GLOBAL RESEARCH ANALYSIS

ISSN No 2277 - 8160

Listed & Indexed with

ISSN Directory, Paris



Multi-Subject Journal

Volume : 1 | Issue : 2 | July 2012 | ₹ 250/-

GLOBAL RESEARCH ANALYSIS

ISSN No 2277 - 8160

GLOBAL RESEARCH ANALYSIS

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Volume : 1 | Issue : 2 | July 2012 • ISSN No 2277 - 8160

Research Paper | Environment Science

Assessment of Godavari River Water For Sustainable Utilization.

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ABSTRACT

Survey of Godavari river water from its origin at Trimbakeshwar (Nashik) to Nanded the river end of Maharashtra state is carried out to know the present status of water and its quality, topography of areas, degradation areas, pollution, man made construction and other activities in Godavari river valley. Identification of water flow, human intervention and inflow of industrial waste water is carried out after selecting locations for impact assessment. The seasonal study on spatial variations on water quality parameters and its temporal trend and the violations over prescribed water quality standards helps to know the impact of lotic environment on the diversity of flora and fauna in different locations and helps to identify options and development of models to be adopted for the restoration of threatened species to enrich its wild population. However, participatory approach in the management of the water body is desirable.

KEYWORDS: Godavari river, Trophodynamics, Water quality management

Introduction

India is blessed with unparalleled resources of rivers, reservoirs, estuaries, lakes, ponds and flood wetlands. Water is one of the most natural resources for all the living organisms, weather unicellular or multi cellular, since it is required for their various metabolic activities. In addition, water is required for various domestic purposes irrigation, shipping, power generation and industries. Natural waters are extremely varies in chemical composition and the factors controlling the composition include physical, chemical and biological processes (Bhosle 2001).

Fresh water represents a very small part of the total water on the earth. Fresh water has become a critical natural resource due to number of reasons. The increasing demand of fresh water in all the sectors like drinking, agriculture, aquaculture and industrial. India receives about 1400-1800 mm of rainfall annually. It is estimated that 85% of water is used for agriculture, 10% for industry and 5% for domestic use and analysis conducted in 1982 revealed that about 70% of all the available water in our country is polluted (Chandrasekhar 1997; Andhale, 2008).

The man's influence on these water bodies caused by rapid cutting of surrounding vegetation, thus increasing silt and nutrient load, disposal of sewage and industrial wastes, use for defecation, cultural activities, agriculture chemicals greatly increased the quantity of nutrients and organic input into a water body (Matakar 2008).

In India all the 14 major rivers including Coocum, Ganga, Gomati, Yamuna, Cauvery, Damoder, Krishna, Godavari, and Mini-Mahi have become polluted. Many parts of the river do not seem to have any dissolved oxygen and no wonder that they fail to support the growth of desirable aquatic flora and fauna. All these river systems share between them 83% of the drainage basin and account for 85% of the surface flow in the country. Apart from these, there are 44 medium and 55 minor rivers, which originates generally in the coastal mountains. They are monsoon fed and fast flowing. By the time they reach the plains they become tidal in nature. Only 4 of the 14 major rivers viz., Brahmaputra, Ganga, Mahanadi and Brahmani are perennial with a minimum discharge of 0.47Mm3/km2/yr. Krishna, Indus, Godavari, Narmanda, Tapti and Subaarnarekha have average discharge of 0.26 Mm3/km2/yr.

A survey of industrial cities of India has shown that industrial wastewater constitutes by volume between 8 to 16 percent of total waste water generated, the remaining 84 to 92% being generated from the domestic sector. With rapid industrialization the waste water from industrial sector is 33%. A survey has also shown that 5.6% Class I cities population and 1.6% Class II towns have full sewerage and treatment facilities, while 50.7% class I cities and 77.36% class II towns have neither sewerage nor treatment facilities and sewerage is the major cause of water pollution. To safe guard the long term sustainability of ground water resources, the quality of water needs to be continuously monitored (NEERI 1981). The water quality index, proved to be very useful and efficient tool for communicating the information on the pollutional status of water to the general public and policy makers to point out the trouble and what action can bring the largest improvement in the quality of water. In the present study attempt was made to study eco-sustainability assessment of Godavari river water flowing from Maharashtra from Nashik to Nanded by studying water characteristics, to indicate the sustainability of water from drinking point of view.

Material and Methods:

Survey of Godavari river water bodies was carried out to assess the spatial and temporal variations in the water quality at different stations of upper and lower Godavari to know the present status of water Quality. Nearly of about 12 sampling stations were selected after survey from upper Godavari and lower Godavari river basin approximately at the distance of 50 km, as per the guidelines of Maharashtra pollution Control Board and Central Pollution Control Board. There are 12 (S1-S12) stations selected for study.

The river water was monitored quarterly for monitoring parameters of diversity indexes. The analysis of samples for routine parameters is conducted on the spot in field and in the research laboratory. The survey of Godavari river water is carried out Analysis of water quality of different water bodies was carried seasonally for its physico-chemical characteristics according to (APHA et al. 1989), (Trivedy & Goel 1987) and as per the CPCB guidelines.

Result and DISCUSSION:

Water quality characteristics were carried out in summer, monsoon and winter from different locations all along the Godavari river bed from Nashik to Nanded the river end of Maharashtra (Table 1-3). The temperature, chloride, hardness, carbon dioxide were at high levels in summer due to increasing temperature in the surrounding environment and reduction of water flow into the river. Whereas, dissolved oxygen, BOD and COD were at low levels. Dissolved oxygen was high in winter due to the increased water level and low turbidity also due to increased biotic activity like photosynthesis of algal biomass. DO levels generally fluctuate according to the balance between rate of photosynthesis and respiration and decomposition of the organic materials in the water (Bankar et al. 2005). In monsoon, alkalinity, calcium, Sulphate and Phosphate were at high levels whereas pH was at low level. In the present study, the pH was ranged between 6.73 to 7.93 which are not favorable to life in the water body. The changes in pH together with conductivity of water body indicate the presence of certain pollutants. (Jadhavar et al. 2010). pH plays an important role in the interaction between heavy metals and parameters such as carbonates, bicarbonates, hardness and organic compound. The increase in alkalinity during monsoon may be due to agricultural runoff with rain water in addition to the domestic wastes from nearby villages. The higher alkalinity of water also may be due to the accumulation of carbonate salts from surrounding and removal of carbon dioxide due to excessive photosynthesis. The chloride

content from most of the locations was reported to the maximum in summer and minimum in monsoon. Generally, sewage contributes to the salinity of water in urban wetlands and chloride was higher in summer due to the evaporation losses. Lower values recorded in monsoon which can be attributed to dilution effect from renewal of water mass from summer stagnation in monsoon.

The ions such as calcium and magnesium in combination with bicarbonates, carbonates, sulphide, sulphates and other anions make the water hard. Hard waters are belived to be more productive than soft waters. Hard waters may also create problems to human health causing gastritis (Abdlhossein 2008). Lower values of hardness in monsoon showed much depletion in calcium, which has considerable impact on the growth of the shells of benthic invertebrates, low values of chlorides from most of the locations from Godavari river was recorded in winter due to high sedimentation rate in relatively stable environmental conditions. Chloride content may be due to anthropogenic activities in addition to the progression of a trophy and edging of the river beds. The rising concentration depends upon dumping of wastes from municipal as well as industrial activities. The observed low values of dissolved oxygen the locations studied from river water might be attributed to the activity of domestic sewage causing anoxic conditions due to decay of organic matter. The maximum values of dissolved oxygen in winter was probably accounted due to progressive lowering of turbidity resulting in resumption of photosynthetic activity in the river water at particular locations.

In winter, high values of COD indicated high organic load in to the water bodies and high organic waste disposal on the shore of the river and municipal waste discharge into the water body. The high COD values are found mainly in water, which may be due to the mixing of domestic and industrial waste (Murugesan et al. 2007). Low COD concentrations in summer due to strength of pollution in relation to dilution available from clear water flow. High sulphate was observed in monsoon due to the heavy rainfall and agricultural runoff from the catchment area. Low concentrations in sulphate in summer probably may be due to the aerobic conditions in which reduction of sulphate is an assimilatory from few of the locations indicated that untreated domestic sewage are being dumped into the river resulting in accumulation of large amounts of organic matter thereby giving a high biological oxygen demand, while the lower values of BOD from summer indicated the retaining capacity of water to recover from pollutional stress or organic substances, low values of phosphate in winter indicated low productivity while, high values of phosphate in monsoon due to the demand by the phytoplankton and zooplanktons.

Conclusions

The present study of Godavari river water quality it shows the temperature, chloride, hardness, carbon dioxide were at high levels in summer due to increasing temperature in the surrounding environment and reduction of water flow into the river. Whereas, dissolved oxygen, BOD and COD were at low levels. Dissolved oxygen was high in winter due to the increased water level and low turbidity also due to increased biotic activity like photosynthesis of algal biomass. In monsoon, alkalinity, calcium, Sulphate and Phosphate were at high levels whereas pH was at low level. In the present study, the pH was ranged between 6.73 to 7.93 which are not favorable to life in the water body.

Acknowledgement

Authors would like to thank U.G.C. Delhi (India), for providing Project found and fellowship for the research work and also thanks to Dr.Babasaheb Ambedkar Marathwada University, Aurangabad for their help and support in completion of this work.

Table 1 Seasonal Variations in Physico- Chemical Parameters of the water at different stations along the bank of Godavari River from Maharashtra (2010-2011)

Stations	Temperature ^{0}c			pH			Electrical conductivity µ mhos/cm		Alkalinity mg/l			
	S	M	W	S	M	W	S	M	**W**	**S**	**M**	**W**
S 1	29.03 ± 2.33	27.03 ± 0.80	25.55 ± 0.45	7.97 ± 0.46	7.70 ± 0.37	7.89 ± 0.35	238.83 ± 0.42	224.47 ± 16.17	232.58 ± 0.705	482.20 ± 14.86	472.05 ± 5.93	459.16 ± 2.45
S 2	30.19 ± 1.33	28.42 ± 0.37	24.62 ± 0.69	6.73 ± 0.83	6.97 ± 0.12	7.24 ± 0.13	310.62 ± 0.28	259.62 ± 0.83	289.50 ± 0.48	513.6 ± 10.12	480.0 ± 0.83	489.34 ± 0.89
S 3	29.48 ± 0.68	28.63 ± 0.89	23.42 ± 0.38	6.81 ± 0.42	7.14 ± 0.30	7.2 ± 0.11	258.3 ± 0.07	250.15 ± 0.24	261.3 ± 0.18	503.4 ± 0.66	437 ± 0.11	462.39 ± 0.48
S 4	30.1 ± 0.3	29.26 ± 0.66	25.23 ± 0.08	6.93 ± 0.65	7.34 ± 0.72	7.24 ± 0.14	264.4 ± 0.08	255.25 ± 0.92	258.6 ± 0.48	468.9 ± 1.48	451.6 ± 2.93	402.68 ± 4.62
S 5	29.6 ± 0.8	26.6 ± 0.38	21.42 ± 2.24	7.43 ± 0.8	7.68 ± 0.32	7.94 ± 0.49	268.3 ± 0.69	238.2 ± 0.89	252.6 ± 0.12	524.3 ± 12.3	496.4 ± 8.26	478.9 ± 6.20
S 6	30.24 ± 0.14	27.5 ± 0.59	20.4 ± 0.43	7.3 ± 0.42	7.7 ± 0.40	7.4 ± 0.82	259.3 ± 0.36	242.3 ± 0.34	260.3 ± 0.59	484.3 ± 8.80	469.1 ± 3.22	438.3 ± 1.29
S 7	30.5 ± 0.35	28.28 ± 0.88	22.62 ± 0.64	7.98 ± 0.49	7. 73 ± 0.36	7.94 ± 0.64	242.6 ± 0.42	228.47 ± 6.12	236.3 ± 2.38	523.8 ± 11.3	489.6 ± 9.32	456.3 ± 3.32

S 8	28.2 ± 0.12	26.28 ± 0.18	24.29 ± 1.26	7.53 ± 0.94	7.43 ± 0.48	7.48 ± 0.26	232.6 ± 1.20	227.3 ± 3.21	231.2 ± 0.25	418.2 ± 0.82	434.9 ± 2.32	449.3 ± 0.89
S 9	29.6 ± 2.19	27.28 ± 0.18	24.63 ± 0.39	7.96 ± 1.26	7.6 ± 0.49	7.78 ± 0.78	249.3 ± 3.92	229.4 ± 4.12	232.4 ± 4.36	429.3 ± 0.78	398.2 ± 2.62	338.3 ± 6.78
S 10	30.2 ± 0.38	28.29 ± 0.68	25.34 ± 0.54	7.42 ± 0.42	7.62 ± 0.58	7.26 ± 0.12	224.6 ± 0.26	218.9 ± 2.48	215.62 ± 0.28	402.68 ± 0.74	349.2 ± 2.69	369.2 ± 4.29
S 11	29.6 ± 0.2	27.5 ± 0.59	28.2 ± 0.12	7.68 ± 0.32	7.78 ± 0.78	7.7 ± 0.40	259.3 ± 0.36	227.3 ± 3.21	242.3 ± 0.34	524.3 ± 12.3	496.4 ± 8.26	469.1 ± 3.22
S 12	30.2 ± 0.49	28.62 ± 0.34	27.62 ± 0.92	7.43 ± 0.8	7.34 ± 0.72	7.3 ± 0.42	258.9 ± 0.60	239 ± 0.89	243.9 ± 0.70	486.3 ± 2.5	472.6 ± 0.69	480.2 ± 2.69

Table 2 Seasonal Variations in Physico- Chemical Parameters of the water at different stations along the bank of Godavari River from Maharashtra (2010-2011)

Stations	Nitrate(mg/ l)			Dissolved oxygen (mg/ l)			BOD (mg/ l)			COD (mg/ l)		
	S	M	W	S	**M**	**W**	**S**	**M**	**W**	**S**	**M**	**W**
S_1	2.69 ± 0.33	4.18 ± 1.38	3.82 ± 0.66	8.32 ± 0.42	8.69 ± 0.93	9.13 ± 1.32	3.46 ± 0.22	2.85 ± 0.62	2.48 ± 0.38	18.68 ± 3.62	10.09 ± 2.62	15.54 ± 1.08
S_2	6.21 ± 0.86	6.73 ± 2.29	5.93 ± 3.03	7.39 ± 0.49	7.82 ± 1.42	8.51 ± 0.63	14.46 ± 1.48	13.83 ± 2.85	12.57 ± 0.67	23.62 ± 0.89	20.74 ± 2.69	22.43 ± 4.16
S_3	5.38 ± 0.89	5.43 ± 0.74	5.52 ± 0.98	7.75 ± 1.42	7.79 ± 2.69	7.93 ± 0.42	13.03 ± 3.04	11.93 ± 0.68	11.58 ± 1.42	48.43 ± 2.48	21.57 ± 0.98	41.19 ± 1.08
S_4	5.32 ± 1.32	5.53 ± 0.69	4.84 ± 1.38	7.69 ± 2.34	7.42 ± 0.78	7.83 ± 1.62	12.68 ± 1.53	10.73 ± 0.72	10.10 ± 1.42	52.57 ± 0.28	38.36 ± 0.95	44.31 ± 2.63
S_5	5.98 ± 0.63	6.03 ± 2.21	5.43 ± 0.69	8.34 ± 0.73	8.09 ± 0.46	8.12 ± 4.43	10.62 ± 1.63	10.52 ± 0.74	10.60 ± 0.66	53.48 ± 3.46	34.58 ± 2.31	39.42 ± 1.46
S_6	4.93 ± 0.83	4.78 ± 1.19	4.08 ± 0.52	7.02 ± 3.22	7.29 ± 0.82	7.38 ± 1.93	1 0 . 8 9 ±0.48	9.92 ± 0.83	9.58 ± 0.89	64.08 ± 5.57	49.53 ± 3.13	53.41 ± 0.98
S_7	4.85 ± 1.16	5.00 ± 1.01	4.10 ± 0.30	6.75 ± 0.52	7.44 ± 0.81	7.94 ± 0.18	12.53 ± 1.37	11.90 ± 0.40	11.53 ± 1.29	70.04 ± 06.37	35.32 ± 4.35	51.56 ± 10.70
S_8	5.32 ± 1.72	4.91 ± 0.46	4.32 ± 0.82	6.42 ± 0.58	6.68 ± 0.93	6.63 ± 0.18	13.42 ± 0.69	12.46 ± 2.42	12.03 ± 0.88	68.32 ± 4.31	52.46 ± 3.32	50.68 ± 0.39
S_9	4.23 ± 0.74	4.05 ± 0.68	3.85 ± 0.29	5.93 ± 0.43	5.98 ± 0.18	6.48 ± 0.57	11.88 ± 0.95	11.13 ± 1.42	10.89 ± 0.63	53.69 ± 0.94	39.16 ± 2.09	46.47 ± 2.08
S_{10}	4.08 ± 0.32	4.13 ± 0.62	3.89 ± 0.48	5.86 ± 0.66	6.06 ± 0.42	6.34 ± 0.18	9.48 ± 0.61	9.40 ± 0.46	8.86 ± 0.23	49.47 ± 2.28	28.49 ± 1.39	42.83 ± 1.69

S 11	5.02 ± 0.83	4.88 ± 0.74	4.38 ± 0.62	6.06 ± 0.57	6.38 ± 0.68	6.40 ± 0.32	12.40 ± 3.18	11.63 ± 0.57	11.24 ± 0.65	56.45 ± 4.39	38.32 ± 3.63	44.49 ± 0.98
S 12	5.51 ± 0.39	5.02 ± 0.68	4.86 ± 0.82	6.34 ± 1.41	6.51 ± 0.67	6.46 ± 0.12	12.49 ± 0.83	11.38 ± 0.98	11.08 ± 0.49	44.82 ± 1.93	28.72 ± 1.06	33.08 ± 0.98

Table 3 Seasonal Variations in Physico- Chemical Parameters of the water at different stations along the bank of Godavari River from Maharashtra (2010-2011)

Stations	Hardness (mg/ l)			Chloride (mg/ l)			Phosphate			Sulphate		
	S	M	W	S	M	W	S	**M**	**W**	**S**	**M**	**W**
S 1	232.39 ± 2.39	121.69 ± 0.83	143.29 ± 0.62	156.3 ± 0.60	128.69 ± 2.62	136.25 ± 1.53	5.96 ± 0.68	5.43 ± 0.32	5.09 ± 0.46	141.3 ± 6.8	129.32 ± 0.68	132.68 ± 1.33
S 2	259.68 ± 1.68	153.29 ± 0.86	159.39 ± 1.26	356.92 ± 3.08	295.42 ± 8.62	363.4 ± 5.32	9.48 ± 2.69	9.03 ± 2.69	8.62 ± 0.88	142.46 ± 1.38	130.62 ± 3.33	126.43 ± 2.21
S 3	253.28 ± 2.68	178.68 ± 3.46	138.29 ± 8.26	302.43 ± 0.89	312.8 ± 0.62	346.3 ± 3.92	10.68 ± 3.64	10.02 ± 1.62	8.15 ± 0.74	128.3 ± 0.63	119.63 ± 1.32	120.64 ± 0.73
S 4	235.2 ± 3.68	224.3 ± 1.96	194.36 ± 0.72	289.3 ± 3.64	196.62 ± 8.6	241.7 ± 0.12	10.92 ± 1.32	10.06 ± 0.89	9.63 ± 1.78	136.32 ± 0.63	103.29 ± 1.19	96.32 ± 0.98
S 5	272.68 ± 4.36	209.8 ± 7.63	219.08 ± 0.63	236.47 ± 2.24	202.6 ± 0.86	162.3 ± 0.26	7.98 ± 0.78	7.03 ± 0.24	7.51 ± 0.26	146.31 ± 4.32	126.39 ± 1.63	120.74 ± 0.98
S 6	248.66 ± 8.25	140.00 ± 1.01	143.6 ± 0.49	255.58 ± 9.03	270.41 ± 3.66	294.16 ± 3.29	8.43 ± 1.32	7.64 ± 0.80	7.05 ± 0.40	160.08 ± 15.24	144.25 ± 10.18	150.00 ± 13.05
S 7	260.75 ± 9.44	136.83 ± 3.71	148.08 ± 2.18	309.81 ± 12.4	272.7 ± 3.19	236.3 ± 0.46	9.68 ± 3.38	9.26 ± 0.48	9.02 ± 0.89	173.62 ± 0.69	152.67 ± 1.68	146.39 ± 3.61
S 8	248.32 ± 0.92	169.83 ± 1.26	182.39 ± 6.26	296.3 ± 4.62	246.9 ± 7.4	272.4 ± 0.46	8.92 ± 2.83	8.46 ± 0.69	8.52 ± 0.54	163.49 ± 1.38	138.73 ± 3.42	128.43 ± 1.69
S 9	232.56 ± 0.92	186.3 ± 0.60	132.46 ± 2.39	253.6 ± 1.36	247.6 ± 4.8	291.2 ± 6.68	8.08 ± 1.68	7.73 ± 3.46	7.21 ± 1.43	153.30 ± 4.61	141.32 ± 1.42	138.43 ± 2.26
S 10	246.3 ± 3.49	194.39 ± 0.82	191.69 ± 0.32	226.4 ± 7.26	202.7 ± 5.29	146.3 ± 0.98	7.29 ± 0.43	8.62 ± 2.62	8.28 ± 1.32	143.9 ± 1.29	138.67 ± 1.32	128.83 ± 2.26
S 11	272.4 ± 0.46	247.6 ± 4.8	194.36 ± 0.72	305.2 ± 10.4	269.7 ± 8.6	202.4 ± 0.68	9.32 ± 1.49	9.62 ± 0.42	9.03 ± 0.18	156.3 ± 2.28	139.64 ± 0.68	146.32 ± 6.8
S 12	253.9 ± 0.68	202.3 ± 0.12	219.3 ± 0.39	219.3 ± 0.78	147.3 ± 0.86	158.6 ± 0.42	8.32 ± 1.48	8.52 ± 4.48	8.46 ± 3.18	139.68 ± 1.68	128.54 ± 2.36	130.42 ± 0.93

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