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Hydrobiological study of Bendsura River at district Beed (M.S.) India with reference to fisheries

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Abstract
Hydrobiological studies of Bendusara River were carried out for a period of one year from January 2019 to December 2019 from three different stations at Beed (MH). The parameters taken included the water temperature, pH, dissolved oxygen, calcium, carbon dioxide, BOD, alkalinity, chlorides, total hardness and total dissolved solids. These properties were analyzed and compared with standard values recommended by bureau of Indian standards and world health organization. Present investigation was undertaken to ascertain the water quality status of Bendusara River at Beed. The results revealed that there were significant seasonal variations in most of the parameters; water was found to be hard, polluted and not suitable for domestic, agricultural and fish growth.

Keywords: Hydrobiological status, Bendsura River, water, fish culture

Introduction
Rivers are vital and vulnerable freshwater systems that are critical for the sustenance of all lives. However, the declining quality of the water in these systems threatens their sustainability and is therefore a cause for concern. Rivers are waterways of strategic importance across the world, providing main water resources for domestic, industrial and agricultural purposes (Prakash *et al.*, 2020) [13]. The maintenance of healthy aquatic ecosystem is required for ecological balance and agriculture (Verma, 2018a, 2018b) [24, 25], which depends on good physico-chemical properties of water. India is gifted with a river system comprising more than 20 major rivers with several tributaries (Kumar *et al.*, 2005) [9], and more than 50% of water resources of India are located in various tributaries of these river systems (Lal, 2001).
Bendusara River is the major river in Beed district of Maharashtra. Beed city is situated on the banks of Bendsura River which is a tributary of Godavari often described as Ganges of Southern India. Bendusura River is polluted due to solid, liquid wastes and sewage disposal which is largely responsible for pollution. Although a large number of workers have studied the hydrobiological parameters and plankton as well as fish diversity of fresh water bodies including Rao (1977) [16], Prakash (2020) [13], Prakash *et al*., (2002) [19], Singh and Verma (2016) [20], Sugumaran *et al*., (2020) [21], Verma (2016, 2017, 2018c, 2019) [22, 23, 27, 26], Verma and Prakash (2018, 2020a) [28, 30], Bhagde *et al.*, (2020) [3] but till now there is no sufficient baseline data about physicochemical parameters of Bendsura river at Beed. Therefore, the present work was undertaken to study the hydrobiological characteristics of Bendsura River in relation to fisheries and pollution. Purpose of the study was not only to enhance the hydobiological condition of river but also to explore the possibilities for better management and development.

Materials and Methods
Bendusara river originates from the hills of Balaghat range rises near Waghera about two km. north -west of Limbaganesh and has a fairly long course (about 30 km) on the northern slopes of the Balaghat plateau, first flowing northwards and after Kadamwadi eastwards to Pali village, receiving a number of tributaries on both banks comprising a fairly large catchment area of 183 square km on the slopes of the plateau. About 8 kms below Pali, the river flows through Beed town and divides the city into smaller eastern and larger western parts then join to the river Sindphana which join the Godawari at Kshetra manirath. Three sampling sites were, selected along the course of the river at Beed city with the view of obtaining an accurate data.

The water samples were collected from three different sites in morning between 8.30 and 9.30 a.m. during the period of January 2019 to December 2019. Water was collected using sterile glass stopped bottles and 2L capacity plastic bottle. The estimation of various physico-chemical parameters was done following standard methods described by APHA (2005) [1], Trivedy and Goel (1986) [18] and Kodarkar (1998) [10].

Results and Discussion:

The water quality parameters and their range and mean values for selected sampling sites are presented in Table.1.

Table 1: Water quality of Bendsura River at Beed.

Parameters	Sampling Sites			Mean ±SD
	B1	B2	B3	
Water Temperature (^{0}C)	21.0-32.0	21.3 -31.5	21.2-31.0	27.8±0.15
pH	7.0-8.2	7.3-8.5	7.4-8.4	7.6± 0.12
Dissolved Oxygen (mg/l)	2.3-3.4	2.0-3.0	2.4-3.6	2.8±0.14
Calcium (mg/l)	25-28	29-37	27-38	32.0±1.3
Free CO_2 (mg/l)	7.2-8.0	8.2-8.6	8.0-8.8	8.4±1.5
BOD (mg/l)	38-41	37-42	38-43	40.0±1.8
Alkalinity (mg/l)	170-178	167-179	171-177	172±2.5
Chloride (mg/l)	282-284	275-280	281-284	277±2.4
Total Hardness (mg/l)	108-120	121-130	112-125	114.5±1.9
TDS (mg/l)	825-827	820-824	795-800	815±2.8

Temperature measurement is an important aspect of water quality assessment as it not only determines the solubility of different gases in the water but also affects certain biochemical reactions taking place in the aquatic organisms (Singh and Singh, 2020) [17]. The temperature was ranged between 21.0 and 31.5 ^{0}C with mean temperature 27.8 ^{0}C. The maximum temperature was recorded as 31.5 ^{0}C at site-B2 in the month of June and minimum was recorded as 21.0 ^{0}C at site –B1 in the month of December. In summer months, water temperature was generally higher as compared to winter months (Prakash *et al.*, 2015) [15]. Fluctuation in air temperature had direct impact on water temperature (Welch, 1952) [32]. The range of water temperature was within the optimum range and suitable for the development and growth of fish (Jhingran, 1988) [6].

The pH value was varied between of 7.0 and 8.5. The minimum pH was recorded 7.0 at site-B1 while maximum 8.5 at site-B2. This value is within permissible limits as per prescribed by world health organization. Alkalinity range of river water is indicative of the fact that photosynthetic activity has dominance over the respiratory activity of the biota (Ansari and Prakash, 2020) [13]. The pH of water ranged between 7.0 and 8.5 which show the favorable conditions of productivity of fishes.

Dissolved oxygen level in the three sampling sites was ranged between 2.0 and 3.6 mg/l. It was maximum (3.6mg/l) at site-B3 in winter month and was minimum (2.0mg/l) at site- B2. The high range of dissolved oxygen was found during December i.e. winter season at site-B3. The dissolved oxygen value was slightly lower throughout the year from the permissible limit (BIS, 1983) [5]. The fish needs at least 5 mg/l dissolved oxygen therefore the water of river is not suitable for development and growth of fish (Verma, 2020b) [31].

Calcium is an important nutrient for aquatic organisms. The calcium level was ranged between 25-38 mg/l. It is found to be low in monsoon and high in winter season which could be due to its higher solubility at low temperature (Ansari and Prakash, 2000) [2]. The low calcium content present in the water resource may be responsible for maintaining normal hardness level. Maximum calcium was observed at site-B3 in the winter season. The minimum value of calcium was recorded at site-B1 in the monsoon season.

The free CO_2 level was ranged 7.2-8.8 mg/l with mean value 8.4mg/l. It was maximum at site-B3 in the month of December and minimum range of CO_2 was found at sitet-B1 in monsoon months. The free carbon dioxide present in the river is used by the phytoplankton and macrophytes in photosynthetic process (Prakash, 2001) [12]. The appearance of high concentration of free carbon dioxide could probably be associated with rapid decomposition of organic matter in the sediments.

BOD values ranged between 37-43 mg/l with mean value 40.0 mg/l. The maximum BOD was observed at site-B3 and minimum BOD at site-B2 in the months of July and August, respectively. Changes in BOD appear to be an amount of organic material in an aquatic solution which aids the microbial growth of water. It should be due to more sewage entering into the river. Rivers with low BOD have low nutrient levels; therefore, much of the oxygen remains in the water. Unpolluted, natural waters will have a BOD of 5mg/l or less. BOD directly affects the amount of dissolved oxygen in rivers and streams. The greater the BOD, the more rapidly oxygen is depleted in the stream. This means less oxygen is available to higher forms of aquatic life. The BOD level between 3.0 to 6.0 mg/l has been reported as optimal for normal activities for fishes (Bhatnagar and Devi, 2013) [4].

The alkalinity is the quantitative capacity of water sample to neutralize a strong acid to a designated pH which plays an important role in controlling enzyme activities (Prakash, 2001) [12]. In the present study total alkalinity also showed a seasonal fluctuation. The values were high during December at site-B3 and low during July at site- B2. The range (167-179 mg/l) of total alkalinity indicates that the water is hard type and is not suitable for fish growth (Verma and Prakash, 2020b) [31].

Generally unpolluted water contains low concentration of chlorides lower than 10mg/l. Permissible level of chloride is 250 mg/l (Joseph and Jacob, 2010). In the present study the chloride value was varied from 275-284mg/l with mean value 277mg/l. The chloride concentration indicates the river water was highly polluted.

The level of total hardness ranges from 108-114 mg/l with mean value 114.5 mg/l. The hardness of the river increases in the polluted waters by the deposition of calcium and magnesium salts. On the basis of hardness, Kiran (2010) [8] classified the water into soft (< 75 mg/l), moderate hard (75-150 mg/l), hard (150-300 mg/l) and above that very hard. Thus, the present finding suggests that the river water is moderately hard.

The total dissolved solids represent total mineral contents, which may or may not be toxic. It is an index of fertility of the aquatic ecosystem. In the present study, TDS of river water was ranged from 795-800 mg/l. The total hardness ranged between 795-800 mg/l indicates that water of the river was not suitable for fishes (Jhingran, 1988) [6].

Results of present investigation indicate the water is not suitable for drinking, domestic and agriculture purposes. In current status, this river was not found very much suitable for fish culture. The problem faced by Bindusara River was due to human activities and illegal in commercial developments in its basin. The river which is a natural drain is transformed in to a 'nallah' (channel) in which solid and liquid municipal

waste is dumped without any treatment leading to gross pollution of the precious aquatic resource. Thus, authors suggest to implement effective conservation measures for sustainable conservation of the river.

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