Water Quality Of River Kunda, District Khargone, Madhya Pradesh (India) With Special Reference to Physico-Chemical Parameters

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Abstract: The study on some physico-chemical characteristics of River Kunda at its source has been calculated for the period of one year (August 2010 to July 2011). The sampling points were selected on the basis of their importance. For surface water determination of water quality index becomes essential and pre-requisite. Analysis of some physico-chemical characteristics like water temperature, pH, transparency, dissolved oxygen, BOD, total hardness, alkalinity, Chloride, Nitrate and Phosphate has been done during the investigation period. Increase in temperature, pH, Transparency, Chlorides and Phosphates values were higher in Siptan Station, whereas the increase in Total Hardness and Nitrates values were higher in Khargone station to the intensity of expulsion of contamination. The Total Alkalinity, Dissolved oxygen and BOD values higher in Confluence with Undri River station owing to unpolluted water. The Kunda River has been facing severe anthropogenic activities, mostly due to municipal sewage and industrial waste and dense population etc.

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1. Introduction

The health a water body or his quality is assessed using physical, chemical and biological parameters (APHA, 2002). Blockeel *et al.,* (1999) Suggested that physical and chemical properties give a specific picture of water quality in fresh water at a particular point in time, while the biota (biological property) act as a continuous monitor and give more general pictures of water quality over a period of time. Measurement of physical attributes serves as indicators of some forms of pollution, changes in temperature may, indicate the presence of certain effluents while changes in stream width, depth and velocity, turbidity and rock size may indicate dredging in the area (Chris Kreger, 2002).

Chemical characteristics of a healthy water body affect its toxicity and also aesthetic qualities such as how water looks, smell and tastes. Assessment of water quality by its chemistry includes measures of many elements and molecules dissolved or suspended in the water and can be used to detect imbalances within the ecosystem. Such imbalances may indicate the presence of certain pollutants as suggested Dzeroski *et al.,* (2002). The commonly measure chemical parameters includes pH, alkalinity, hardness, nitrates, nitrites and ammonia, ortho and total phosphate and dissolved oxygen for Biochemical Oxygen Demand (BOD). Measurements such as conductivity and density in chemical measurement actually indicate the physical presence of pollutants in water (Chris Kreger, 2002).

Water is one of the most important natural resources in the United States and around the world (EPA 2001). It is necessary for life and provides a variety of uses from drinking water in cities to the irrigation of crops in agricultural areas. Water also provides recreational uses as well as habitat for wildlife. According to the Environmental Protection Agency (2001) "rivers, lakes, estuaries and wetlands are among the Nation's most precious resources". In the Khargone present is six river, its name is Kunda, Veda, Bakund, Indravati, Morani and Undri river. Population of Khargone district water supply main source is Kunda river, its river situated it Bhagwanpura block of Khargone district. In the Khargone district present is 4 Tanki and its water capacity 8 Lac Gallon. On the Nagar Panchayat drinking water arrangement 75 Thousands Population is depend. Its tributary river of Undri river. Khargone district in present is small and large dam. Their districts on the view of water structure are devide two parts. Area of Department of water resources Khargone one medium and 27 short irrigation scheme. The area of Khargone are made small and large dam, some dams name is following- Dejla-Devada, Adampura, Garhigaltar, Nand Gaugaon, Momdia, Bhikarkhedi, Silatia, Baghai Mata, Ban Ganga, Chand Gaghd, Oon, Sagaon and is Sangaon-2. Main dams of Khargone district in Dejla Devada dam canal length is about 26 Kms. Dejla Devada dam water capacities is 13m. Besides it main canal together also present is small Accessory canal. These

canal area of Devada, Bhagwanpura, Taradpura, Badda, Umar Khali, Tanda, Barud, Sinkheda etc. these region supply irrigation water.

Khargone has a transitional climate between a tropical wet and dry climate and a humid subtropical climate. Three distinct seasons are observed: summer, monsoon and winter. Summers are extremely hot and dry in this region, lasting from mid-march to mid-june followed by the monsoon season. The temperatures in summer are usually above 40°c during April-May. During these months when temperatures become very high the dry and hot wind (Locally known as loo) blows in this area widely affecting the local ecology. The temperature also remains quite high during the night. The monsoon arrives in late June, with temperatures around 29°c and about 36 in. rainfall. The rainy season is humid and has substantial rainfall. Local people are commonly affected by the flooding of river Kunda which flows from outskirts of the city. Winters start in mid-November and are dry, mild and sunny. Temperatures average about 4–15 °C (39–59 °F), but can fall close to freezing on some nights.

Khargone District climate is changed. Water of river is absorbed and water pollution amount is increased day by day. Its district Noise pollution, Soil pollution and Water pollution and many more pollution also increases. On the Kunda river reach daily 4 gutters and do polluted water, Every month 1 ton or its more waste material reach in Kunda river. Khargone district and its attached in Panchayat of water also increase in quantity of chlorides and yet increase is disease of Allergy, And through chemical manure reach sulpher in water sources, and soil also polluted. Currently it district of average $_{P}$H value is 7.5 and $_{P}$H value more 8 yet soil is unfertile. Many years ago $_{P}$H of soil was 7 and more quantity use of chemical manure soil and water polluted.

Many dirty gutters are joining Kunda river form new bridge to old bridge in urban areas. These dirty gutters are polluting to this River. Due to increasing population of urban up to today, there are many gutters. In these gutters dirtiness is also increase these gutters are seen near the old bridge on the way of Kaladeval, near Ganesh temple, near Pathanwadi, near the church of Saint Thomas, near the temple of Kalika Mata and near the Islampura. These all the gutters carry dirty water to the river kunda. It is going up to today. Yet Khargone district day by day population, pollution and many gutters increase and in these gutters also increased waste material, And it gutters mixed in kunda river and it process continued modern time.

Kunda river in urban areas on duration of one year any year 9 month or any year 7 month fulfill in waste material, yet year in the region of Bhagwanpura is raining heavy and some some days duration this river small or large flooded yet Freshness of river only 3 month only July to September and after 9 month it river fulfill of waste material, on this river last 2 years duration of 3 to 4 Km. distance it river are constructed 7 stopdams while rainy season relief one or two month it river changed in gutter and fill for water but it not possible stop dam from on near of new bridge next year after rainy season stopped water it reason of gutter stopwater fulfill for dirty, fresh and clear water fulfill plastic bags, dirty clothes, old flowers and dirty materials.

The basic economy of the city constitutes the agricultural and the cotton industries. While there is a good market for clothing, jewellery and sarees, most of the general purpose requirements of the public are easily fulfilled by local markets. Both the auto and the electronic businesses are also growing. All of them use Kunda river water for their water requirements. Either directly or indirectly all their effluents reach Kunda river causing severe pollution, affecting agriculture and causing severe environmental damage. The present study has been carried out to evaluate the physico-chemical parameter of river Kunda by using standard method, which enables the common man to understand the quality of water.

Materials and Methods

Study Area:

The Kunda River is a Main river of Khargone district. It is a tributary river of Narmada river. It's originated from forest, Amba and Sirvel village. River Kunda has a length of approximately 169Kms. and its catchment area of 3825sq.km. Its river situated in the west directions of M.P. and its flows from South to North through four block of Khargone district Bhagwanpura, Goganwa, Khargone, and Kasrawad. Its Latitude 21º49'16" N and Longitude 75º36'4"E. On the Kunda River there are two Dams constructed Dejla-Devada dam & Vanihar dam. It's Provides of drinking water for the Khargone city. There is on a Shiv temple and Ahilyaghat before Siddhi vinayak ganesh temple at the bank of Kunda River in Khargone. There are 7 stop dams is being constructed in last two years. These Stop dams provide drinking water & irrigation facility to Khargone District. Its water works water capacity 20 crore litre. Its 7 stop dams are water holding capacity 0.646 million cubic meters. Its capacities in stop water 1.5 million cubic meter and these stopdams made in front of Kalika mata temple.

Sampling stations:

The sampling would be collected from various shoreline area of following selected station.

Dejla-Devada Dam

Dejla-Devada Dam is situated on Kunda River. It is 5km. away from Bhagwanpura Tehsil in Khargone district of western Madhya Pradesh. Its total length is 6010m. And Its 357.20m. high from the deepest foundation level. Its Irrigation area is about 8000 hectare. Its water holding area is 335.40 sq. km. and its complete storage capacity is 56.35million cubic meter, its total dam surface 383.20m. And its maximum dam surface 38920m.

Its latitude 21°36'45" (DMS) N & longitude 75°37'30" (DMS) E. //

2. Confluence with Undri River

Undri River is a tributary river of Kunda river. This place is situated 12km away From the Dejla-Devada dam. At this village Undri river confluence in Kunda River this village is called Bagdhari. At this place Garhi-Galtar project has made, which provided Irrigation facility to near about 1157 km. hectare Land.

Its latitude 20°41'30" (DMS) N & longitude 75°52'15" (DMS) E. //

3. KHARGONE

Khargone district formerly known as West Nimar district. It is a district of Madhya Pradesh state in central India. The district lies in Nimar region, and is part of Indore Division. Khargone town is the headquarters of this district. It is situated on the bank of Kunda River. Khargone is located at South-West border of Madhya Pradesh, 283 meters above sea level. Area of the district is 8030 square km. The district is surrounded by Dhar, Indore and Dewas in the north, Maharashtra state in the south, Khandwa, Burhanpur in the east and Barwani in the west. The district forms almost the central section of Narmada valley which is bordered by Vindhachal ranges in the north and Satpura ranges in the south. Narmada is the main river flowing through the district. Its river flows in a path of 50 Km. inside the district. Kunda and Veda are other main rivers in the district. Khargone is fastly growing as a city. Khargone district Total population is above 1872413. It district water use 141 Lac liter per day and its situated Intecvel its water capacity 1.062 Crore liter. It's situated in small and large 146 dam. Dejla-Devada, Garhi-Galtar & Ambaknala are main irrigation projects. Khargone generally has hot climate with little rain. The average rain fall 831mm. The summers are long ranging from March to July. Monsoon is brief and arrives in mid August.

Its latitude 20°22' and 22°35' N & longitude 74°25' and 76°14' E. //

4. Siptan

Siptan is a small town. It is a terminal point of Kunda river, At this point Kunda river confluence with the Veda River. After this place Kunda river is called Veda River. Siptan is situated 35km away from administrative headquarters of Khargone district. Siptan is near the village named Bhulgori. Siptan catchments area is about 798.10sq.m.

Its latitude 21°41'30" (DMS) N & longitude 75°41'30" (DMS) E.

Water analysis

The water samples were collected from the four selected sampling stations viz., Dejla-Devada dam = Station 1, Confluence with Undri river = Station 2, Khargone = Station 3 and Siptan = Station 4 in the Kunda River for the period of one year from August 2010 to July 2011. In the analysis of the physico- chemical properties of water, standard method prescribed in limnological literature were used. Temperature, pH, Transparency, Dissolved Oxygen were determined at the site while Biochemical oxygen demand, Total Hardness, Alkanity, Chloride, Nitrate, Phosphate were determined in the laboratory. The Physico- Chemical parameters were determined by standard methods of APHA (2002), Welch (1998), Golterman (1991). All the chemicals used were of AR grade.

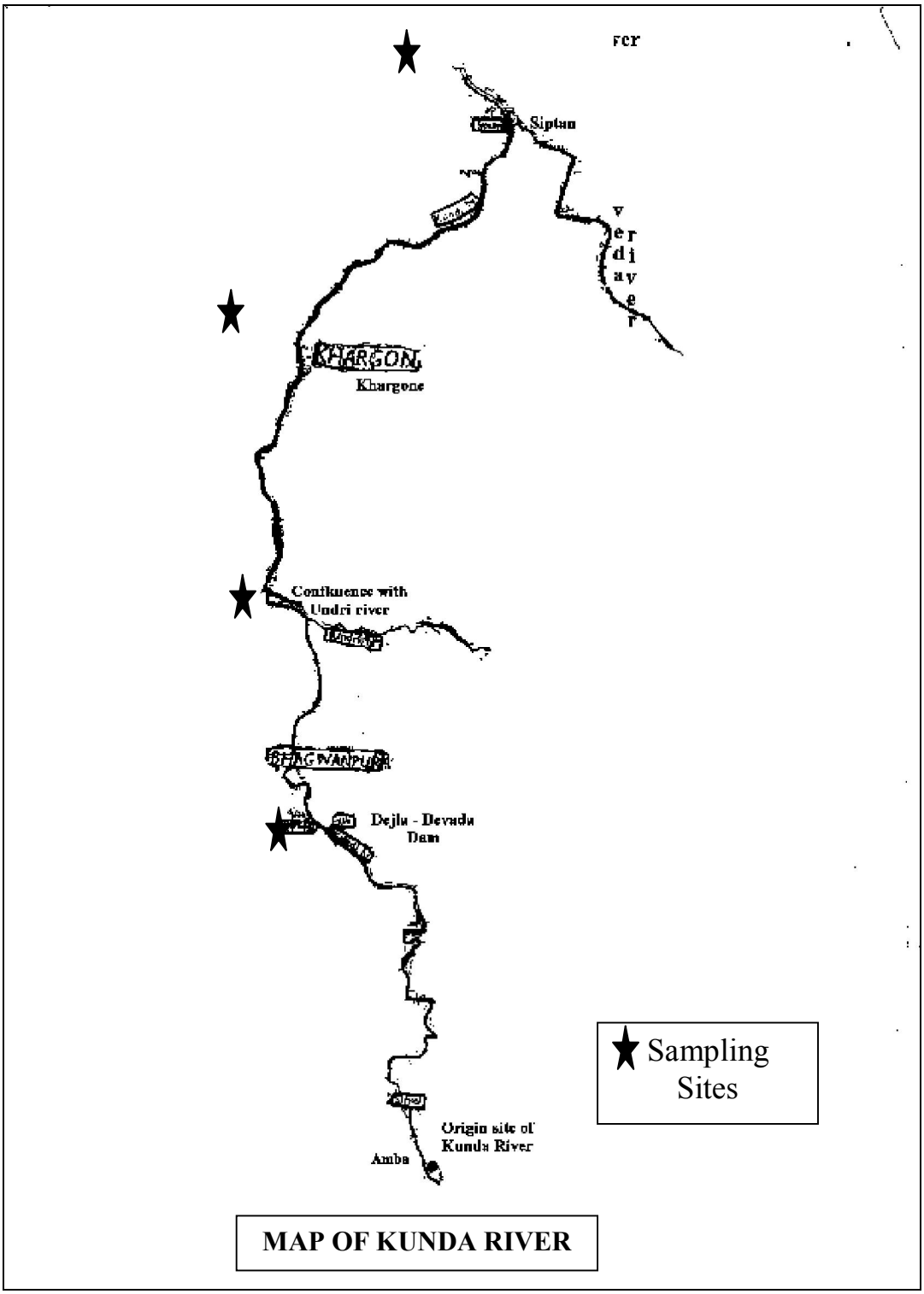
Results and Discussion

The physico-chemical characteristics of the four samples points were given in Table 1, 2, 3 and 4 along with the respective values and the mean values with range values were given in the Table 5 and Monthly Fluctuation of physicochemical parameters are presented in figure 1-10.

Temperature is an important biologically significant factor, which plays an important role in the metabolic of the organism. Temperature value was found to be ranging from 20°C to 43°C. An increase in the Temperature was observed at Siptan (20°C to 43°C) further increased values could be noticed at Dejla- Devada dam (25°C to 42°C) and Confluence with Undri river (25°C to 40°C)) and Khargone (22°C to 41°C)). The mean value of Temperature in Dejla- Devada dam 32.33°C and Confluence with Undri river 31.70°C and Khargone 31.25°C and Siptan 31.41°C.

Lowest water temperature was observed in the Siptan 20 °C. A study increase in water temperature in the course of River Kunda was noticed. There was an increase in water temperature after the discharge of the effluents into the river. An increase in temperature was observed from upstream station to lower (Dejla- Devada dam to Confluence with Undri river to Siptan to Khargone). This might be due to mixing of the effluents. Our property of water is that with change in temperature, its density varies and it becomes less with warming up and more with cooling Bhagavathi *et al.,* (2001). The pH value was found to be ranging from 7.2 and 9.4. An increase in the pH was observed at Siptan (7.2 and 9.4.) further increased values could be noticed at

Dejla- Devada dam (7.61 and 9.22) and Confluence with Undri river 7.9 and 8.8 and Khargone (7.5 and 9.3). The mean value of pH in Dejla- Devada dam 8.465 and Confluence with Undri river 8.36 and Khargone 8.325 and Siptan 8.29.



Map -1. Location map showing the Kunda River and Four sampling points, Khargone, M.P. India.

The River was found to be slightly alkaline at Siptan minimum of pH value was noticed 7.2 and maximum value pH value was noticed 9.4. pH is one of the most important factors that serve as an index of the pollution. The pH values of majority reservoir in India have been found between 6 to 9. The higher range of pH indicates higher productivity of water. Khan *et al.,* (1985).

The transperancy value was found to be ranging from 12.0 N.T.U to 60.0 N.T.U. An increase in the transparency was observed at Confluence with Undri river (12.0 N.T.U to 60.0 N.T.U.) further increased values could be noticed at Dejla- Devada dam (15.0 N.T.U to 53.0 N.T.U.) and Khargone 15.0 N.T.U to 58.0 N.T.U. and Siptan (18.0 N.T.U to 60.0 N.T.U. The mean value of transparency in Dejla-Devada dam 33.89 N.T.U and Confluence with Undri river 34.66 N.T.U. and Khargone 34.33 N.T.U. and Siptan 34.91 N.T.U. The transparency value was ranging from 12.0 N.T.U to 60.0 N.T.U. Highest transparency value was noticed at Siptan 60.0 N.T.U and the lowest value was noticed in Confluence of Undri river 12.0 N.T.U.

Dissolved Oxygen an important limnological parameter indicating level of water quality and organic pollution in the water body Wetzel *et al.,* (2006). The dissolved oxygen value was found to be ranging from 4.9 mg/l to 9.8mg/l. An increase in the dissolved oxygen was observed at Confluence with Undri river (4.9 mg/l to 9.8 mg/l) further increased values could be noticed at Dejla-Devada dam (6.21 mg/l to 9.12 mg/l) and Khargone (6.10 mg/l to 9.30 mg/l) and Siptan (6.0 mg/l to 9.5 mg/l). The mean value of dissolved oxygen in Dejla-Devada dam 7.36 mg/l and Confluence with Undri river 7.01 mg/l and Khargone 7.39 mg/l and Siptan 7.3 mg/l. Dissolved oxygen is an important parameter of the river, which is essential to the metabolism of all aquatic organisms Wetzel, R.G. (1975) The Dissolved oxygen percent saturation was low at Confluence with Undri river. These tallies with the research finding of Turkish Standards (1988). The biochemical oxygen demand (BOD) value was found to be ranging from 2.8mg/l to 6.3mg/l.An increase in the BOD was observed at Confluence with Undri river (2.8 mg/l to 6.3 mg/l) further increased values could be noticed at Dejla- Devada dam (3.1 mg/l to 5.63 mg/l) and Khargone (3.1 mg/l to 5.63 mg/l) and Siptan (3.0 mg/l to 5.9 mg/l). The mean value of BOD in Dejla- Devada dam 4.43 mg/l and Confluence with Undri river 4.59 mg/l and Khargone 4.43 mg/l and Siptan 4.6 mg/l. BOD were decreased with low in the pollution level Borse *et al.,* (2001). Pointed out that the minimum oxygen content in water for maintaining fish life healthy condition. An increase in the BOD was observed at Confluence with Undri river (2.8 mg/l to 6.3 mg/l). This range is contrary to the BOD range value of EPA international standard of fresh water. According to EPA, the BOD standard for fresh waters of unpolluted rivers is less than 5.0mg/l. the high level of BOD might have been attributed to the discharge of pollutants into the river through washing, sewage contamination, industrial affluent and a like.

The Total Hardness in water depends on the presence of principle cations Ca++ and Mg++. The Total Hardness value was found to be ranging from 71mg/l to 245mg/l.An increase in the Total Hardness was observed at Dejla- Devada dam (71mg/l to 245mg/l) further increased values could be noticed at Confluence with Undri river (128 mg/l to 210 mg/l) and Khargone (115 mg/l to 245 mg/l) and Siptan (135 mg/l to 235 mg/l). The mean value of Total Hardness in Dejla- Devada dam 111.9 mg/l and Confluence with Undri river 172.75 mg/l and Khargone 185.66 mg/l and Siptan 185.33 mg/l.

Alkalinity is not a pollutant. It is a total measure of the substances in water that have “acid-neutralizing” ability. Alalinity value was found to be ranging from 160mg/l to 415mg/l. An increase in the Alalinity was observed at Confluence with Undri river (160 mg/l to 415 mg/l) further increased values could be noticed at Dejla- Devada dam (230 mg/l to 300 mg/l) and Khargone (230 mg/l to 305 mg/l) and Siptan (210 mg/l to 315 mg/l). The mean value of Alalinity in Dejla- Devada dam 259 mg/l and Confluence with Undri river 318.83 mg/l and Khargone 259.41 mg/l and Siptan 253.83 mg/l. Alkalinity is important for fish and aquatic life because it protects or buffers against pH changes and makes water less vulnerable to acid rain.

Chloride is a material that is both a natural component of water in northeast Ohio and also a very common industrial material. It enters rivers from industrial processes, domestic sewage, and surface runoff. Chloride value was found to be ranging from 0.3mg/l to 69mg/l. An increase in the Chloride was observed at Dejla- Devada dam (0.3 mg/l to 69 mg/l) further increased values could be noticed at Confluence with Undri river (18 mg/l to 43mg/l) and Khargone (20 mg/l to 58 mg/l) and Siptan (28mg/l to 69 mg/l). The mean value of Alalinity in Dejla-Devada dam 36.46 mg/l and Confluence with Undri river 29.5 mg/l and Khargone 37.91 mg/l and Siptan 46.75 mg/l. Chloride is often termed a conservative pollutant. That is, it does not react as readily as many other materials in the water; nor does it settle out as readily. As a result, it is often a very good indicator of the aggregate amount of anthropogenic materials dumped into the river from all sources Jammal, A. (1998) similar results has been observed by Ahmed, A.M. (2004).

Nitrate is the number one limiting factor that prevents the completion of this cycle. Nitrate value was found to be ranging from 0.070mg/l to 0.890mg/l. An increase in the Chloride was observed at Khargone (0.070 mg/l to 0.890 mg/l) further increased values could be noticed at Dejla- Devada dam (0.11 mg/l to 0.131mg/l) and Confluence with Undri river (0.110 mg/l to 0.890 mg/l) and Siptan (0.080mg/l to 0.780 mg/l). The mean value of Nitrate in Dejla- Devada dam 0.355 mg/l and Confluence with Undri river 0.316 mg/l and Khargone 0.176 mg/l and Siptan 0.172 mg/l. Nitrate is attributed mainly due to anthropogenic activities such of run of water from agricultural lands, industrial wastes, discharge of house hold and municipal sewage from the market place and other effluents containing nitrogen.

Phosphate is the most important factor in the cultural eutrophication of rivers and streams throughout the world. Phosphate value was found to be ranging from 0.16mg/l to 0.86mg/l. An increase in the Phosphate was observed at Siptan (0.25 mg/l to 0.86 mg/l) further increased values could be noticed at Dejla- Devada dam (0.5 mg/l to 0.49mg/l) and Confluence with Undri river (0.16 mg/l to 0.66 mg/l) and Khargone (0.17mg/l to 0.66 mg/l). The mean value of Phosphate in Dejla- Devada dam 0.355 mg/l and Confluence with Undri river 0.361 mg/l and Khargone 0.03 mg/l and Siptan 0.510 mg/l. Phosphates stimulate the growth of plankton and water plants that provide food for fish. Phosphates come from fertilizers, Pesticides, industry and cleaning compounds. Natural sources include phosphate- containing rocks and solid or liquid wastes. This may increase the fish population and improve the waterway's quality of life. If too much phosphate is present algae and water weeds grow wildly, choke the waterway, and use up large amounts of oxygen. Many fish and aquatic organisms may die.

The results of the physico-chemical analyses have classified for water quality in by the Dzerosi *et al.,* (2002). All physicochemical parameters determined in the Narmada river, Bhavani river, Challawa river and Abeokuta, Nigeria Sharma *et al.,* (2012); Varunprasath *et al.,* (2010); . Indabawa I. I. (2010); Shittu et al., (2008). Cekerek stream are similar to those reported in the River Yesilirmak, Tuzen *et al.,* (2001). The physico-chemical parameters of lakes, ponds and rivers have considerable effect on the aquatic life. These parameters Provide information on the characteristics and quality of a water body Haruna *et al.,* (2006).

Table 1: [Station I] Physico-chemical characteristics of river Kunda at Dejla-Devada dam for one year (August 2010 to July 2011)

Month	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July
Temp.(°C)	28	30	35	31	29	25	27	33	35	42	41	32
pH	9.1	8.7	8.2	8.5	7.61	7.84	7.8	8.2	8.1	9.2	9.22	9.11
Transperancy (N.T.U.)	16	25	38	50.5	51.2	53	45	39	28	24	22	9.11
D.O. (Mg/l)	8.2	6.23	6.50	6.35	6.39	6.21	6.9	7.2	7.5	8.7	9.1	9.12
B.O.D. (Mg/l)	5.63	5.5	4.8	3.1	3.2	3.31	3.9	4.0	4.5	4.81	5	5.45
Total Hardness (Mg/l)	80	78	73	71	89	107	121	157	145	147	190	85
Alkalinity	245	255	230	250	235	250	245	264	258	298	300	278
Chloride (Mg/l)	49	38	0.3	25.4	21	26	36.5	39.1	46.7	49.1	53.4	53.1
Nitrate (Mg/l)	0.125	0.3	0.131	0.121	0.11	0.89	0.76	0.78	0.89	0.102	0.109	0.112
Phosphate (Mg/l)	0.46	0.49	0.5	0.16	0.17	0.21	0.23	0.27	0.31	0.35	0.42	0.45

Table 2: [Station II] Physico-chemical characteristics of river Kunda at Confluence with Undri river for one year (August 2010 to July 2011)

Month	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July
Temp.(°C)	27.1	30.1	35	31.3	29.2	25.2	29	33.3	34	40	35.1	31.2
pH	8.5	8.7	8.2	8.5	7.61	7.84	7.8	8.2	8.1	9.2	9.22	9.11
Transperancy (N.T.U.)	20	30	42	55	48	58	45	36	28	22	20	12
D.O. (Mg/l)	6.2	9.2	9.8	6.5	7.2	7.5	8.1	7.3	6.4	5.7	4.9	5.4
B.O.D. (Mg/l)	6.3	5.7	5.08	3.0	2.8	3.1	3.8	4.3	4.7	5.1	5.5	5.7
Total Hardness (Mg/l)	128	136	170	165	155	180	188	200	170	210	205	166
Alkalinity	365	415	390	415	385	255	245	256	375	230	160	335
Chloride (Mg/l)	30	18	20	23	38	32	37	24	18	40	47	27
Nitrate (Mg/l)	0.120	0.135	0.139	0.120	0.110	0.890	0.765	0.780	0.850	0.115	0.190	0.122
Phosphate (Mg/l)	0.66	0.40	0.55	0.16	0.20	0.31	0.20	0.37	0.29	0.31	0.49	0.40

Table 3: [Station III] Physico-chemical characteristics of river Kunda at Khargone for one year (August 2010 to July 2011)

Month	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July
Temp.(°C)	25	31	33	32	28	22	26	33	35	41	39	30
pH	9.3	8.8	8.4	8.0	7.5	7.9	8.0	8.6	7.8	8.8	9.0	7.8
Transperency (N.T.U.)	19	28	40	55	52	58	42	37	22	20	24	15
D.O. (Mg/l)	7.8	6.50	6.25	6.65	6.89	6.10	6.90	7.50	7.10	8.90	9.30	8.80
B.O.D. (Mg/l)	5.63	5.5	4.8	3.1	3.2	3.31	3.9	4.0	4.5	4.81	5	5.45
Total Hardness (Mg/l)	115	125	165	188	165	190	205	235	210	245	215	170
Alkalinity	250	258	239	260	230	252	240	275	252	285	305	267
Chloride (Mg/l)	41	35	28	24	20	27	35	40	42	50	55	58
Nitrate (Mg/l)	0.140	0.125	0.135	0.115	0.105	0.095	0.076	0.070	0.890	0.125	0.119	0.122
Phosphate (Mg/l)	0.39	0.55	0.50	0.36	0.25	0.17	0.28	0.33	0.30	0.45	0.66	0.29

Table 4: [Station IV] Physico-chemical characteristics of river Kunda at Siptan for one year (August 2010 to July 2011)

Month	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July
Temp.(°C)	22	30	32	30	26	20	24	35	37	43	38	28
pH	9.0	8.2	8.8	8.4	7.9	7.5	8.5	8.9	7.2	8.0	9.4	7.7
Transperancy N.T.U.)	21	25	35	50	59	60	46	35	30	18	22	18
D.O. (Mg/l)	6.9	6.5	6.0	6.5	6.2	6.0	7.0	7.9	7.7	8.4	9.5	9.0
B.O.D. (Mg/l)	5.0	5.7	4.5	3.6	3.8	3.0	3.8	4.4	4.9	5.1	5.5	5.9
Total Hardness (Mg/l)	135	145	185	195	165	180	198	210	180	220	235	176
Alkalinity	220	245	220	230	210	245	260	287	260	299	315	255
Chloride (Mg/l)	50	45	39	32	28	36	48	55	60	69	56	43
Nitrate (Mg/l)	0.130	0.115	0.145	0.125	0.115	0.090	0.080	0.095	0.780	0.145	0.120	0.125
Phosphate (Mg/l)	0.55	0.75	0.69	0.45	0.39	0.25	0.30	0.39	0.44	0.57	0.86	0.49

Table 5: Physico-chemical characteristics of river Kunda(Dejla-Devada dam, Confluence with Undri river, Khargone, Siptan) at four stations(mean values for one year (August 2010 to July 2011)

Physical characters	Dejla-Devada dam	Confluence with Undri river	Khargone	Siptan
Temperature(°C)	32.33(25-42)	31.70(25.2-40)	31.25(22-41)	30.41(20-43)
pH	8.465(7.61-9.22)	8.36(7.9-8.8)	8.325(7.5-9.3)	8.29(7.2-9.4)
Traneperancy (N.T.U.)	33.89(15-53)	34.66(12-58)	34.33(15-58)	34.91(18-60)
D.O. (Mg/l)	7.36(6.21-9.12)	7.01(4.9-9.8)	7.39(6.10-9.30)	7.3(6.0-9.5)
B.O.D. (Mg/l)	4.43(3.1-5.63)	4.59(2.8-6.3)	4.43(3.1-5.63)	4.6(3.0-5.9)
Total Hardness(Mg/l)	111.9(71-190)	172.75(128-210)	185.66(115-245)	185.33(135-235)
Alkalinity	259(230-300)	318.83(160-415)	259.41(230-305)	253.83(210-315)
Chloride(Mg/l)	36.46(0.3-53.4)	29.5(18-47)	37.91(20-58)	46.75(28-69)
Nitrate(Mg/l)	0.355(0.11-0.131)	0.361(0.110-0.890)	0.176(0.070-0.890)	0.172(0.080-0.780)
Phosphate(Mg/l)	0.335(0.5-0.49)	0.361(0.16-0.66)	0.03(0.17-0.66)	0.510(0.25-0.86)

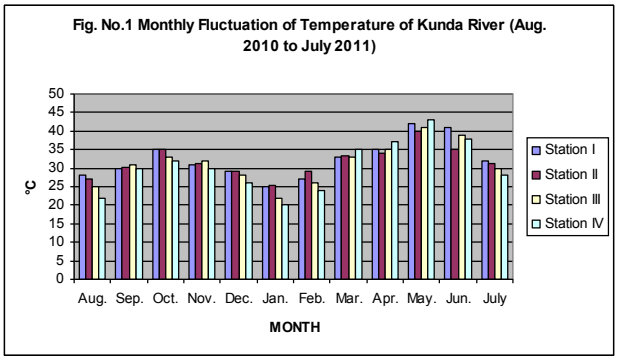


Figure 1: Bar diagram showing Monthly Fluctuation of Temperature of Kunda River (August 2010 to July 2011)

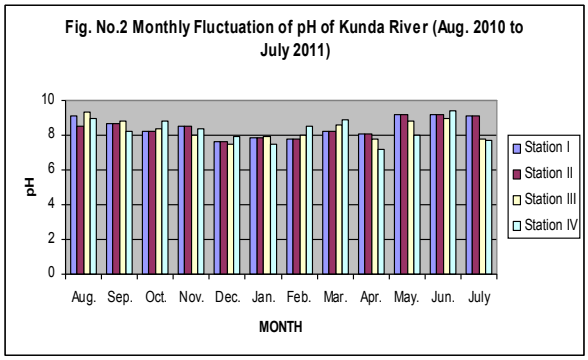


Figure 2: Bar diagram showing Monthly Fluctuation of pH of Kunda River (August 2010 to July 2011)

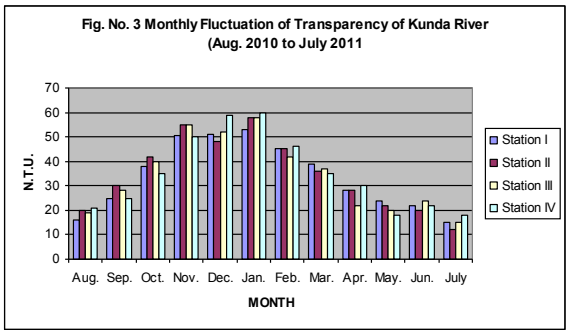


Figure 3: Bar diagram showing Monthly Fluctuation of Transparency of Kunda River (August 2010 to July 2011)

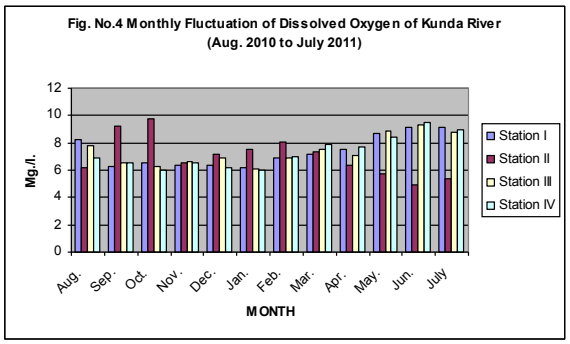


Figure 4: Bar diagram showing Monthly Fluctuation of Dissolved oxygen of Kunda River (August 2010 to July 2011)

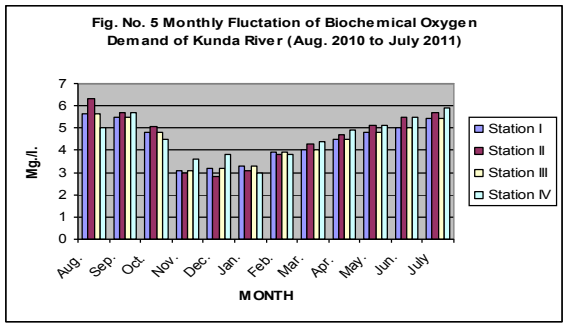


Figure 5: Bar diagram showing Monthly Fluctuation of Biochemical Oxygen Demand of Kunda River (August 2010 to July 2011)

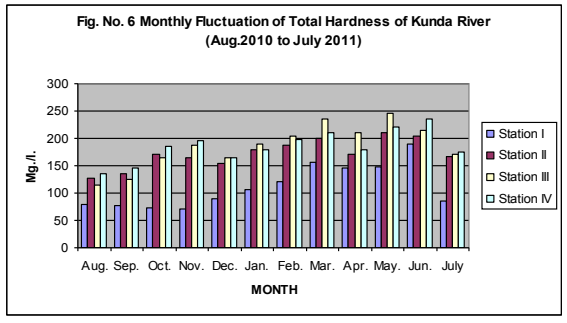


Figure 6: Bar diagram showing Monthly Fluctuation of Total Hardness of Kunda River (August 2010 to July 2011)

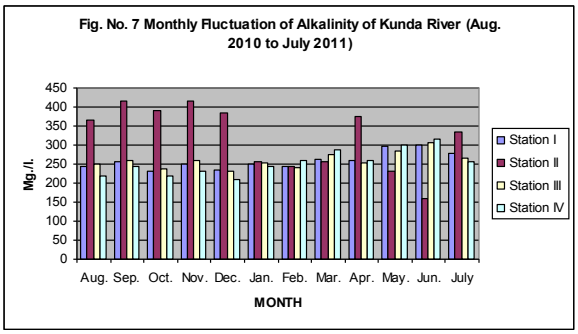


Figure 7: Bar diagram showing Monthly Fluctuation of Alkalinity of Kunda River (August 2010 to July 2011)

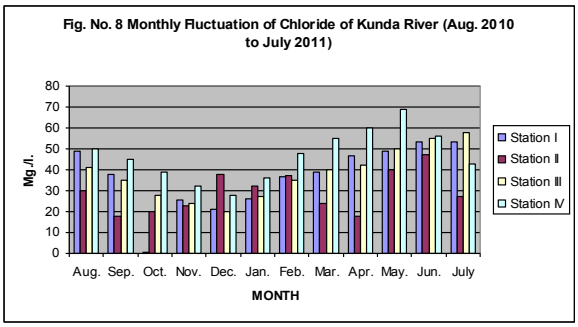


Figure 8: Bar diagram showing Monthly Fluctuation of Chloride of Kunda River (August 2010 to July 2011)

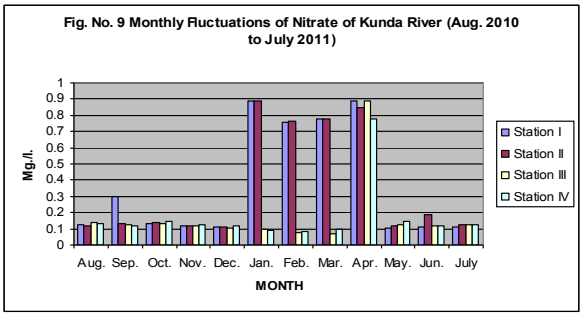


Figure 9: Bar diagram showing Monthly Fluctuation of Nitrate of Kunda River (August 2010 to July 2011)

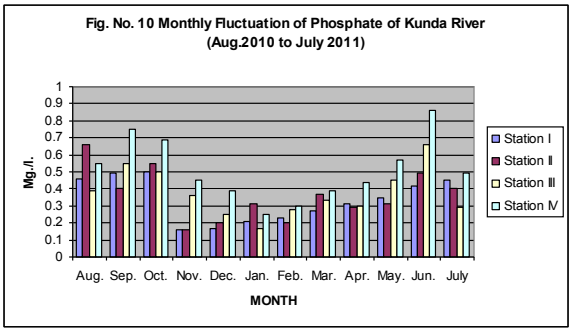


Figure 10: Bar diagram showing Monthly Fluctuation of Phosphate of Kunda River (August 2010 to July 2011)

Conclusion

The assessment of water quality at Kunda river for a period of One Year via physicochemical analysis indicated that the temperature, pH and Transparency lies within the standard limit of good water quality set for freshwater according to EPA and WHO, while dissolved oxygen concentration and Biochemical oxygen demand recorded have exceeded the minimum standard values limit set by EPA and WHO. There is therefore a need of for a regular monitoring of the water to reduce the pollution level.

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