



Assessment of Water Quality Changes at Two Locations of Chambal River: M.P

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Abstract

Maintaining the water quality of a river is very essential in order to utilize the resource effectively. Rapid industrial and urban development's often witness deterioration of water quality of the river. It is very important to assess the baseline characteristics of river water quality so that, sustainable development can be pursued. 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). Change in total solid, pH, dissolved oxygen, biochemical oxygen demand, total phosphorus, nitrates, and turbidity were used for the calculation of the index. Considering the above factors an attempt has been made to assess the water quality of Chambal River M.P, India, through seven parameters of water. This study reveals that the Pollution level of Chambal River has not changed from 2010 to 2013. The River water of Chambal comes under the categories of Good quality. This indicates that very little anthropogenic activity has been found and it will solve the problem of drinking water nearby area.

Keywords: Water Quality Index, Pollution, Chambal River

1. Introduction

Rivers are the vital source of water, which plays an important role in development of nation and sustenance of life. However, they are being polluted due to rapid industrialization, urbanization and other developmental activities/processes. The Chambal River remains one of North India's pretty clean rivers, habitat to a rich diversity of flora and fauna. National Chambal (Gharial) Wildlife Sanctuary is famous for the rare Ganges river dolphin. As it is a well established fact that mighty Chambal river is engulfed with vast tract of ravines. The Chambal River originates from a place Mhow near Indore in Madhya Pradesh (M.P). The total length covered by Chambal River is 960 km encompassing a total catchment area 143,219 Km² and its average discharge is 456m³/s. The river flows in the North-North East through M.P passing through some parts of Rajasthan forming a boundary between M.P and Rajasthan and then turning towards south east direction to merge with Yamuna in Etawah (U.P). The mean annual rainfall over the Chambal Basin was computed as 797 mm, of which about 93% falls during the four Monsoon months (June-September). Today, the main concern with environmental pollution is with its impact on the health of the present generation and the future ones. Untreated domestic waste way into the rivers through sewage, outfalls drains etc. Water quality index (WQI) is one of the most effective tools to monitor the surface as well as ground water pollution and can be used efficiently in the implementation of water quality upgrading programmes [1]. The water quality is assessed in terms of its physical, chemical and biological parameters [2]. The data sets contain very rich information about

the behavior of the water resources. The classification, modelling and interpretation of data are the most important steps in the water quality assessment. The index is a numeric expression used to renovate large quantities of water characterization data into a single number, which indicates the water quality level [3-5]. Various water quality indices have been formulated all over the world that can be used to assess overall water quality within a particular area promptly and efficiently. For example, NSFQI, Canadian Council of Ministers of the Environment Water Quality Index (CCMEWQI), British Columbia Water Quality Index (BCWQI), and Oregon Water Quality Index (OWQI) [6&7]. Out of the various WQI, NSFQI is the widely used index system for river/ lakes. A commonly used WQI was developed by the National Sanitation Foundation (NSF) in 1970 [8]. The WQI is one of the most widely used of all existing water quality procedures. WQI was the intent of providing an important tool for simplifying the report of water quality data [9]. The index ranges from 0 to 100, where 100 represent an excellent water quality condition. The present investigation on Chambal River at M.P aims to weigh up the suitability of water for various human activities and for the protection of aquatic life based on NSFQI.

2. Material and methods

Two different Stations at Chambal River were selected in order to study the physicochemical Characteristics of River water samples in the years 2010 to 2013. Regions behind the chosen of two locations as; (a) majority of the Ghrial populations were found in this location; (b) little anthropogenic activities has been shown in this location only. As per the norms of the APHA, wide mouthed plastic bottles of one liter size was used for collecting the samples and preserved till the parameters were analyzed in laboratory. Water samples were analysed for following physico-chemical and biological parameters viz. pH, biological oxygen demand (BOD), dissolved oxygen (DO), total phosphorus (TP), total hardness (TH), total solids (TS) and nitrate [10]. Samples DO and BOD were collected separately in BOD (glass) bottles. In this study, calculation of water quality index was based on seven important physico-chemical parameters. The NSFQI calculated using the different water quality parameters.

2.1 National Sanitation Foundation Water Quality Index (NSF WQI)

NSF WQI is an excellent management and general administrative tool in communicating water quality information. This index has been widely field tested and applied to data from a number of different geographical areas all over the world in order to calculate WQI of various water bodies' critical pollution parameters were considered.

The mathematical expression for NSF WQI is given by

$$\text{NSFWQI} = \sum_{i=1}^p W_i I_i$$

Where; I_i is the sub-index for i^{th} water quality parameters; W_i is the weight (in terms of importance) associated with i^{th} water quality parameter; p is the number of water quality parameters.

3. Results and Discussion

A WQI is a means to summarize large amounts of water quality data into simple terms for reporting to management and the public in a regular manner. There are several reports on lake water quality assessment using physico-chemical parameters [11]. The 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 [12 &13]. A water quality index can be of different types depending on its

final 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/utilization. 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 [14] and compared with standard water quality rating as shown in Table 1.

Table 1: Water quality index rating of the lake water

WQI	Rating
90-100	Excellent
70-90	Good
50-70	Medium
25-50	Bad
0-25	Very bad

The physico-chemical characteristics give a fair amount of idea to assess the ecological health of Chambal River. NSFQI has been calculated using the standard software [15], results are reported in Table 2 and graphically shown in Figure 1.

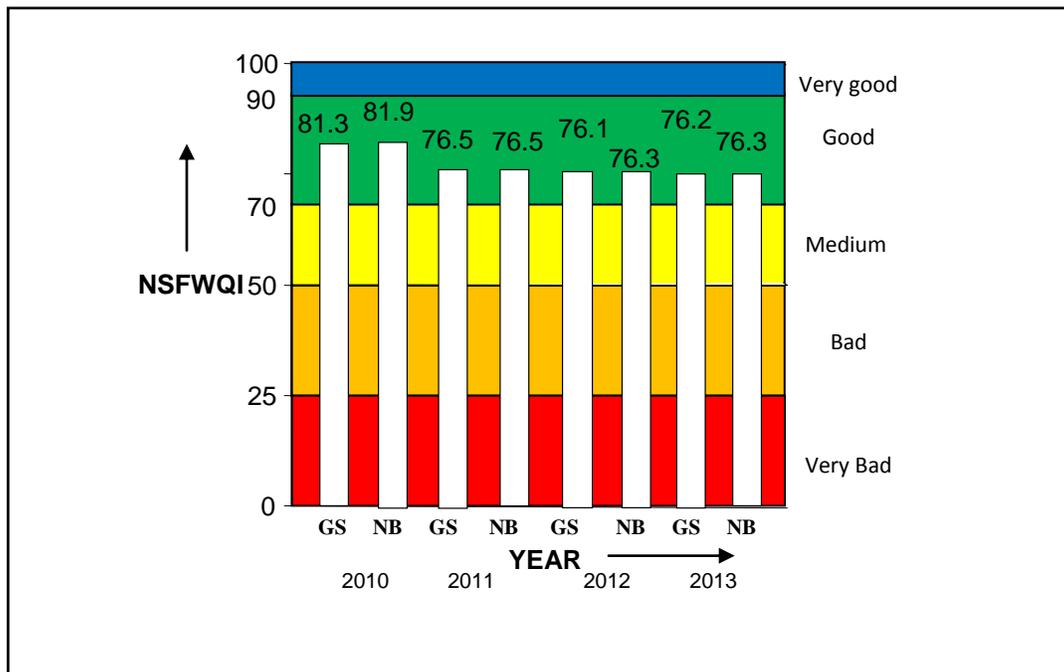


Figure 1: Water quality index of Chambal River from 2010-2013

In the figure 1, the blue portion depicts that the value of Water Quality Index is high (>90), hence it can be said that water in these regions are free from polluted i.e. fit for drinking purpose. The Water Quality Index for the region which is green reads from 70-90, reveals that the water quality in these regions is good. The Water Quality Index for the region showed in red (0-25) confirms that the water in these regions has been contaminated with high pollutant level which is unsuitable for drinking. From the above figure 1, it can be also seen that the Chambal river water quality is found in ‘good’ quality range during 2010-13. Evaluation of NSFQI in Chambal River during 2010-13 has been shown in Table 2.

Table 2: Evaluation of NSFQI in Chambal River during 2010-13

WQP	2010 (Year)		2011 (Year)		2012 (Year)		2013 (Year)	
	Ghrial Sanctuary (GS)	Near Bridge (NB)						
TS	70	73	71	72	71	72	71	72
DO	90	87	81	81	81	81	80	81
pH	92	91	93	93	93	93	92	93
Turbidity	81	84	54	51	54	51	53	52
BOD	91	93	89	91	88	90	86	90
Nitrate	96	97	97	97	97	97	97	97
TP	49	48	50	50	49	50	48	50
NSFWQI	81.3	81.9	76.5	76.5	76.1	76.3	76.1	76.3
Rating	Good	Good	Good	Good	Good	Good	Good	Good

The above Table 2 reveals that, water quality (WQ) was found to be good at Chambal Ghrial sanctuary and near bridge, because the NSFQI comes within the range of 70-90 at both the location during the period of 2010-13. The index values ranged from a minimum of 76.1 during the year 2012 & 2013 at Ghrial Sanctuary and reached a maximum of 81.9 in year 2010 near the bridge. The conditions in it often stray from the normal levels. It is evident from the results that water quality in the Chambal River under study is good considerably, due to very less contamination of water by sewage from the village and little anthropogenic activities.

4. Conclusions

On the basis of various parameters analyzed in this investigation, it was concluded that the water quality of river Chambal is fit for drinking purposes. By using NSFQI, the results of water quality assessment have found that the Chambal water is comes under the bracket of good quality at Chambal Ghrial sanctuary and near the bridge based on past four year's data. NSFQI may be used as indicator to know the health of river. It is also conclude that the pollution level is not different in different stations so it serves the needs of nearby area.

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