Research Paper

Volume : 2 | Issue : 4 | Apr 2013 • ISSN No 2277 - 8179

Water Quality Assessment of Gullava Reservoir of Belgaum District Using NSF-WQI

Environment

KEYWORDS : Reservoir, Physico-chemical characteristics, NSF-WQI, Water quality.

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ABSTRACT

Physico-chemical analysis of the water does not provide the direct conclusions on the quality of water. Water quality index calculates all the parameters and gives an easy decision making output to analyze the quality of water. A Simple but useful index is the National Sanitation Foundation-Water Quality Index (NSF-WQI). This index can be calculated by determining only selected physicochemical parameters. Change in water temperature, pH, dissolved oxygen, biochemical oxygen demand, total phosphorus, nitrates, and turbidity were used for the calculation of the index.

Introduction:
Water is a very essential and precious natural resource for sustaining life on this planet. Owing to the increase in population and indiscriminate utilization, this vital resource is now under tremendous pressure. In rural areas the water quality of lakes is being deteriorated due to human and other biological activities. The provision of safe drinking water reduces the incidences of many water borne diseases. The chemical pollutants of industrial, domestic and agricultural origin find their way into lakes through surface runoff and precipitation increasing the level of pollutants (Yalchin & Sevinc 2001). Anthropogenic stresses, particularly the interaction of chemicals into water may adversely affect many species of aquatic flora and fauna Chimnoy and Raziuddin (2002).

The quality of water is assessed in terms of its physical, chemical and biological parameters (Sargaonkar and Deshpande, 2003). The main problem in water quality monitoring is the complexity associated with analyzing the large number of measured variables (Saffran, 2001). The data sets contain rich information about the behaviour of the water resources. The classification, modelling and interpretation of data are the most important steps in the assessment of water quality.

WQI is a widely used tool in different parts of the world to solve the problems of data management and to evaluate success and failures in management strategies for improving water quality. The index is a numeric expression used to transform large quantities of water characterization data into a single number, which represents the water quality level (Sanchez et al., 2007, Prati 1971, Schaeffer et al., 1977, Otto 1978a, Abbasi 2002). A number of indices have been developed to summarize water quality data for communication to the general public in an effective way. In general water quality indices incorporate data from multiple water quality parameters into a mathematical equation that rates the health of water body with a single number. That number is placed on a relative scale to justify the water quality in categories ranging from very bad to excellent. This number can be easily interpreted and understood by political decision makers, non-technical water managers and the general public.

The water quality index (WQI) has been considered as one criteria for drinking water classification, based on the use of standard parameters for water characterization. A commonly used WQI was developed by the National Sanitation Foundation (NSF) in 1970 (Brown et al., 1970). The WQI is one of the most widely used of all existing water quality procedures. WQI was the intent of providing a tool for simplifying the report of water quality data (Liou et al., 2003). The index ranges from 0 to 100, where 100 represent an excellent water quality condition.

The present investigation on Gullava reservoir of Belgaum district aims to weigh up the suitability of water for various human activities and for the protection of aquatic life based on NSF-WQI.

Materials and Methods:
Study Area: Gullava water reservoir from Shedbal village of Belgaum district is located at 16°41 24.85 N 74°45 26.99 E having elevation of 574 m above MSL. The reservoir is nearby main bus stop of the village and it gets water in the form of surface run off from village and also from overflow of the drinking water tank near it. The water from this reservoir is mainly used for the Cattle bathing, washing clothes and other domestic purposes.

Sampling and Analysis: Composite surface water sampling method was followed for the collection of samples between 9 to 11 am on first week of every month throughout the year (August 2010 to July 2011). Black plastic carbouys of one litre capacity were used for collecting the samples. Temperature and pH were analysed on the spot and winkelerization was done in separate 300ml bottles for the estimation of Biochemical Oxygen Demand. For transportation of samples to laboratory, dark coloured ice box was used in order to avoid the exposure of samples to sunlight variations in temperature. Samples were analysed for physico-chemical variables following the Standard Methods (APHA, 1998).

Results and Discussion:
There are several reports on lake water quality assessment using physico-chemical parameters (Hosmani et al., 1980, Ravikumar et al., 2011, Giriyappanavar et al., 2013). The water quality index (WQI) integrates complex analytical raw data and generates a single number that expresses subjectively the water quality. Such a rating scale allows for simplicity and consumer comprehensibility. The WQI approach has many variants in the literature, and comparative evaluations have been undertaken (SDD 1976, Otto 1978b, Dunnette 1979, Miller et al., 1986, Smith 1990, Cude 2001). A water quality index can be of different types depending on its final intended purpose. It can be highly specific for different bodies of water or could be a general one for all types of waters meant for human consumption. A WQI can also be based not just on readings at a single point of time but also on data collected over a period of time. The WQI was calculated using NSF information software (Ramakrishnaiah 2009) and compared with standard water quality rating (Table 1).

Table 1: Water quality index rating of the lake water

WQI	Rating
90-100	Excellent (E)
70-90	Good (G)
50-70	Medium (M)
25-50	Bad (B)
0-25	Very bad (VB)

Table 2: Monthly variations in Physico-chemical parameters and WQI of the reservoir.

Parameters	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
pH	7.3	8.2	7.8	7.4	8.2	8.3	8.4	7.8	7.3	7.7	7.7	7.9
Temp(°C)	26	26.5	29	25	22.5	23	22.5	23	26	27	26.5	25
DO mg/L	4.999	4.12	6.432	3.43	6.26	6.867	7.718	4.116	4.288	2.855	2.573	5.574
BOD mg/L	4.117	3.72	6.432	3.43	6.26	5.52	7.288	4.116	4.288	2.855	4.288	5.574
Turbidity	16.8	12	8.3	9.7	3	13	6	25	0	4	13	6
TP mg/L	2.547	0.25	0.19	0.040	0.0576	0.16	0.18	0.2	0.24	0.22	0.17	2.13
Nitrate mg/L	0	0	0.11	0.21	0.15	0.08	0.1	0.14	0.14	0.11	0.09	0.1
WQI	55.47	60.15	59.63	66.78	64.48	59.50	58.58	59.75	62.78	64.09	61.46	55.22
Rating	M	M	M	M	M	M	M	M	M	M	M	M

All the values are expressed in mg/L except Turbidity (NTU)

The index values ranged from a minimum of 55.22 during the month of July and reached a maximum of 66.78 during November. The water quality of Gullava reservoir is rated medium during all the months of study (Table 2). The conditions in it often stray from the normal levels. It is evident from the results that water quality in the reservoir under study is degraded considerably due to contamination of water by sewage from the village and diverse anthropogenic activities.

Zaheeruddin and Khurshid (1998), Manish and Pawan (1998) have attributed industrial growth, urbanization and agricultural activities as the major sources of water contamination. However in the present study, it is observed that the stress on the reservoir under study is largely due to entry of domestic sewage.

Acknowledgement:
The present work is financially supported by University Grants Commission, New Delhi. Authors are thankful to Prof. S.P. Hosmani for his valuable suggestions during the present work.

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