C) in the period of post monsoon at the study site B and lowest value recorded was (22^{0}C) in the period of pre monsoon at the site A. In Singijan.the maximum value was (30^{0}C) in the period of post monsoon at the site C and minimum value was (22.22^{0}C) in the period of post monsoon at the study site C. In Ghagorbasti, maximum value recorded was (27.72^{0}C) in the period of post monsoon at the study site C and minimum value recorded was (22^{0}C) in the period of post monsoon at the site B.

In the study water depth or increase or decrease of water level is directly proportional to precipitation and discharge of water. In Baghjan, maximum water depth recorded was (1.2m) in post monsoon season at the study site C and

minimum value was (0.1m) in the period of in pre monsoon period at the study site A. In Singijan, maximum value recorded was (1.3m) in the period of post monsoon at the site B and minimum value recorded (0.1m) in the season of post monsoon at the study sites A.B,and C,also in monsoon period at the site A. In Ghagorbasti, maximum water depth recorded was (1.1m) in the period of post monsoon at the study site C and minimum water depth was (0.1m) in the periods of post monsoon and monsoon at the study site B.

In Baghjan maximum value of width (16.7m) recorded in the period of post monsoon at the study site B and minimum value was(1.7m) in the period of pre monsoon at the site C.

In Singijan, maximum value recorded was (8.4m) in the period of monsoon at the site B and minimum value recorded (1.1m) in the season of post monsoon at the study site A. In Ghagorbasti, maximum water depth recorded was (4.25m) in the periods of post monsoon and monsoon at the study sites C and A and minimum width was (1.23m) in the periods of post monsoon and monsoon at the study sites C and A.

In Baghjan the highest DO value (9.28mg/L) was recorded in post monsoon period at the study site C and the lowest value (1.3mg/L) was recorded in the period of monsoon at the site A.In Singijan, the highest value for DO recorded was 7.67mg/L in the period of post monsoon at the study segment B and the lowest value was recorded 1.2mg/L in monsoon period at study site A. In Ghagor basti, the highest value of DO recorded was 10.88mg/L in the period of post monsoon at the study segment C and the lowest value for DO was recorded 1.61mg/L in the period of monsoon at study site B. The variation of DO level is due to decomposition of organic waste and respiration in water body as well as photosynthetic activity of aquatic plant species.

In Baghjan the highest value for free carbon dioxide recorded was (61.6mg/L) in the period of pre monsoon at the site A and lowest value was (6.36mg/L) in the period of post monsoon at the site A. In Singijan, the maximum value was 35.2mg/L in the period of monsoon at the study B and the minimum value was 6.07mg/L in the period of post monsoon at the study sites B and C.In Ghagorbasti highest value recorded was 33mg/L in the period of monsoon at the study sites B and C, the lowest value recorded was 10.07mg/L in the period of post monsoon at the study site B. This may be depends upon alkalinity and hardness of water body

In Baghjan, the highest value of acidity was recorded (67.75mg/L) in the period of pre monsoon at the sampling site A and lowest value recorded was (10.1mg/L) in the period of post monsoon at the sampling site A. In Singijan, maximum value observed was 30.41mg/L in post monsoon period at the site A and minimum value 7.06mg/L was seen in post monsoon period at the site B. In Ghagorbasti, maximum acidity value was 35mg/L in post monsoon period at the site B and minimum value 10mg/L was recorded in monsoon period at the sites A and B.

In Baghjan, the maximum value of alkalinity was (130mg/L) in the period of post monsoon at the study site A and minimum value recorded was (45mg/L) in the period of post monsoon at the study site A. In Singijan, maximum value recorded was 100mg/L in the period of post monsoon at the study site B, lowest value 35mg/L in the period of monsoon at the study site A. In Ghagorbasti, highest value recorded was 110mg/L in the period of monsoon at the study site A, lowest value was 50mg/L in the period of monsoon at the study sites B and C. Increase in alkalinity at specific study sites mainly due to concentrations of domestic sewage or nutrients in water and decrease is mainly due to dilution caused by rain water.

Chloride is one of the major anions to be found in water and sewage. Its presence in large amounts may be due to natural processes such as passage of water through natural salt formation in the earth or it may be an indication of pollution from domestic or industrial waste. This water quality indicator is of great ecological significance because it regulates salinity of water; also exert consequent osmotic stress on biotic communities. In Baghjan maximum value was recorded (26.92mg/L) in the period of monsoon at the study site A and minimum value recorded was (9.82mg/L) in the period of post monsoon at the study site B. In Singijan, the maximum value was (32.66mg/L) in the period of post monsoon at the study site B, lowest value was (10.48mg/L) in the period of post monsoon at the study site C.

In Ghagorbasti, maximum value was (34.08mg/L) in the period of monsoon at the study site C, lowest value was recorded (9.03mg/L) in the period of post monsoon at the study site C During the study, observed higher value of chloride is only due to intermixing of domestic wastes in all the three sampling stations and the lower value could be attributed to dilution effect.

In Baghjan, highest value of pH was observed (6.97) in the season of post monsoon at the study site C and lowest value was (5.03) in the season of post monsoon at the study site A. In Singijan, maximum value was (6.87) in the period of post monsoon at the site C and minimum value was (5.03) in the period of monsoon at the study site A. In Ghagorbasti, maximum value recorded was (6.56) in the period of post monsoon at the site A and minimum value

was (4.18) in the period of monsoon at the study site A. The substantial seasonal variation of pH is due to higher concentration of effluents in water which can cause increase and rainwater dilution results decrease in the value of pH in all the three sampling stations.

The study has revealed that there was certain fluctuation in the physical and chemical parameters which entirely depends upon precipitation which maintain the flow regime of the ephemeral stream that regulates the chemistry, physical nature or biological inhabitants of the water. The fluctuations are normal and dependent on seasons, time of day or location of the testing site.

Table 3: Seasonal variation of physicochemical parameters of Ghagorbasti (Sep2011-Aug2012)

Parameter	sites	POM		W	PRM	M	
		M±S.D.	Range			M±S.D.	Range
Temperature(^{0}C)	A	24.87±1.21	23-27.32			25.03±0.75	23.88-26.66
	B	24.49±1.07	22-26.72			24.94±0.72	23.88-26.66
	C	24.9±1.16	23-27.72			25.21±0.55	23.88-26.66
Depth(m)	A	0.57±0.25	0.11-0.9			0.24±0.06	0.12-0.35
	B	0.19±0.07	0.1-0.6			0.28±0.06	0.1-0.39
	C	0.51±0.29	0.11-1.1			0.64±0.23	0.3-0.95
Width(m)	A	1.81±0.25	1.4-2.3			2.36±1.05	1.23-4.25
	B	1.97±0.51	1.35-3.2			2.91±0.31	2.3-3.7
	C	2.36±1.05	1.23-4.25			2.65±0.22	2.3-3.17
D.O(mg/L)	A	3.41±0.87	2.42-5.24			4.15±1.89	2.02-6.85
	B	5.02±1.39	2.82-6.85			3.3±1.29	1.61-5.23
	C	5.56±2.34	2.82-10.88			4.27±0.79	3.22-5.24
FCO_2(mg/L)	A	16.23±2.63	11.62-21.66			17.09±1.34	14.4-19.8
	B	14.42±2.08	10.07-17.56	DRY	DRY	19.1±6.43	11-33
	C	17.72±5.71	10.36-27.46			26.83±3.14	22-33
Total. Acidity(mg/L)	A	17.07±2.36	12.34-20.61			16.7±3.44	10-21.75
	B	15.1±1.59	12.24-17.56			22.54±8.08	10-35
	C	19.12±5.49	10.66-27.81			23.18±3.69	16.75-30
Total. Alkalinity(mg/L)	A	77.81±8.23	60-95.41			83.72±10.16	65-110
	B	79.64±13.02	63-105.6			72.73±10.22	50-88.73
	C	74.39±6.03	64.5-86			71.43±10.1	50-90
Chloride(mg/L)	A	13.81±1.62	10.11-16.83			18.72±1.43	15.62-20.59
	B	14.68±4.27	9.45-22.52			23.52±2.94	17.75-20.59
	C	15.04±4.75	9.03-24.54			24.78±4.04	19.88-34.08
P^H	A	6.18±0.18	5.82-6.56			4.73±0.27	4.18-5.25
	B	6.11±0.17	5.71-6.41			4.86±0.24	4.57-5.29
	C	6.15±0.22	5.72-6.51			4.86±0.18	4.68-5.17

POM=Post monsoon,, PRM=Pre monsoon, M=Monsoon, M=Mean, S.D. =Standard Deviation, R=Range

REFERENCES

[1] APHA, *Standard method for the experimentation of water and waste water, American public Health Association, New York*, **1989**
[2] J.Bendix, C.R.Hupp, *Hydrolog Process*, **2000** 14:2977–2990
[3] K.L.Halwas, M. Church, and. J.S.Richardson, *J. N. Am. Benthol. Soc.*, **2005**, 24:478–494.
[4] C. R. Hupp, W. R. Osterkamp, *Riparian vegetation and fluvial geomorphic processes. Geomorphology*, 1996, 14:277-295.
[5] D. A. Lytle, N.L. Poff, (100), *Adaptations to natural flow regime Trends Ecol Evol* (19):2–94, 2004
[6] J.R. Shaw, D.J. Cooper, *Linkages among watersheds, stream reaches, and riparian vegetation in dry land ephemeral stream networks. Journal of Hydrology* 2008, 350, p. 68 – 82.
[7] D.A.Stonestrom, J. Constantz, Ferre´TPA, Leake SA (eds), *Ground-water recharge in the arid and semi-arid southwestern United States: U.S. Geological Survey Professional Paper* 1703, 414 p, 2007
[8] P.S.Welch, *Limnology, McGrew Hill Book Company, Inc., New York*.1952.